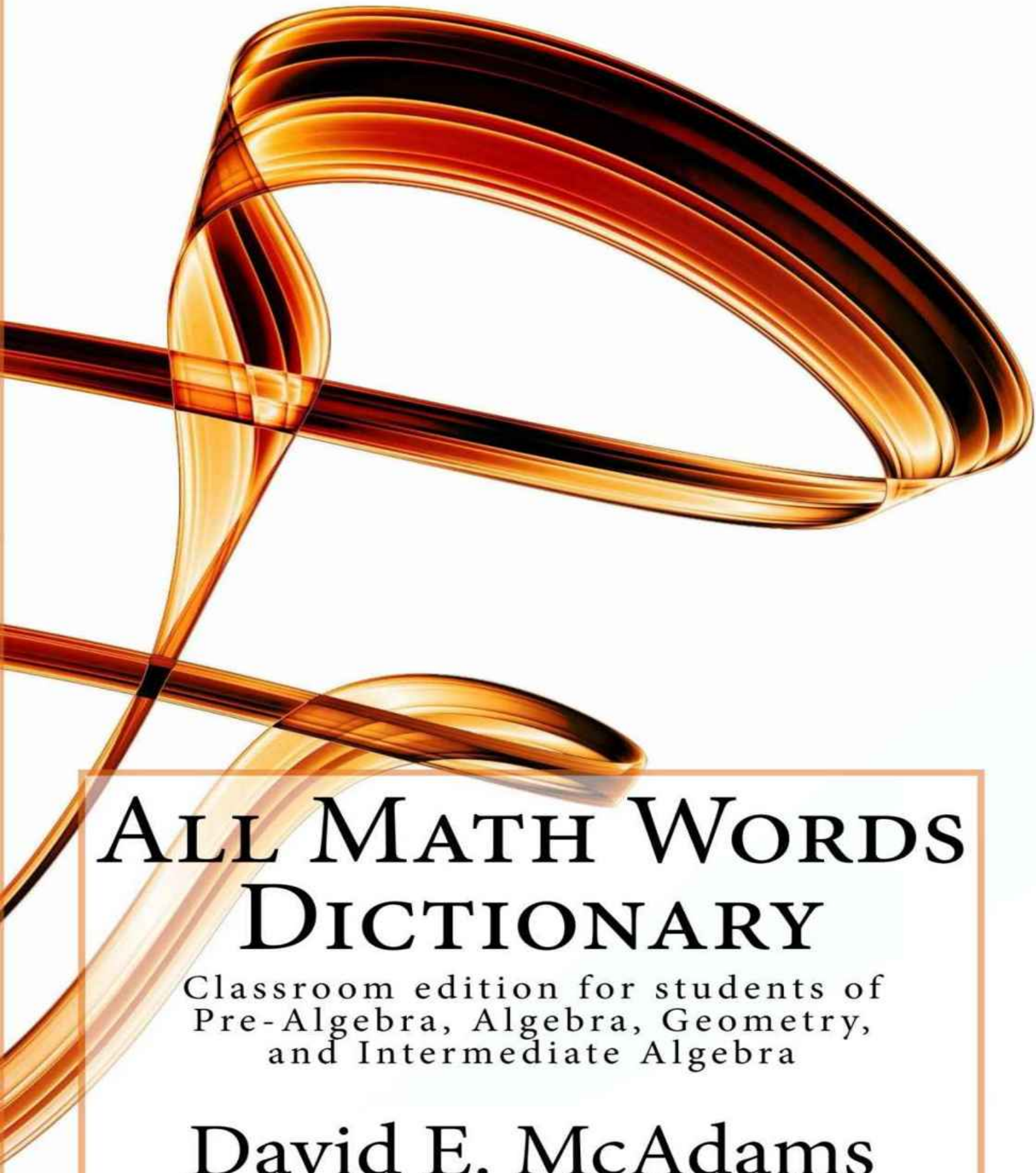

All Math Words Dictionary

Classroom edition for students of Pre-Algebra, Algebra, Geometry, and Intermediate Algebra

David E. McAdams

All Math Words Dictionary By David E. McAdams

Second Edition
Version 20140501

OceanofPDF.com

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Dedicated to the Math Department at Utah Valley University, Orem, Utah for their excellent teaching.

Table of Contents

Preface

All Math Words Dictionary is designed for students of pre-algebra, algebra, geometry, and intermediate algebra in middle school and high school. It is designed using the four 'C's of math writing:

- **Concise**: Definitions are compact, yet understandable.
- **Complete**: All words and phrases of interest to targeted students are included, plus a few just beyond the scope of the target classes. Tables of symbols and notation, formulas, and units of measurement, plus lists of properties of objects give the student all the information needed to weld their understanding of the concepts and decipher many problems.
- **Correct**: The definitions have been thoroughly reviewed for mathematical and literary correctness.
- **Comprehensible**: The definitions are written to be understood by targeted students. Abundant illustrations aid in understanding.

One of the difficulties many students experience in learning math skills has to do with the fact that an entire language, both spoken and written, has grown up around math. Students that acquire that language are successful in math studies. Students that do not acquire that language have serious problems with mathematics. This dictionary is designed to aid in the acquisition of the language of math.

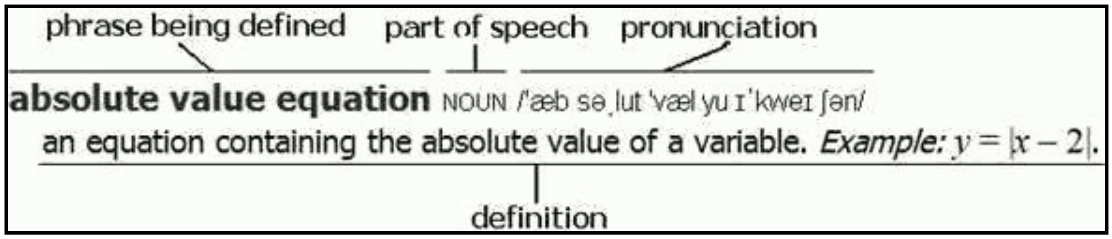
This dictionary has:

- over 3000 entries
- more than 140 notations defined
- in excess of 790 illustrations
- IPA pronunciation guide

- greater than 1400 formulas, equations, definitions, examples, identities and expressions.
- conversion of measures

How to Use this Dictionary

This dictionary has alphabetized entries plus a subject index containing formulas and identities. Most entries are laid out like this:



At the end of the entry, there may be additional notes such as synonyms and references to related words or to the subject index.

The pronunciation in this dictionary is given in International Phonetic Alphabet (IPA) style. A brief guide to the portion of IPA used in the section IPA Pronunciation. For a detailed explanation of IPA, see http://www.langsci.ucl.ac.uk/ipa/.

Some words and phrases have more than one distinct meaning. In this case, there will be several enumerated definitions:

logic NOUN /ˈlɒdʒ.ɪk/
1. the science that investigates the principles governing correct and reliable inference.
2. a series of statements that make use of the science of logic.

If pronunciations of a word for different definitions are different, the pronunciation will appear with each definition.

Multiple words with the same meaning are typically defined only once, with the less common usage referring to the main entry like this:

null set NOUN /nʌl sɛt/ *see empty set*.

Abbreviations and acronyms are given their own entry without a definition of the abbreviated word. An acronym is a set of letters that stand for a phrase, usually the first letter of each

word in the phrase. You can look up the word once you know what the abbreviation stands for:

> **lcd** ABBREVIATION *least common denominator*.

Entries describing elements of computer languages have COMPUTERS for the part of speech and have no pronunciation, like this:

> **atan()** COMPUTERS
> represents the arctangent function in many computer languages.

Prefix entries are similar to regular entries. Each prefix is followed by a hyphen. This tells the reader that the prefix is not a whole word, but is used to form other words:

> **delta-** PREFIX /ˈdɛl.tə/
> having to do with equilateral triangles.

If the plural of a word or phrase has an unusual spelling or pronunciation, that spelling and pronunciation appear at the end of the entry like this: *Plural: series*.

At the end of each definition there may be list of related words. Related words can be synonym, antonyms, or variants of each word. Also, external dynamic geometry applications can be accessed on many readers by clicking the GeoApp! link on many words.

There is a section with common math notation in the section Notation. Since these symbols can not be alphabetized, they are grouped by category. Within each category they appear in no particular order.

How Entries are Alphabetized

There are several things which influence the alphabetization scheme of this dictionary:

- This dictionary defines many phrases in addition to single words.
- Numeric digits are part of some entry headings.
- Hyphens and commas appear in some entry headings.
- Mathematical symbols are used in some entry headings.

Because of these issues, a special alphabetization scheme is used.

1. Capital letters are alphabetized the same as lower case letters. The following words are in the special alphabetical order:
   abacus
   Abelian group
   abscissa
2. Spaces are ignored. The following words are in the special alphabetical order:
   amplitude
   analytical proof
   analytic geometry
3. Numeric digits come before alphabetic letters and are in numeric order. The following entries are in the special alphabetical order:
   1, property of multiplication by
   2-space
   3-space
4. All punctuation marks such as commas and hyphens are ignored. The following entries are in the special

alphabetical order:

half
half-angle
half life
half-line

Exception: In the case of a prefix, the entry with the dash comes after any entries with the same letters but no dash, but before any words using that prefix. The following entries are in the special alphabetical order:

- **a**
- **A**
- **a-**
- **AAA**

Conventional Plurals

The plurals (more than one) of nouns are shown at the end of an entry only if the spelling or pronunciation of the plural is unusual. The usual spelling of plurals are:

Conventional Plurals			
Ending	**Spelling**	**Pronunciation**	**Example**
'se' (silent e)	'ses'	səz	**inverse** *Plural: inverses* /ɪn'vɜr.səz/
's', 'x', or 'ch'	'ses'	səz	**class** *Plural: classes* /klæ.səz/
'y'	'ies'	iz	**identity** *Plural: identities* /aɪ'dɛn tɪ tiz/
All others	's'	s or z	**shift** *Plural: shifts* /ʃɪftz/

IPA Pronunciation

Stress marks: /ˈ/ primary; /ˌ/ secondary

	Consonants
b	base, double
d	disk, and
ð	the, father
dʒ	general, page
f	from, graph, fan
g	get, angle
h	head, ahead
j	yes
k	chord, fact, key
l	low, slow
m	middle, time
n	not, in
ŋ	thing, long
ŋg	finger, angle
θ	third, math
p	pi, cap
r	row, from
s	side, base
ʃ	show, addition
t	true, write
tʃ	check, catch
v	value, have
w	wave, swap

ʰw	wh<u>wh</u>y
z	<u>z</u>ero, i<u>s</u>
ʒ	mea<u>s</u>ure, divi<u>s</u>ion
	Vowels
ɑ	f<u>a</u>ther
ɑr	<u>ar</u>c, b<u>ar</u>n
ɒ	s<u>o</u>ng, s<u>o</u>lid
ɒr	b<u>or</u>row
æ	<u>a</u>dd, <u>a</u>ngle
ær	<u>ar</u>row, m<u>ar</u>ry
aɪ	b<u>y</u>, s<u>i</u>gn
aʊ	<u>ou</u>t, h<u>ow</u>
aʊər	h<u>our</u>
ɛ	b<u>e</u>ll
ɛr	<u>er</u>ror
ɛər	sq<u>uare</u>, <u>ar</u>ea
eɪ	f<u>a</u>ce, r<u>a</u>te
ɪ	<u>i</u>n, l<u>i</u>d
ɪr	p<u>yr</u>amid, g<u>ir</u>l
ɪər	n<u>ear</u>, z<u>er</u>o
ɔɪ	ch<u>oi</u>ce, b<u>oy</u>, p<u>oi</u>nt
ɔr	chord, corner
oʊ	r<u>ow</u>, g<u>o</u>
ʊ	f<u>oo</u>t
ʌ	<u>o</u>f, n<u>u</u>mber
ɜr	<u>cu</u>rve, c<u>ir</u>cle
u	contin<u>u</u>e
y	c<u>u</u>be
	Reduced vowels

ə	comm<u>a</u>
ər	cent<u>er</u>
i	happ<u>y</u>
o	g<u>o</u>ld

Notation

Numbers

14	integer
1.5	real number
$3 + 4i$	complex number
$2.2i$	imaginary number
$\frac{7}{15}$	rational number, fraction
I	Roman numeral for 1
V	Roman numeral for 5
X	Roman numeral for 10
L	Roman numeral for 50
C	Roman numeral for 100
D	Roman numeral for 500
M	Roman numeral for 1000
∞	infinity
−	negative
+	positive
%	percent
	scientific notation

3.77×10^4	
37.7×10^3	engineering notation
$2.64\text{E}05$	E notation
$a < b$	a is less than b
$a \leq b$	a is less than or equal to b
$a = b$	a is equal to b
$a \neq b$	a is not equal to b; a is less than or greater than b.
$a \geq b$	a is greater than or equal to b
$a > b$	a is greater than b
$x \mid y$	x divides evenly into y
$x \nmid y$	x does not divide evenly into y.
$y \bmod q$	the remainder when y is divided by q
$x \equiv y \bmod q$	x is congruent with y modulo q
z	complex number
$\overline{z}$	complex conjugate
$\Im$, Im	imaginary part of a complex number
$\Re$, Re	real part of a complex number

Sets of Numbers

$[m,n]$	closed interval from m to n: $m \leq x \leq n$.

(m,n), $]m,n[$	open interval from m to n: $m < x < n$.
$(m,n]$, $]m,n]$	half open interval on the left from m to n: $m < x \leq n$.
$[m,n)$, $[m,n[$	half open interval on the right from m to n: $m \leq x < n$.
$(-\infty,\infty)$	interval of all real numbers
...	ellipsis, (continued in the same pattern.)
sup.	supremum
inf.	infimum

Arithmetic

$a + b$	addition, add a to b
$a - b$	subtraction; subtract b from a
$-b$	negation; negative b
$a \pm b$	a plus or minus b
$a \mp b$	a minus or plus b
$a \times b$	multiply a by b
$a \cdot b$	multiply a by b
ab	multiply a by b
$a*b$	1. multiply a by b in some computer languages. 2. an arbitrary operation on a and b.

a^b	exponentiation: a raised to the b power; a multiplied times itself b times.
a^b	exponentiation in some computer languages (a raised to the b power).
a**b	exponentiation in some computer languages (a raised to the b power).
$\sqrt{n}$	square root of n
$\sqrt[3]{m}, \sqrt[4]{m}, \sqrt[n]{m}$	cube root of m, fourth root of m, etc.
$\frac{a}{b}$	fraction, division
$a \div b$	a divided by b
$a \,/\, b$	a divided by b
$a : b$	ratio of a to b, divided by

Algebra

$a \ldots z, A \ldots Z$	variables
$a_1, a_2, \ldots$	indexed variables
$a \equiv b$	1. a is identical to b. 2. a is equivalent to b
$c \equiv a \bmod b$	c is congruent to a modulo b.
$\rightarrow$	1. approaches 2. implies
$\Rightarrow$	implies

$a \propto b$	a varies as b, a is proportional to b.
∞	infinity
$f \circ g(x)$	composition of functions f and g.
( )	parenthesis, grouping of operations
[ ]	brackets, grouping of operations, matrices
{ }	1. braces, grouping of operations 2. *see Set Theory*
$<2,-1>$	vector notation; a vector with an x-component of 2 and a y-component of -1.
$\|A\|$	the determinant of matrix A.
$\mathrm{I_n}$	an n×n identity matrix
$\mathrm{Z_n}$	an n×n zero matrix
A^{-1}	the inverse of matrix A.
n°	n degrees
n'	1. n minutes (1/60th degree) 2. n feet.
n''	1. n seconds (1/60th minute) 2. n inches
Δx	change in x, delta x
Σ	sum of a sequence
$f(x)$	function f of x
$n!$	n factorial

$\lvert x \rvert$	absolute value of x, magnitude of x
$\lceil x \rceil$	ceiling function of x
$\lfloor x \rfloor$	floor function of x
$\lim_{x \to a} f(x) = b$	the limit of $f(x)$ as x approaches a is equal to b

Geometry

$\approx$	is congruent with
$\cong$	is congruent with
$\not\approx$	is not congruent with
$\ncong$	is not congruent with
$\sim$	is similar to
$\overline{AB}$	line segment AB
AB	length of line segment AB
$\overleftrightarrow{AB}$	line AB
$\overrightarrow{AB}$	ray AB
$\angle \alpha$	angle alpha
$\mathrm{m} \angle \alpha$	the measure of angle alpha
$\Delta \mathrm{ABC}$	triangle ABC
$\mathrm{l} \parallel \mathrm{m}$	l is parallel to m

$l \nparallel m$	l is not parallel to m
$l \perp m$	l is perpendicular to m
$\overset{\frown}{JK}$	minor arc with endpoints J and K
$\overset{\frown}{ABC}$	major arc containing point B

Logic

$P,\ Q$	propositions
$\text{-}P,\ \sim P$	negation, $\text{NOT}\ P$
$P \vee Q,\ P + Q$	disjunction, $P\ \text{OR}\ Q$
$P \wedge Q,\ P \cdot Q$	conjunction, $P\ \text{AND}\ Q$
$P \oplus Q$	exclusive disjunction, $P\ \text{xor}\ Q$
$P \rightarrow Q$	P implies Q
$P \Rightarrow Q$	P implies Q
$P \leftrightarrow Q$	equivalence, biconditional, if and only if
$P \Leftrightarrow Q$	equivalence
$P \equiv Q$	equivalence
$\equiv$	identity
iff	if and only if
$0,\ \text{F}$	false
$1,\ \text{T}$	true
$\therefore$	therefore, in conclusion

Q.E.D.	End of proof
∎	end of proof

Set Theory

$A, B, C, \ldots$	set
$a, b, c, \ldots$	element of a set; member of a set
$x \in A$	x is an element of A
$x \notin A$	x is not an element of A
$A \subset B$	A is a subset of B
$A \subseteq B$	A is a subset of or equal to B
$A \subsetneq B$	A is a proper subset of B
$B \supset A$	B is a superset of A
$A \not\subset B$	A is not a subset of B
$A \not\subseteq B$	A is neither a subset of nor equal to B
$A \bigcup B$, $A + B$	A union B
$A \bigcap B$, $A \cdot B$	A intersection B
$A - B$	difference of A and B
$\emptyset$, $\{\}$	empty set, null set
A'	complement of set A
A / S	complement of set A in S.
$\{x : P(x)\}$	the set of all x with property P
$\{a, b, c, \ldots\}$	set

$(a,b,c,\ldots)$	ordered set
$<a,b,c,\ldots>$	ordered set
$A \times B$	Cartesian product, A cross B
$f \circ g(x)$	composition of functions f and g.
$f(X)$	image of set X
one to one	one to one correspondence
$\|X\|$	cardinality of set X
$\aleph_0$	denumerable infinity
$\aleph_1, \aleph_2, \aleph_3, \ldots$	nondenumerable infinities
$\wp(A)$	power set of A

Probability

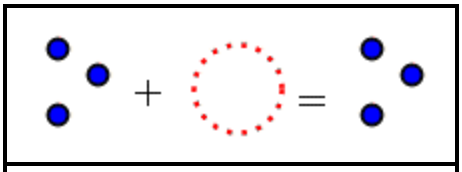
$P(e)$	probability of event e
$P(e_1,e_2)$	conditional probability of e_1 given e_2.
$E(X)$	mathematical expectation of X
$E(X,c)$	conditional expectation of X given condition c.
e'	complement of event e.

Numbers

0, division by NOUN /ˈzɪər.oʊ dɪˈvɪ.ʒən baɪ/ division by 0 is undefined; division by zero has no meaning. *Math definition:* $\frac{a}{0}$ is undefined; $a \div 0$ is undefined.

0 exponent NOUN /ˈzɪər.oʊ ˈɛks.poʊ.nənt/ anything to the zero power, except zero, equals one. *Math definition:* $b^0 = 1, b \neq 0$; 0^0 is undefined.

0, Property of Addition by NOUN /ˈzɪər.oʊ ˈprɒ.pər.ti ʌv əˈdɪ.ʃən baɪ/ if zero is added to any number, the results is equal to that number. *Math definition:* $0 + a = a$, $a + 0 = a$.

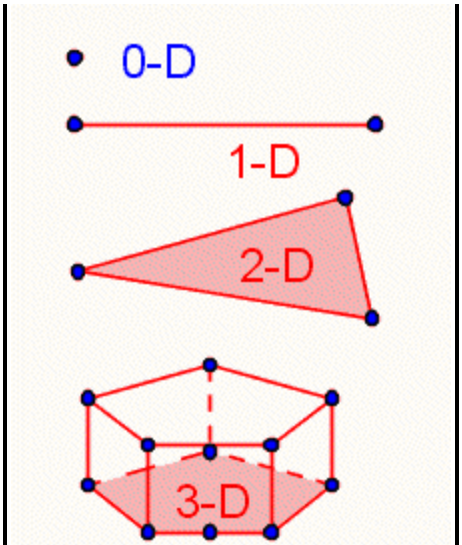


Property of Addition by Zero

0, Property of Multiplication by NOUN /ˈzɪər.oʊ ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən baɪ/ any number times zero equals zero *Math definition:* $0 \cdot a = 0$, $a \cdot 0 = 0$.

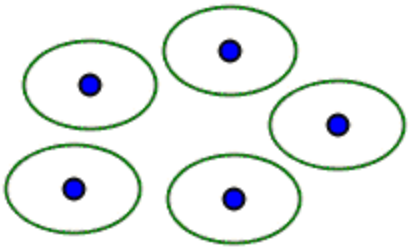
0 to the 0 power NOUN /ˈzɪər.oʊ tu ðə ˈzɪər.oʊ ˈpaʊ.ər/ 0^0 is undefined.

1-D ABBREVIATION one dimensional.



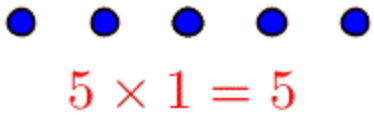
Dimensions

1, Property of Division by NOUN /wʌn ˈprɒ.pər.ti ʌv dɪˈvɪ.ʒən baɪ/ any number divided by 1 equals itself. *Math definition:* $a \div 1 = 1$.



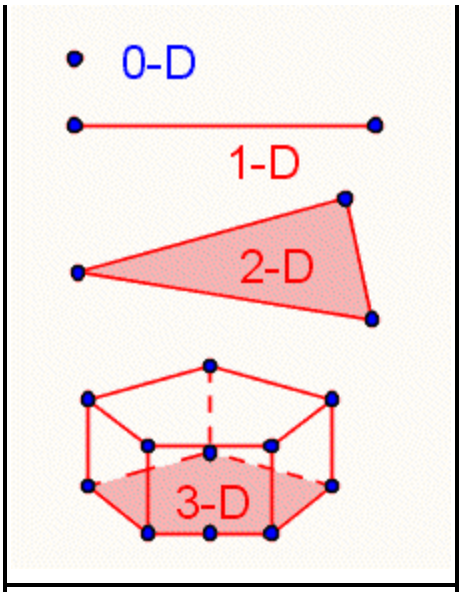
Property of Division by 1

1, Property of Multiplication by NOUN /wʌn ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən baɪ/ any number times one equals itself. *Math definition:* $1 \cdot a = a$, $a \cdot 1 = a$.



Property of Multiplication by 1

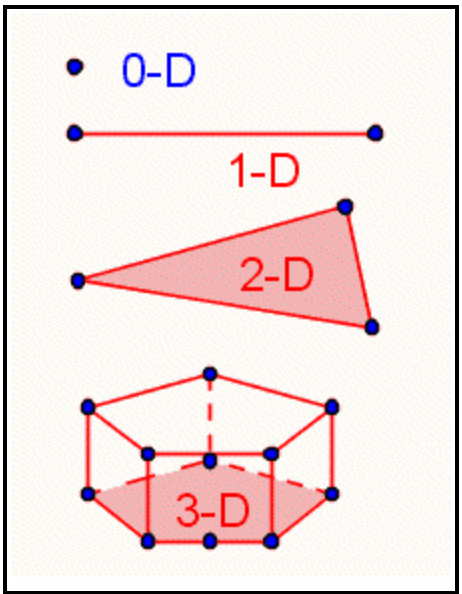
2-D ABBREVIATION two dimensional.



Dimensions

2-space NOUN /tu speɪs/ a geometric space with 2 dimensions. The Euclidean geometry of 2-space is called plane geometry. *Example:* rectangular coordinate plane.

3-D ABBREVIATION three dimensional.



Dimensions

3-space NOUN /θri speɪs/ a geometric space with 3 dimensions. The Euclidean geometry of 3-space is called solid geometry.

4-cube NOUN /fɔr kyub/ *See hypercube.*

4-space NOUN /fɔr speɪs/ a geometric space with 4 dimensions.

10^{100} NOUN a googol is a large number.

10^{googol} NOUN a googolplex, or $10^{10^{100}}$, is a very large number.

International System of Units

Value	Name (Short scale)	SI Prefix	Abbr.
10^{24}	septillion	yotta-	Y
10^{21}	sextillion	zetta-	Z
10^{18}	quintillion	exa-	E
10^{15}	quadrillion	peta-	P
10^{12}	trillion	tera-	T
10^{9}	billion	giga-	G
10^{6}	million	mega-	M
10^{3}	thousand	kilo-	k
10^{2}	hundred	hecto-	h
10	ten	deka-	da
10^{-1}	tenth	deci-	d
10^{-2}	hundredth	centi-	c
10^{-3}	thousandth	milli-	m
10^{-6}	millionth	micro-	µ
10^{-9}	billionth	nano-	n
10^{-12}	trillionth	pico-	p
10^{-15}	quadrillionth	femto-	f
10^{-18}	quintillionth	atto-	a
10^{-21}	sextillionth	zepto-	z
10^{-24}	septillionth	yocto-	y

A

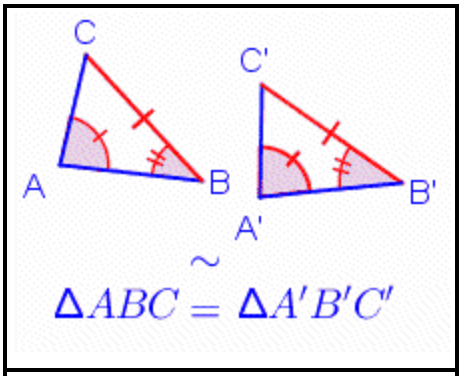
a ABBREVIATION See atto-.

A ABBREVIATION See ampere.

a- PREFIX not. *Example:* asymmetric.

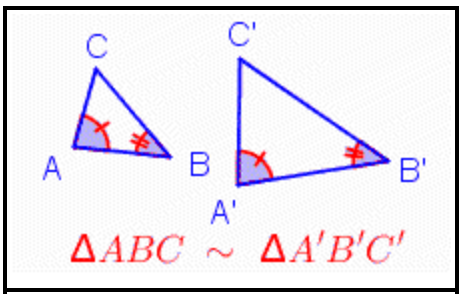
AAA similarity NOUN /eɪ eɪ eɪ ˌsɪm.ə'lær.ɪ.ti/ angle-angle-angle similarity. *See AA similarity.*

AAS congruence NOUN /eɪ eɪ es kən'gru.əns/ angle-angle-side congruence. Two triangles are congruent if and only if two adjacent angles and a side not between the angles are congruent with the corresponding angles and side of the other triangle. *Math definition:* Given ΔABC and $\Delta A'B'C'$, $\Delta ABC \cong \Delta A'B'C'$ if and only if $\angle CAB \cong \angle C'A'B'$ and $\angle BCA \cong \angle B'C'A'$ and $\overline{BC} \cong \overline{B'C'}$. *See also GeoApp!.*



AAS congruence.

AA similarity NOUN /eɪ eɪ ˌsɪm.ə'lær.ɪ.ti/ angle-angle similarity. Two triangles are similar if and only if at least two corresponding angles are congruent. *Math definition:* Given ΔABC and $\Delta A'B'C'$, $\Delta ABC \sim \Delta A'B'C'$ if and only if $\angle CAB \cong \angle C'A'B'$ and $\angle ABC \cong \angle A'B'C'$. *See also GeoApp!.*



AA Similarity

abacus NOUN /'æb.ə.kəs/ a device used for counting and arithmetic that has sliders and beads. *Plurals: abacuses, abaci* /'æb.ə.kai/.

Abacus

abbreviation NOUN /ə'bri.vi¸eɪ.ʃən/ a short way to write a word or phrase. *Example:* A is the abbreviation for ampere.

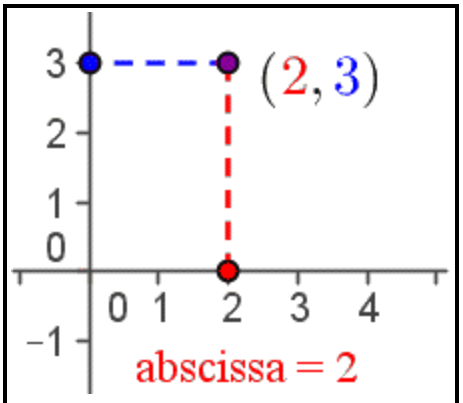
Abelian ADJECTIVE /ə'bi.li.ən/ *See commutative.*

Abelian group NOUN /ə'bi.li.ən grup/ *See commutative group.*

abscissa NOUN /æb'sɪ.sə/

1. the horizontal coordinate of a point: (abscissa, ordinate). *See also GeoApp!.*
2. the value of the independent variable in a relation or function.

Plural: abscissae /æb'sɪs.i/. *Synonym: x-coordinate.*



Abscissa

absolute ADJECTIVE /æbs.ə'lut/

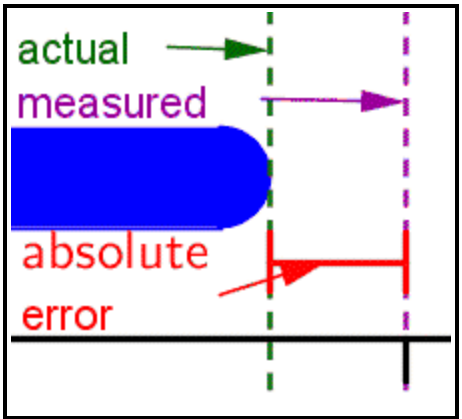
1. having to do with absolute value.
2. exact.
3. global.

absolute convergence NOUN /æbs.ə'lut kən'vɜr.dʒəns/ the property of converging absolutely. *See also converge absolutely.*

absolute convergence test NOUN /æbs.ə'lut kən'vɜr.dʒəns tɛst/ if the absolute values of the terms of a sequence converge, then the original sequence converges. *Math definition:* if $\{|a_1|, |a_2|, |a_3|, \ldots\}$ converges then $\{a_1, a_2, a_3, \ldots\}$ converges.

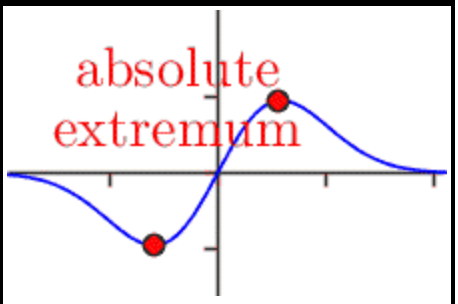
absolute deviation NOUN /æbs.ə'lut ˌdi.vi'eɪ.ʃən/ the distance between a data point and a center of a dataset. *Formula:* $D_i = |x_i - m(X)|$ where x_i is the value of data point i, $m(X)$ is the center of the dataset, and D_i is the absolute deviation of data point i. *For contrast, see deviation. See also average absolute deviation.*

absolute error NOUN /æbs.ə'lut 'ɛr.ər/ the difference between a measured or estimated value and the actual value.



Absolute Error

absolute extremum NOUN /æbs.ə'lut ɪk'stri.məm/ an absolute minimum or an absolute maximum.



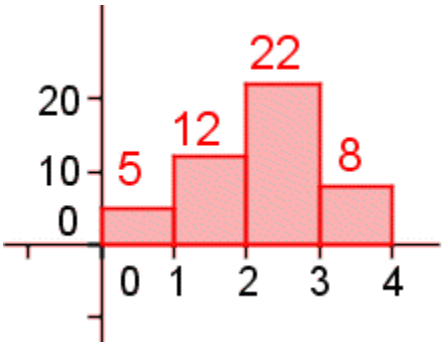
Absolute Extremum

absolute frequency NOUN /æbs.ə'lut 'fri.kwən.si/

1. (probability) the total number of times an event happened during

a set of experiments.
2. (statistics) an exact count of elements of a dataset that share a particular property.

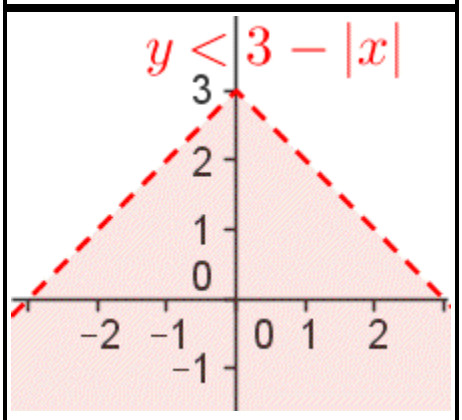
For contrast, see relative frequency.



Absolute Frequency

absolute inequality NOUN /æbs.ə'lut ˌɪn.ɪ'kwɒl.ɪ.ti/ an inequality that has at least one absolute value containing a variable.

Example: $y < 3 - |x|$. *See also GeoApp!.*



Absolute Inequality

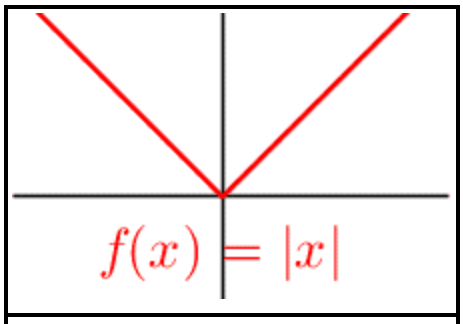
absolute magnitude NOUN /æbs.ə'lut 'mæg.nɪˌtud/ *See absolute value.*

absolute maximum NOUN /æbs.ə'lut 'mæk.sə.məm/ *See global maximum.*

absolute mean deviation NOUN /æbs.ə'lut min ˌdi.vi'eɪ.ʃən/ *See mean deviation.*

absolute minimum NOUN /æbs.ə'lut 'mɪn.ə.məm/ *See global minimum.*

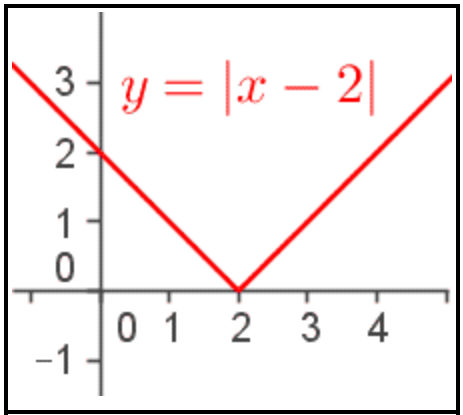
absolute value NOUN /æbs.ə'lut 'væl.yu/ the distance of a point from zero. *Formulas:* For real numbers: $|a| \equiv \sqrt{a^2}$, $|a| \equiv \begin{cases} a \geq 0: & a \\ a < 0: & -a \end{cases}$., For complex numbers: $|a + bi| \equiv \sqrt{a^2 + b^2}$. *Synonyms:* *magnitude*, *modulus*. *See also* *GeoApp!*.



Absolute Value

absolute value equation NOUN /æbs.ə'lut 'væl.yu ɪ'kweɪ.ʒən/ an equation containing the absolute value of a variable.

Example: $y = |x - 2|$. *See also* *How To Plot!*, *GeoApp!*.



Absolute Value Equation

absolute zero NOUN /æbs.ə'lut 'zɪər.oʊ/ the theoretical temperature at which all movement stops.

abstract algebra NOUN /æb'strækt 'æl.dʒə.brə/ algebra generalized to any set and operations on that set, not just numbers. Elements of the set can be matrices, equations and abstract objects. An operation is some mapping of one or more elements of a set that gives another element contained in the set. *See also* *modern algebra*.

absurd ADJECTIVE /əb'sɜrd/

1. inconsistent with reason.
2. contradictory.

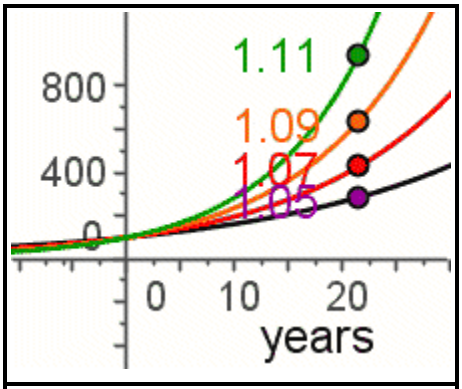
abundant number NOUN /əˈbʌn.dənt ˈnʌm.bər/ an integer whose sum of its proper divisors is greater than the integer itself. *Example:* $1+2+3+4+6 > 12$. *For contrast, see deficient number, perfect number.*

acceleration NOUN /ækˌsɛl.əˈreɪ.ʃᵊn/ speeding up or slowing down; the rate of change of velocity with respect to time. *Notations:* m/s^2 *(meters per second squared),* k/h^2 *(kilometers per hour squared). Formula:* $a = d/t^2$ where a is acceleration, d is distance traveled and t is time. *See also GeoApp!.*

accidental sample NOUN /ˌæk.sɪˈdɛn.tl ˈsɑm.pəl/ *See convenience sample.*

account VERB /əˈkaʊnt/ to verify usage or explanation of.

accumulation factor NOUN /əˌkyu.myuˈleɪ.ʃən ˈfæk.tər/ the quantity $\left(1+\frac{i}{n}\right)$ in the formula for compound interest: $P = P_0\left(1+\frac{i}{n}\right)^{m\cdot n}$.



Accumulation Factor

Accumulation factor measures the rate at which principal grows. *See also compound interest, GeoApp!.*

accuracy NOUN /ˈæk.yər.ə.si/

1. how close a calculated or estimated value is to the actual value. *Synonym: precision.*
2. the level of freedom from error.

accurate

1. ADJECTIVE /ˈæk.yər.ət/ exact.
2. without error.

acre NOUN /'eɪ.kər/ a unit of measure of land surface equal to 43,560 square feet or 1/600 of a square mile.

Formula: $600 \text{ acres} = 1 \text{ square mile}$.

actual ADJECTIVE /'æk.tyu.l/

1. not estimated or measured; exact
2. real or factual.

actual value NOUN /'æk.tyu.l 'væl.yu/ a value which is exact and *not* estimated or measured.

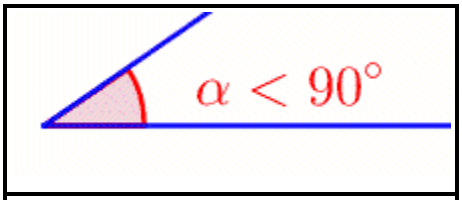
acute ADJECTIVE /ə'kyut/ having one or more angles that measure less than a right angle. *Example:* acute triangle.

acute angle NOUN /ə'kyut 'æŋ.gəl/ an angle that measures less than 90º.

Math definition: $\angle\alpha$ is an acute angle if and only if

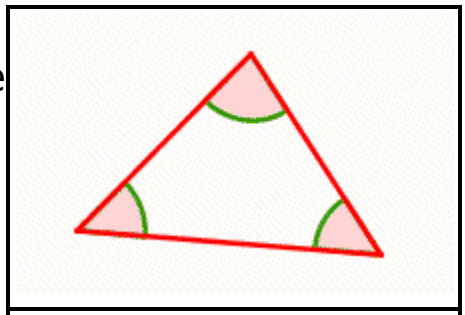
$0° < \alpha < 90°$,

$0 \text{ rad.} < \alpha < \pi/2 \text{ rad.}$. *See also GeoApp!.*



Acute Angle

acute triangle NOUN /ə'kyut 'traɪˌæŋ.gəl/ a triangle that has three acute angles. *See also GeoApp!.*

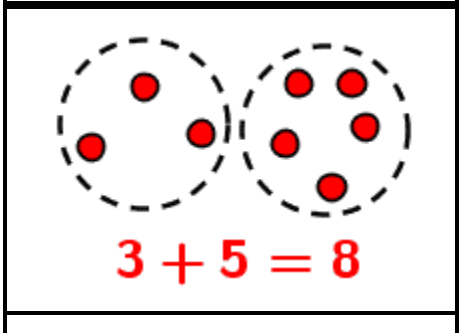


Acute Triangle

add VERB /æd/

1. to join two or more quantities together into a sum.
2. to count objects in two or more groups. *See also GeoApp!.*

Synonym: sum. Inverse: subtract.



Add

addend NOUN /ˈæ.dɛnd/ a number or expression that is to be added. *Formula:* $\text{addend} + \text{addend} = \text{sum}$. *Example:* $\frac{3}{\text{addend}} + \frac{2}{\text{addend}} = \frac{5}{\text{sum}}$.

addition NOUN /əˈdɪ.ʃən/ joining two or more quantities together into a sum. *Notation:* $+$. *Inverse:* *subtraction*. *See also* *Properties of Addition*, *GeoApp!*.

addition fact NOUN /əˈdɪ.ʃən fækt/ two integers and their sum. *Example:* $1 + 1 = 2$. *See also* *Addition Facts*.

addition of polynomials NOUN /əˈdɪ.ʃən ʌv ˌpɒl.əˈnoʊ.mi.əlz/ joining two or more polynomials together into a sum. To add two polynomials, add the like terms.

$$\begin{array}{r} 3x + 4y + -7 \\ +\ 2x + \quad + \quad 6 + 2xy \\ \hline 5x + 4y + -1 + 2xy \end{array}$$

Addition of Polynomials

addition postulate NOUN /əˈdɪ.ʃən ˈpɒs.tʃə.lɪt/ *See* *Angle Addition Postulate*.

Addition Property of Equality NOUN /əˈdɪ.ʃən ˈprɒ.pər.ti ʌv ɪˈkwɒl.ɪ.ti/ the same number can be added to both sides of an equation without changing the truth value of the equation. *Math definition:* if $a = b$ then $a + c = b + c$. If $a \neq b$ then $a + c \neq b + c$.

Addition Property of Inequality NOUN /əˈdɪ.ʃən ˈprɒ.pər.ti ʌv ˌɪn.ɪˈkwɒl.ɪ.ti/ the same number can be added to both sides of an inequality without changing the truth value of the inequality. *Math definition:* If $a < b$ then $a + c < b + c$.

Addition Property of Zero NOUN /əˈdɪ.ʃən ˈprɒ.pər.ti ʌv ˈzɪər.oʊ/ zero can be added to any number without changing the number. *Math definition:* $a + 0 = a$; $0 + a = a$.

addition sign NOUN /əˈdɪ.ʃən saɪn/ $+$ is used to show addition. *Example:* $3 + 2 = 5$.

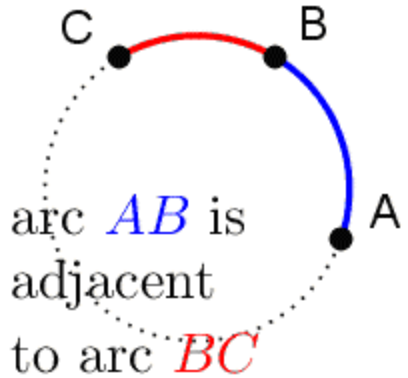
additive ADJECTIVE /ˈæd.ɪ.tɪv/ having to do with addition. *Example:* additive inverse.

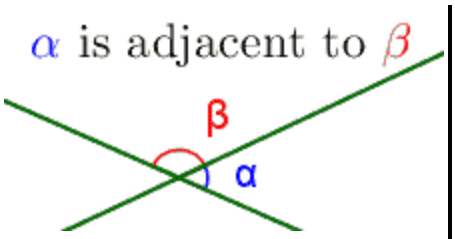
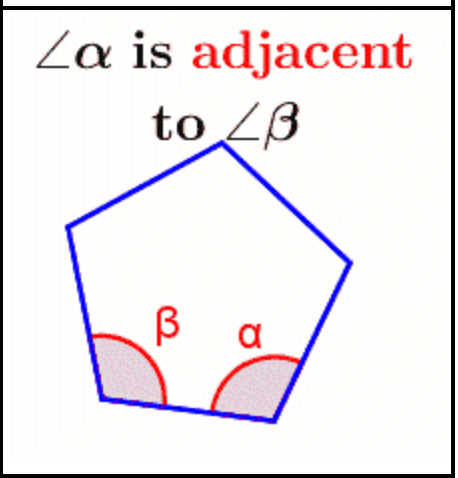
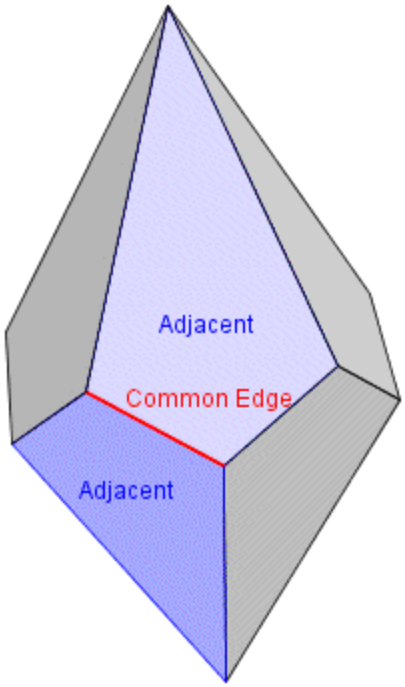
additive identity NOUN /ˈæd.ɪ.tɪv aɪˈdɛn.tɪ.ti/ the additive identity for real and complex numbers is 0 since $a + 0 = a$ and $0 + a = a$.

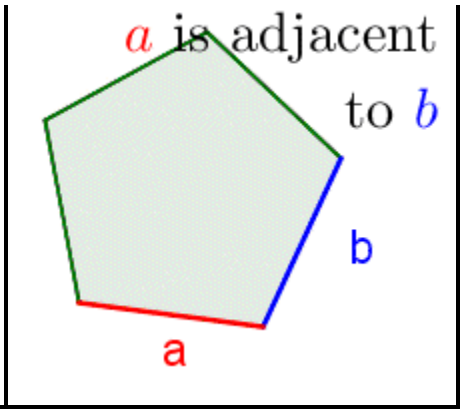
additive inverse NOUN /ˈæd.ɪ.tɪv ɪnˈvɜrs/ the additive inverse of any real or complex number a is $-a$, since $a + (-a) \equiv 0$. *Synonym: opposite number. See also GeoApp!.*

adjacent ADJECTIVE /əˈdʒeɪ.sənt/

1. next to. *Synonym: consecutive.*
2. having a common endpoint or boundary.

Adjacent	
Type	**Example**
Adjacent arcs share an endpoint.	
Adjacent angles on intersecting lines share a side and a vertex, but	

do not share any interior points. *Synonym: consecutive angles*.	
Adjacent angles of a polygon share a side.	
Adjacent faces of a polyhedron share an edge.	
Adjacent sides on a polygon share a vertex	

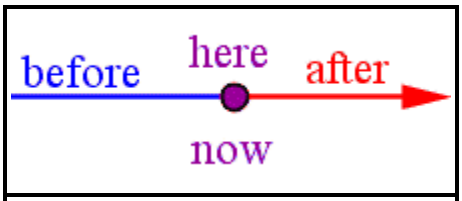


admissible hypothesis NOUN /ædˈmɪs.ə.bəl haɪˈpɒ.θə.sɪs/ an hypothesis that has *not* been proven true and has *not* been proven false. *Synonym: conjecture.*

affine cipher NOUN /əˈfaɪn ˈsaɪ.fər/ a cipher where each letter is converted to a number, then that number is converted to a different number by a function. *Example:* 'hello' becomes '11-8-12-12-15'.

after PREPOSITION /ˈæf.tər/
1. coming in back of.
2. coming later in order or time. *Example:* 5 comes after 3.

Antonym: before.



After

aleph NOUN /ˈɑ.lɪf/ the letter ℵ from the Hebrew alphabet, used with a subscript to indicate the cardinality of infinite sets. *Examples:* $\aleph_0$, $\aleph_1$, $\aleph_2$, ….

aleph null NOUN /ˈɑ.lɪf nʌl/ the symbol $\aleph_0$ representing the cardinality of a denumerable set, a set with a one to one correspondence with the natural numbers. *See also cardinal number.*

algebra NOUN /ˈæl.dʒə.brə/ the study of operations and relations, using variables to represent values.

algebraic ADJECTIVE /ˌæl.dʒəˈbreɪ.ɪk/
1. having to do with algebra. *Example:* algebraic identity.
2. having to do with addition, subtraction, multiplication, division, exponentiation and taking of roots.

Example: algebraic expression.

algebraic equation NOUN /ˌæl.dʒə'breɪ.ɪk ɪ'kweɪ.ʒən/ an equation that uses only the operations of addition, subtraction, multiplication, division, exponentiation and taking of roots. *Example:* $y = 3x^2 + \frac{y}{x} - 2$.

algebraic expression NOUN /ˌæl.dʒə'breɪ.ɪk ɪk'sprɛ.ʃən/ an expression that uses only the operations of addition, subtraction, multiplication, division, exponentiation and taking of roots. *Example:* $3xy + y^2 - \frac{7}{x}$.

algebraic function NOUN /ˌæl.dʒə'breɪ.ɪk 'fʌŋk.ʃən/ a function that uses only the operations of addition, subtraction, multiplication, division, exponentiation and taking of roots. *Example:* $f(x) = 3x^2 + \frac{7}{x} - 2$.

algebraic identity NOUN /ˌæl.dʒə'breɪ.ɪk aɪ'dɛn.tɪ.ti/ an equation that uses only the operations of addition, subtraction, multiplication, division, exponentiation and taking of roots, and is true for all values of the variables. *Notation:* ≡. *Example:* $(x + y)(x - y) \equiv x^2 - y^2$.

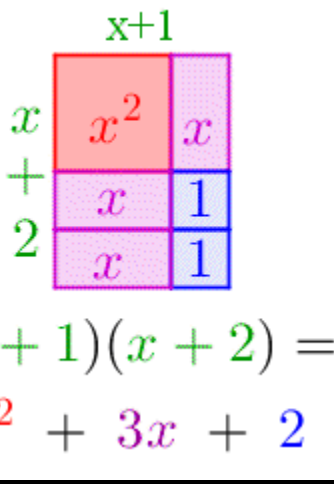
algebraic number NOUN /ˌæl.dʒə'breɪ.ɪk 'nʌm.bər/ any number that is a root of a single variable, non-zero, real-valued polynomial with rational coefficients. *Examples:* 5, $-3/2$, $\sqrt{17}$, $2 + \sqrt{3}$. *Antonym:* *transcendental number*.

algebraic operating system NOUN /ˌæl.dʒə'breɪ.ɪk ˌɒ.pə'reɪ.tŋ 'sɪs.təm/ *See* *order of operations*. *Abbreviation:* *AOS*.

algebraic operation NOUN /ˌæl.dʒə'breɪ.ɪk ˌɒ.pə'reɪ.ʃən/ one of the operations of addition, subtraction, multiplication, division, exponentiation and taking of roots. *Examples:* +, –, ×, ÷, a^b, $\sqrt{\ }$.

algebraic representation NOUN /ˌæl.dʒə'breɪ.ɪk ˌrɛp.rɪ.zɛn'teɪ.ʃən/ a representation that uses algebra, such as an equation. *Example:* If the price of gasoline is $4.70 per gallon, the equation $C = 4.7g$ is an algebraic representation of the cost of purchasing g gallons.

algebra tile NOUN /'æl.dʒə.brə taɪl/ a square or rectangular tile used to represent algebraic operations.



Algebra Tile

algorithm NOUN /'æl.gəˌrɪ.ðəm/ a set of instructions for doing a procedure or solving a problem. *Example:* (cross multiplication): $\frac{a}{b} = \frac{c}{d} \rightarrow ad = bc$. *Synonym: method. Antonym: heuristic method.*

align VERB /ə'laɪn/ to arrange in a straight line; to make line up.

Al-Khwarizmi, Muhammad Ibn Musa PERSON (c 780-850) an Arab mathematician whose works introduced Arabic numerals to Europe.

Muhammad Ibn Musa Al-Khwarizmi

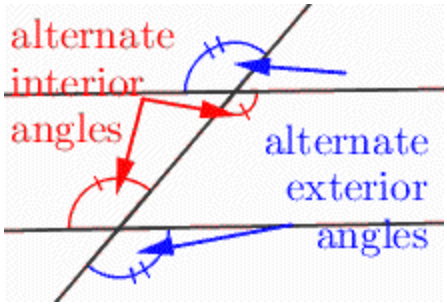
all together PREPOSITION /ɔl tə'gɛð.ər/ added together; summed. Keyword for addition.

alpha NOUN /'æl.fə/ the Greek letter α. α is often used to represent angles.

alternate

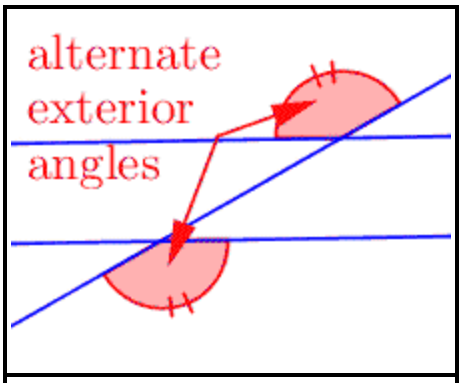
1. ADJECTIVE /'ɔl.tər.nɪt/ on opposite sides.
2. ADJECTIVE /'ɔl.tər.nɪt/ changing signs.
3. ADJECTIVE /'ɔl.tər.nɪt/ one then the other, back and forth.
4. VERB /'ɔl.tər.neɪt/ to change from one to another, back and forth.

alternate angles NOUN /'ɔl.tər.nɪt 'æŋ.gəlz/ angles on opposite sides of a transversal.



Alternate Angles

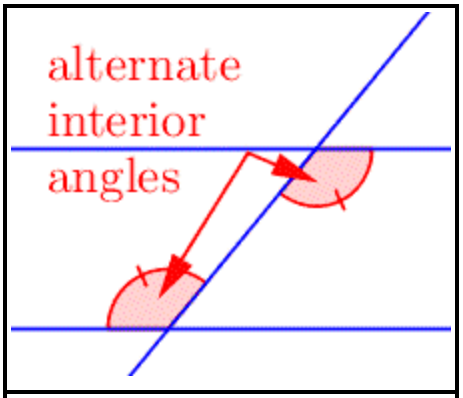
alternate exterior angles NOUN /ˈɔl.tər.nɪt ɪkˈstɪər.i.ər ˈæŋ.gəlz/ angles that are on different sides of a transversal and are outside the transversed lines.



Alternate Exterior Angles

Alternate Exterior Angles Theorem NOUN /ˈɔl.tər.nɪt ɪkˈstɪər.i.ər ˈæŋ.gəlz ˈθɪər.əm/ if two parallel lines are crossed by a transversal, then each pair of alternate exterior angles is congruent.

alternate interior angles NOUN /ˈɔl.tər.nɪt ɪnˈtɪər.i.ər ˈæŋ.gəlz/ angles that are on different sides of a transversal that intersects two other lines. The angles are between the two transversed lines.



Alternate Interior Angles

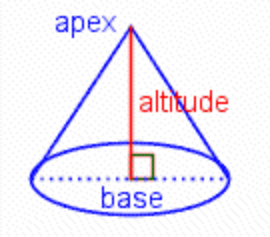
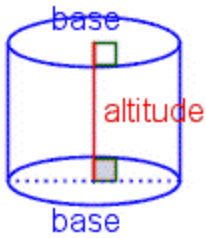
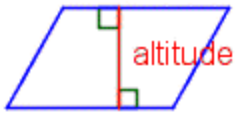
Alternate Interior Angles Theorem NOUN /ˈɔl.tər.nɪt ɪnˈtɪər.i.ər ˈæŋ.gəlz ˈθɪər.əm/ if two parallel lines are cut by a transversal, then each pair of alternate interior angles are congruent.

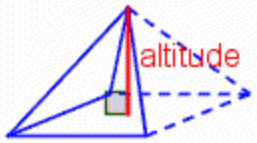
alternating ADJECTIVE /ˈɔltərˌneɪ.ting/ changing between one and the another, back and forth.

alternating series NOUN /ˈɔltərˌneɪ.ting ˈsɪər.iz/ a series which changes back and forth between negative and positive terms. *Example:* $\frac{1}{2} - \frac{1}{3} + \frac{1}{4} - \frac{1}{5} + \ldots$. *Plural: alternating series.*

altitude NOUN /ˈæl.tɪˌtud/

1. a line segment from the base of a figure to the apex that is perpendicular to the base. *See also GeoApp!.*
2. a line segment from the top of a figure to the bottom that is perpendicular to both the top and the bottom.
3. height, usually from sea level or ground level.

Altitudes		
Name	**Figure**	**Altitude**
Cone		The line segment from the vertex of the cone to the plane containing the base. The altitude is perpendicular to the base.
Cylinder		A line segment between the planes containing the bases of the cylinder. The altitude is perpendicular to the bases.
Parallelogram		A line segment between extended parallel sides. The altitude is perpendicular to the parallel sides.
Prism		A line segment between the base planes of the prism. An altitude is

		prism. An altitude is perpendicular to the base planes.
Pyramid		A line segment between the base plane of the pyramid and the apex. The altitude is perpendicular to the base.
Triangle		The line segment from a vertex to the extended opposite side. The altitude is perpendicular to the opposite side. Each triangle has three altitudes.

am ABBREVIATION /æm/ ante meridiem; a time between midnight and noon. This is also abbreviated a.m. with periods. *Example:* 10:00 AM is 10 o'clock in the morning.

ambiguous ADJECTIVE /æm'bɪg.yu.əs / open to more than one possibility. *Example:* ambiguous case.

ambiguous case NOUN /æm'bɪg.yu.əs keɪs/ a case where the result can *not* be uniquely identified. *Example:* Given one side and two angles, the law of sines may not give all possibilities.

amount NOUN /ə'maʊnt/

1. a quantity.
2. a total or sum. *Example:* the amount of money in my wallet.

amp ABBREVIATION /æmp/ See ampere.

ampere NOUN /'æm.pɪər/ a unit of measure of electrical current. *Abbreviations: A, amp.*

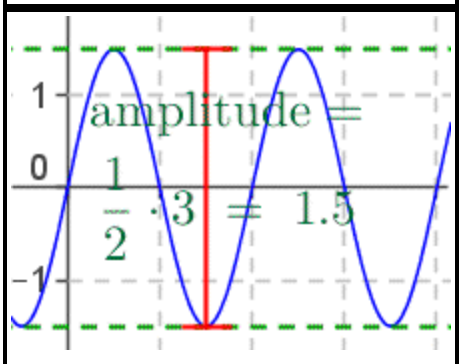
Ampère, André-Marie PERSON /'æm.pɪər 'ɑn.dreɪ mə'ri/ a French physicist, who was one of the original discoverers of electromagnetism. The unit of measure of electric current, the ampere, is named after him.

André-Marie Ampère

amplitude NOUN /'æmp.lɪˌtud/ half the distance from the global minimum value to the global maximum value of a periodic function. In nature, the amplitude of many waves is related to the energy of the waves.

Formula: $\text{amplitude} = \frac{1}{2}(\max(f(x)) - \min(f(x)))$.

See also GeoApp!.



Amplitude

analog ADJECTIVE /'ænlˌɔg/ relating to a mechanism that shows data continuously; that shows data on a dial or by other non-digital means. *Antonym: digital.*

analog clock NOUN /'ænlˌɔg klɒk/ a clock with a minute hand and an hour hand that turn in a circle. *Antonym: digital clock.*

analogy NOUN /æ'næl.ə.dʒi/ a type of reasoning that assumes that two situations are similar and draws conclusions about one based on the other. An analogy is *not* a mathematical proof. *Example:* Life is like an onion.

analysis NOUN /ˌæ'næl.ɪ.sɪs/

1. use of the principles of algebra as opposed to geometry.
2. a branch of mathematics that includes differentiation, integration, infinite series, and analytic functions.
3. the processing of raw data to create information.

analytic ADJECTIVE /ˌæ.nə'lɪt.ɪk/ having to do with analysis.

analytical ADJECTIVE /ˌæ.nə'lɪ.tɪ.kəl/ *See analytic.*

analytic geometry NOUN /ˌæ.nə'lɪt.ɪk dʒi'ɒ.mɪ.tri/ the study of geometry using coordinate systems and the methods of algebra. *Synonym: Cartesian geometry.*

analytic proof NOUN /ˌæ.nə'lɪt.ɪk pruf/

1. a proof that assumes the conclusion is true, then works backwards to a proposition.
2. a proof that uses algebra, and not geometry.

analytic values of trigonometric functions NOUN /ˌæ.nə'lɪt.ɪk 'væl.yuz ʌv ˌtrɪg.ə.nə'mɛ.trɪk 'fʌŋk.ʃənz/ *See exact values of trigonometric functions.*

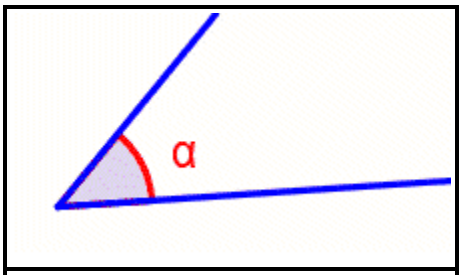
analyze VERB /ˌæ.nə'laɪz/ to look at methodically in order to discover fact.

anchor ring NOUN /'æŋ.kər rɪŋ/ *See torus.*

and NOUN /ænd/ *See conjunction.*

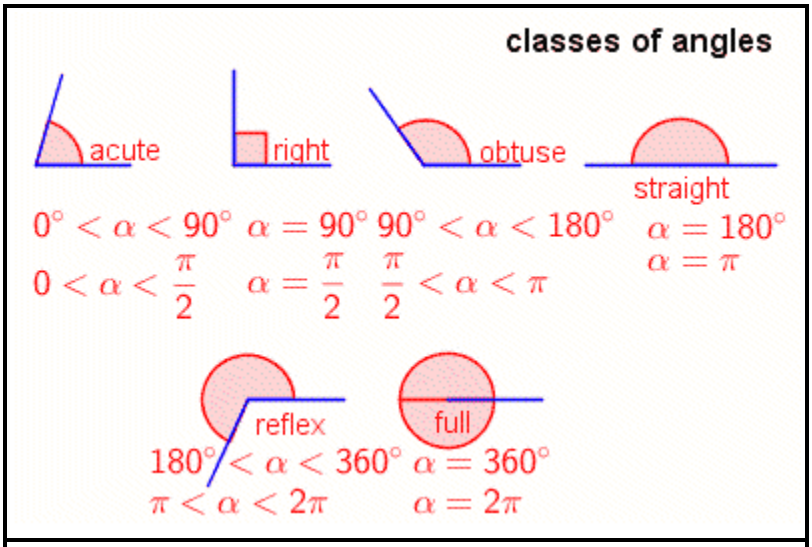
anecdotal ADJECTIVE /'æn.ɪkˌdoʊ.tl/ based on personal experience without scientific observation or experiment. *Antonyms: empirical, theoretical.*

angle NOUN /'æŋ.gəl/ the rotation between two rays or line segments with a common endpoint. Angles are measured in degrees (360 degrees = 1 full circle), radians (2Π radians = 1 full circle) or gradians (400 gradians = 1 full circle).



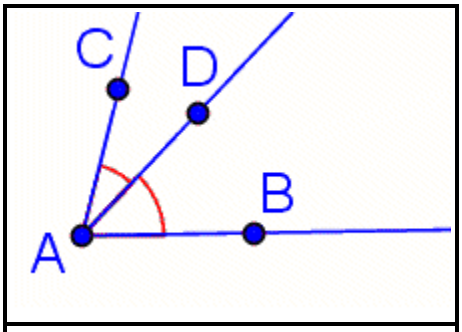
Angle

Notation: ∠. *See also* [Angle Classes!](#).



Classes of Angles

Angle Addition Postulate NOUN /'æŋ.gəl ə'dɪ.ʃən 'pɒs.tʃə.lɪt/ adjacent angles can be added together to form a larger angle. *Math definition:* Given noncollinear points A, B, C and a point D in the interior of $\angle BAC$, $m\angle BAD + m\angle DAC = m\angle BAC$. *See also* [GeoApp!](#).



Angle Addition Postulate

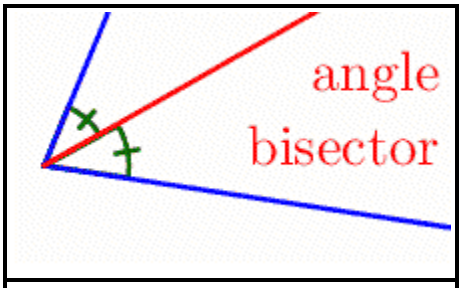
angle-angle-angle similarity NOUN /'æŋ.gəl 'æŋ.gəl 'æŋ.gəl ˌsɪm.ə'lær.ɪ.ti/ *See* [AA similarity](#).

angle-angle-side congruence NOUN /'æŋ.gəl 'æŋ.gəl saɪd kən'gru.əns/ *See* [AAS congruence](#).

angle-angle similarity NOUN /ˈæŋ.gəl ˈæŋ.gəl ˌsɪm.əˈlær.ɪ.ti/ *See AA similarity.*

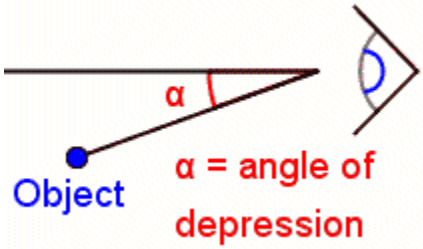
angle bisection NOUN /ˈæŋ.gəl baɪˈsɛk.ʃən/ the act of dividing an angle into two equal angles. *See also bisect, GeoApp!.*

angle bisector NOUN /ˈæŋ.gəl baɪˈsɛk.tər/ a ray or line that divides an angle into two equal angles. *See also bisect, GeoApp!.*



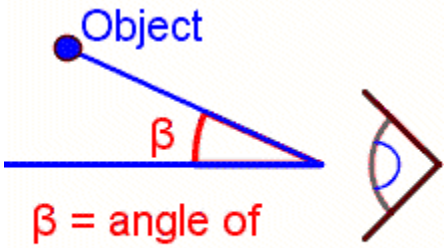
Angle Bisector

angle of depression NOUN /ˈæŋ.gəl ʌv dɪˈprɛ.ʃən/ the angle at which an observer must look below the horizontal to see an object. *See also GeoApp!.*



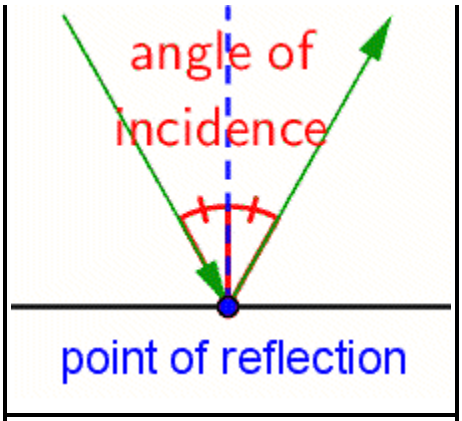
Angle of Depression

angle of elevation NOUN /ˈæŋ.gəl ʌv ˌɛl.əˈveɪ.ʃən/ the angle at which an observer must look above the horizontal to see an object. *See also GeoApp!.*



Angle of Elevation

angle of incidence NOUN /ˈæŋ.gəl ʌv ˈɪn.sɪ.dəns/ the angle at which an object 'bounces' off of a flat surface, measured from a perpendicular at the point of reflection.



Angle of Incidence

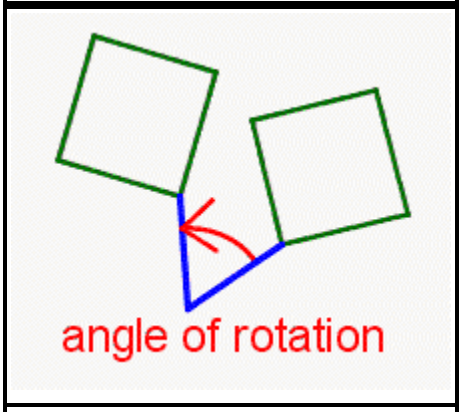
angle of inclination NOUN /ˈæŋ.gəl ʌv ˌɪn.kləˈneɪ.ʃən/
1. either an angle of depression or an angle of elevation.
2. the angle between a plane and a reference plane.

angle of reflection NOUN /ˈæŋ.gəl ʌv rɪˈflɛk.ʃən/ *See angle of incidence.*

angle of repose NOUN /ˈæŋ.gəl ʌv ˌrəˈpoʊz/ the maximum angle of a stable slope of granular materials.

Angle of Repose

angle of rotation NOUN /ˈæŋ.gəl ʌv roʊˈteɪ.ʃən/ the angle though which an object is rotated.

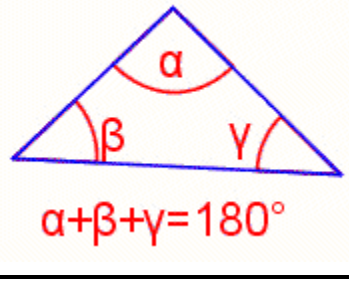


Angle of Rotation

angle-side-angle congruence NOUN /ˈæŋ.gəl saɪd ˈæŋ.gəl kənˈgru.əns/ *See ASA congruence.*

angle sum NOUN /ˈæŋ.gəl sʌm/ the sum of all of the interior angles of a polygon.

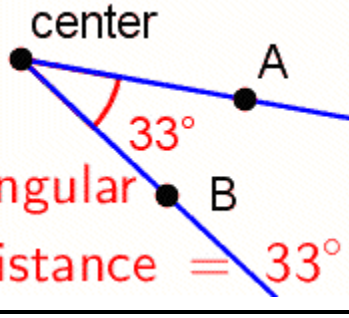
Angle Sum Theorem NOUN /ˈæŋ.gəl sʌm ˈθɪər.əm/ in Euclidean geometry, the sum of the measures of the angles of a triangle is $180º$ or Π radians. *Formula:* $\alpha + \beta + \gamma = 180º$.



Angle Sum Theorem

angular ADJECTIVE /ˈæŋ.gyə.lər/
1. having to do with an angle.
2. measured using an angle. *Example:* angular distance.

angular distance NOUN /ˈæŋ.gyə.lər ˈdɪs.təns/ the measure of the angle between two objects from a reference point.



Angular Distance

annual ADJECTIVE /ˈæn.yu.əl/
1. once a year. *Example:* annual company picnic.
2. during a whole year. *Example:* annual rainfall.

annual interest rate NOUN /ˈæn.yu.əl ˈɪn.trɪst ˈreɪt/ *See annual percentage rate.*

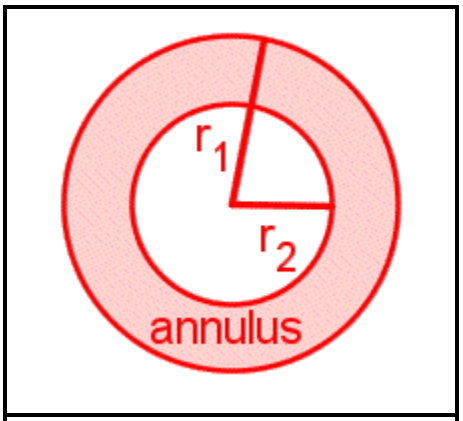
annualize VERB /'æn.yu.əˌlaɪz/ to convert an interest rate to a rate that would generate the same interest amount in a full year. *Formula:* $r_a = \left(1 + \frac{r}{n}\right)^n - 1$ where r_a is the annual interest rate, r is the stated interest rate and n is the number of times per year the interest is compounded. *Example:* 10% compounded 12 times a year:

$$r_a = \left(1 + \frac{0.1}{12}\right)^{12} - 1 = \left(1.00\overline{83}\right)^{12} - 1$$
$$\approx 1.1047 - 1 = 0.1047 = 10.47\%.$$

annually ADVERB /'æn.yu.əˌli/ once a year. *Example:* compounded annually.

annual percentage rate NOUN /'æn.yu.əl pər'sɛnt.ɪdʒ 'reɪt/ an interest rate that, if compounded once a year, would produce the same amount of interest as the nominal (stated) interest rate. *Abbreviation: APR. Synonym: annual interest rate. See also annualize.*

annulus NOUN /'æn.yə.ləs/ the region between two concentric circles. *Formula:* $A = \pi(r_1^2 - r_2^2)$, $r_1 > r_2$. *Example:* the cross section of a pipe is an annulus. *Plural: annuli* /'æn.yəˌlaɪ/.



Annulus

ante- PREFIX /'æn.tə/ before. *Example:* antecedent.

antecedent NOUN /ˌæn.təˈsid.nt/ the first of two statements in an "if-then" relationship (an implication): if antecedent then consequent.

Notation: $antecedent \to consequent$. *Example:* If

$$\frac{\text{a circle has a radius of 1}}{\text{the circle is a unit circle}}\ \frac{\text{then}}{\to}$$

$$\frac{antecedent}{consequent}.$$

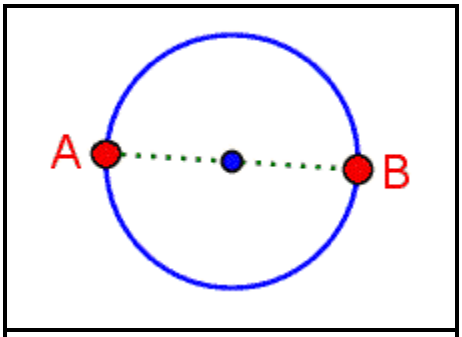
anti- PREFIX /ˈæn.tɪ/

1. opposite of. *Example:* anticlockwise.
2. inverse of. *Example:* antilogarithm.

anticlockwise ADJECTIVE /ˌæn.tɪˈklɒkˌwaɪz/ (British English) *See counterclockwise.*

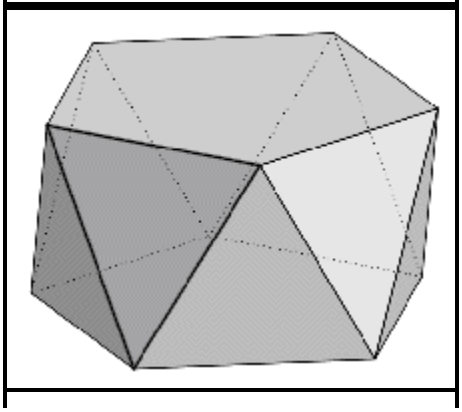
antilogarithm NOUN /ˈæn.tɪˌlɔ.gəˌrɪð.əm/ a number for which the given number is the logarithm. In $y = \log_b x$, x is the antilogarithm of y to the base b.

antipodal ADJECTIVE /ænˈtɪ.paʊ.dl/ being exactly opposite each other; being on the opposite ends of a diameter of a circle or sphere. *Synonym: diametrically opposed.*



Antipodal

antiprism NOUN /ænˌtɪˈprɪz.əm/ a 3-dimensional geometric shape having congruent polygons for bases and isosceles triangles for lateral faces. *See also Net!.*



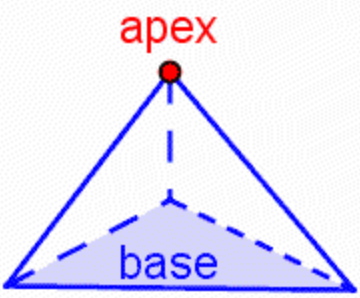
Pentagonal Antiprism

any ADJECTIVE /ˈɛ.ni/ it does *not* matter which.

AOS ABBREVIATION See algebraic operating system.

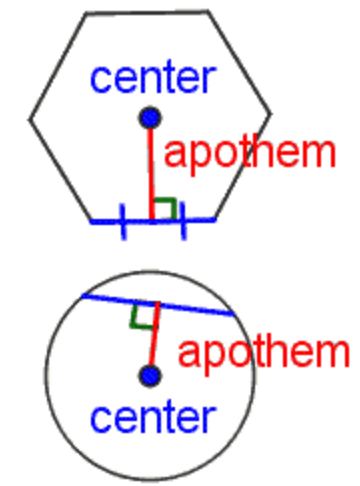
ap- PREFIX /æp/
1. before.
2. away from.

apex NOUN /ˈeɪ.pɛks/ the vertex at the tip top of a cone or a pyramid; the highest point of a figure when that figure comes to a point.



Apex

apothem NOUN /ˈæ.pɑˌθɛm/
1. a line segment from the center of a regular polygon to the midpoint of one of the sides of the polygon.
2. a line segment from the center of a circle to the midpoint of a chord of the circle. *See also GeoApp!.*



Apothem

applied mathematics NOUN /əˈplaɪd ˌmæθ.əˈmæ.tɪks/ mathematics that is applied to real-world problems. *Examples:* accounting, physics. *Antonym: pure mathematics.*

apply VERB /əˈplaɪ/ to use to help solve a problem. *Example:* apply the property of addition by 0.

approach /əˈproʊtʃ/
1. VERB to get close to.

2. NOUN a way to accomplish a task.

approximate

1. ADJECTIVE /əˈprɒk.sə.mɪt/ an estimated value. *Antonym: exact.*
2. VERB /əˈprɒk.səˌmeɪt/ to find a number close to the actual number. *Example:* approximate the square root of 2.

approximately ADJECTIVE /əˈprɒk.sə.mɪt.li/

1. close to the actual value. *Example:* Π is approximately 3.14.
2. estimated to be.
3. changes, but is close to. *Example:* The distance between the moon and the earth is approximately $3.85 \text{x} 10^5$ km.

Antonym: exactly. Notation: $\approx$.

approximation NOUN /əˌprɒk.səˈmeɪ.ʃən/

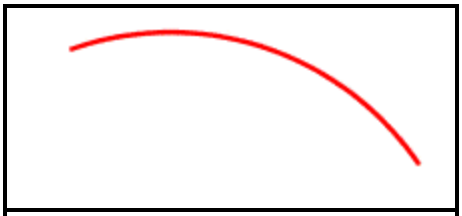
1. a value found by approximating.
2. the process of finding an approximate value.

APR ABBREVIATION *See annual percentage rate.*

Arabic numerals NOUN /ˈær.ə.bɪk ˈnum.rəlz/ numerals that use the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. *Example:* 23.5. *Synonym: Hindu-Arabic numerals. See also decimal numeration.*

arbitrary ADJECTIVE /ˈɑr.bɪˌtrɛr.i/ any value may be chosen, without restriction. *Example:* an arbitrary integer.

arc NOUN /ɑrk/ a smooth, unbroken curve joining two points; a finite curve. *See also circular arc, Parts of a Circle!.*



Arc

arc- PREFIX /ɑrk/ an inverse trigonometric function or an inverse hyperbolic function. *Example:* the arcsine function is the inverse of the sine function.

arccos ABBREVIATION *See arccosine.*

arccosecant NOUN /ɑrk.koʊ'si.kænt/ an angle that has a cosecant equal to a given value. *Notations:* $arccsc$, csc^{-1}. *Math definition:* $\theta = \csc^{-1} x$ if and only if $x = \csc \theta$, $-90° \leq \theta < 0°$ or $0° < \theta \leq 90°$; $-\pi/2 \text{ rad.} \leq \theta < 0 \text{ rad.}$; or $0 \text{ rad.} < \theta \leq \pi/2 \text{ rad.}$.

arccosine NOUN /ɑrk'koʊ.saɪn/ an angle that has a cosine equal to a given value. *Notations:* $arccos$, cos^{-1}. *Math definition:* $\theta = \cos^{-1} x$ if and only if $x = \cos \theta$, $0° \leq \theta < 180°$; $0 \text{ rad.} \leq \theta < \pi \text{ rad.}$.

arccot ABBREVIATION *See arccotangent.*

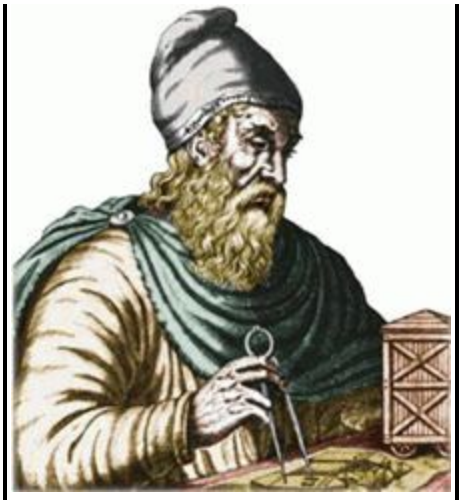
arccotangent NOUN /ɑrk.koʊ'tæn.dʒənt/ an angle that has a cotangent equal to a given value. *Notations:* $arccot$, cot^{-1}. *Math definition:* $\theta = \cot^{-1} x$ if and only if $x = \cot \theta$, $-90° \leq \theta < 0°$ or $0° < \theta \leq 90°$; $-\pi/2 \text{ rad.} \leq \theta < 0 \text{ rad}$, or $0 \text{ rad.} < \theta \leq \pi/2 \text{ rad.}$.

arccsc ABBREVIATION *See arccosecant.*

Archimedean solid NOUN /ˌɑr.kə'mi.diən 'sɒl.ɪd/ one of 13 possible polyhedra whose faces are regular polygons. *Synonym: semi-regular solid.*

Archimedes' axiom NOUN /ˌɑr.kə'mi.diz 'æk.si.əm/ *See Axiom of Archimedes.*

Archimedes of Syracuse PERSON /ˌɑr.kə'mi.diz ʌv 'sɪr.əˌkyuz/ (287 BCE to 212 BCE) an inventor and geometer after whom the Archimedean solids and the axiom of Archimedes are named.

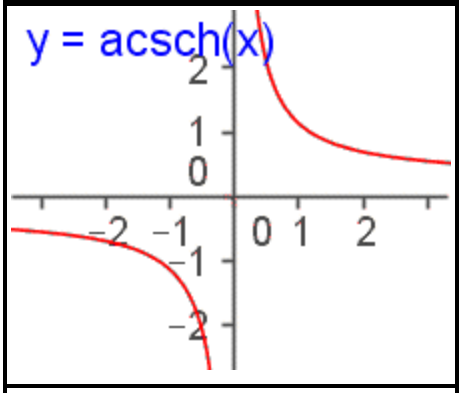


Archimedes of Syracuse

arc hyperbolic cosecant NOUN /ɑrk ˌhaɪ.pər'bɒl.ɪk koʊ'si.kænt/ an angle that has a hyperbolic cosecant equal to a given value. *Formula:*

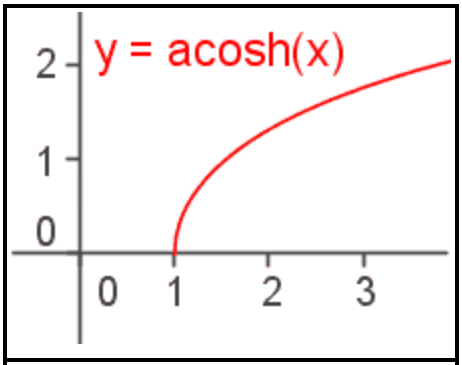
$$acsch\,(x) = ln\,\frac{1+\sqrt{1-x^2}}{x},$$

$x \neq 0$. *Inverse: hyperbolic cosecant.*



Arc Hyperbolic Cosecant

arc hyperbolic cosine NOUN /ɑrk ˌhaɪ.pər'bɒl.ɪk 'koʊ.saɪn/ an angle that has a hyperbolic cosine equal to a given value. *Formula:*



Arc Hyperbolic Cosine

$$arcosh\,(x) = ln\left(x+\sqrt{x^2-1}\right),\ x = 1.$$

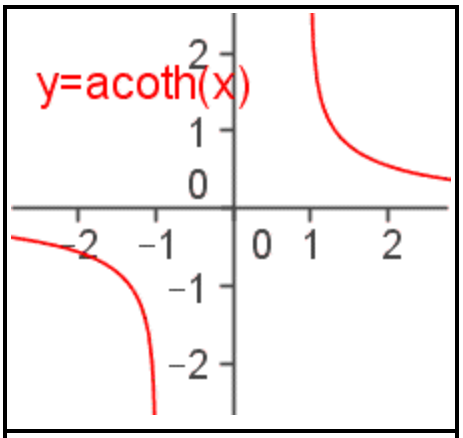
Inverse: hyperbolic cosine.

arc hyperbolic cotangent NOUN /ɑrk ˌhaɪ.pər'bɒl.ɪk 'koʊ.tæn.dʒənt/ an angle that has a hyperbolic cotangent equal to a given value. *Formula:*

$$arcoth\,(x) = \frac{1}{2}\,ln\,\frac{x+1}{x-1},$$

$x < 1$ or $x > 1$.

Inverse: hyperbolic cotangent.



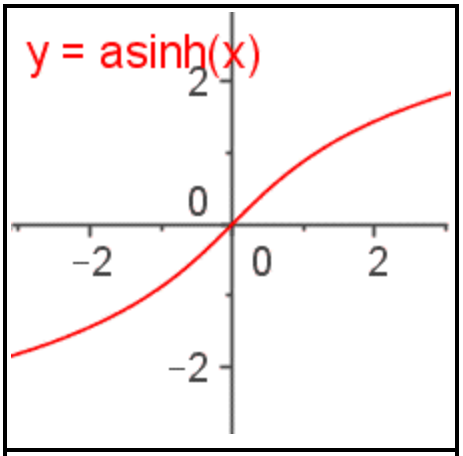
Arc Hyperbolic Cotangents

arc hyperbolic secant NOUN /ɑrk ˌhaɪ.pər'bɒl.ɪk 'si.kænt/ an angle that has a hyperbolic secant equal to a given value.

Formula: $$arsech\,(x) = ln\,\frac{1+\sqrt{1-x^2}}{x},$$

$0 < x < 1$. *Inverse: hyperbolic secant.*

arc hyperbolic sine NOUN /ɑrk ˌhaɪ.pər'bɒl.ɪk saɪn/ an angle that has a hyperbolic sine equal to a given value. *Formula:*



Arc Hyperbolic Sine

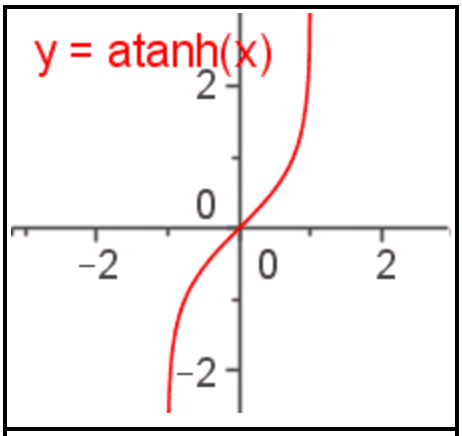
$$arsinh\,(x) = ln\left(x + \sqrt{x^2-1}\right).$$

Inverse: hyperbolic sine.

arc hyperbolic tangent NOUN /ɑrk ˌhaɪ.pər'bɒl.ɪk 'tæn.dʒənt/ an angle that has a hyperbolic tangent equal to a given value. *Formula:*

$$artanh\,(x) = \frac{1}{2}\,ln\,\frac{1+x}{1-x},$$

$-1 < x < 1$. *Inverse: hyperbolic tangent.*

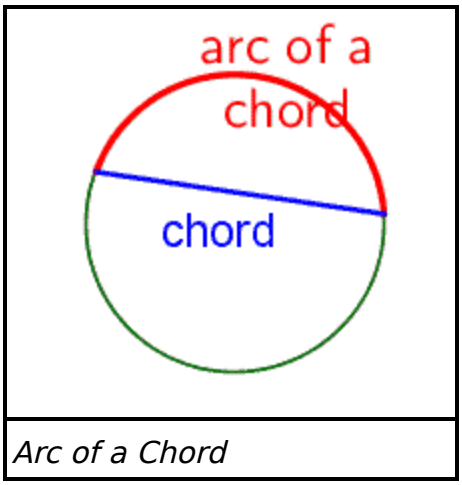


Arc Hyperbolic Tangent

arc length NOUN /ɑrk lɛŋkθ/ the linear length of an arc as if measured along the edge of the curve.

arc minute NOUN /ɑrk 'mɪn.ɪt/ *See minute, definition 2.*

arc of a chord NOUN /ɑrk ʌv eɪ kɔrd/ an arc with the same endpoints as a given chord.



Arc of a Chord

arcosh ABBREVIATION *See arc hyperbolic cosine.*

arcoth ABBREVIATION *See arc hyperbolic cotangent.*

arcsch ABBREVIATION *See arc hyperbolic cosecant.*

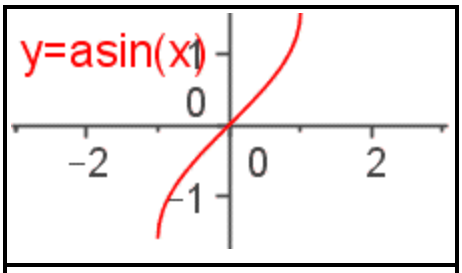
arcsec ABBREVIATION *See arcsecant.*

arcsecant NOUN /ɑrk'si.kənt/ an angle that has a secant equal to a given value. *Notations:* $arcsec$, sec^{-1}. *Math definition:* $\theta = \sec^{-1} x$ if and only if $x = \sec \theta$, $-90° \leq \theta < 0°$ or $0° < \theta \leq 90°$; or $-\pi/2$ rad. $\leq \theta < 0$ rad. or 0 rad. $< \theta \leq \pi/2$ rad..

arc second NOUN /ɑrk 'sɛ.kənd/ *See second, definition 2.*

arcsin ABBREVIATION *See arcsine.*

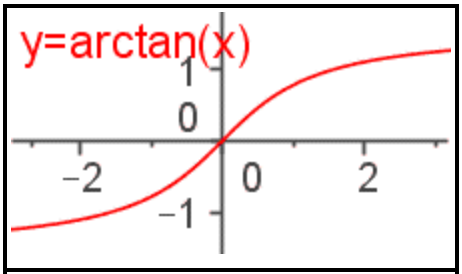
arcsine NOUN /'ɑrk.saɪn/ an angle that has a sine equal to a given value. *Notations:* $arcsin$, sin^{-1}. *Math definition:* $\theta = \sin^{-1} x$ if and only if $x = \sin \theta$, $-90° \leq \theta < 90°$, $-\pi/2 \text{ rad.} \leq \theta < \pi/2 \text{ rad.}$.



Arcsine

arctan ABBREVIATION *See arctangent.*

arctangent NOUN /ɑrk'tæn.dʒənt/ an angle that has a tangent equal to a given value. *Notations:* $arctan$, tan^{-1}. *Math definition:* $\theta = \tan^{-1} x$ if and only if $x = \tan \theta$, $-90° \leq \theta < 90°$, $-\pi/2 \text{ rad.} \leq \theta < \pi/2 \text{ rad.}$.

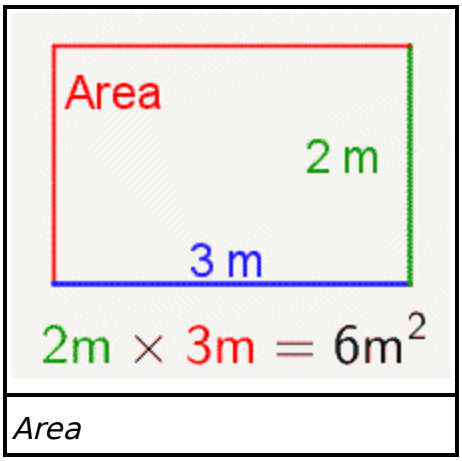


Arctangent

area NOUN /'ɛər.i.ə/

1. the number of square units contained by an object.
2. the measure of space in a two dimensional figure; the measure of a surface in a 3-dimensional figure.

See also surface area, Area Formulas.



Area

Units of Measure of Area	
Unit	**Notation**
square meter	m^2

square centimeter	cm^2
square foot	ft^2
square mile	mi^2
hectare	Ha
acre	acre

Argand diagram NOUN /ɑr'gɑnd 'daɪ.ə.græm/ *See complex plane.*

argument NOUN /'ɑr.gyə.mənt/

1. an independent variable passed to a function.
2. a justification given in a proof. *See also logical argument.*
3. an angle used to represent a complex number in polar form: θ in $\cos\ \theta + i \sin\ \theta$.

arithmetic

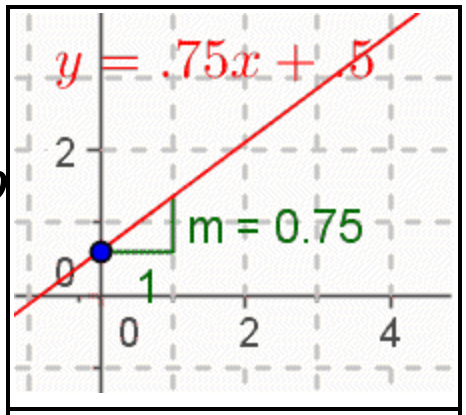
1. ADJECTIVE /ær.ɪθ'mɛt.ɪk/ having to do with addition, subtraction, multiplication, division, and the taking of roots.
2. NOUN /ə'rɪθ.mə.tɪk/ addition, subtraction, multiplication, division, and the taking of roots. *Synonym: computation.*

arithmetic average NOUN /ær.ɪθ'mɛt.ɪk 'æv.rɪdʒ/ *See arithmetic mean.*

arithmetic fact NOUN /ə'rɪθ.mə.tɪk fækt/ an addition, subtraction, multiplication, or division operation on two whole numbers and the correct answer.

Example: $1 + 3 = 4$.

arithmetic growth NOUN /ær.ɪθ'mɛt.ɪk groʊθ/ growth that happens at a constant rate each time period. *Formula:* $y = ax + b$ where b is the initial value and a is the growth rate per time period. *Synonyms: linear growth, constant growth.*



Arithmetic Growth

arithmetic mean NOUN /ær.ɪθ'mɛt.ɪk min/ the sum of a set of numbers divided by the number of elements in the set. *Formula:* for the set $\{a_1, a_2, a_3, \ldots, a_n\}$, the arithmetic mean is $M = \frac{a_1 + a_2 + a_3 + \cdots + a_n}{n}$. *Example:* the mean of $\{1, 2, 4, 8\}$ is $\frac{1 + 2 + 4 + 8}{4} = \frac{15}{4} = 3\frac{3}{4}$. *Synonym: arithmetic average.*

arithmetic precision NOUN /ær.ɪθ'mɛt.ɪk prɪ'sɪ.ʒən/ the number of digits that are accurate. *Example:* if, in the number 32.567325, the arithmetic precision is 4, only the first four digits, 32.56, are significant.

arithmetic progression NOUN /ær.ɪθ'mɛt.ɪk proʊ'grɛ.ʃən/ *See arithmetic sequence.*

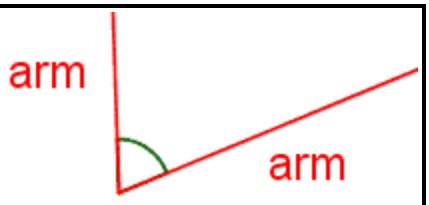
arithmetic sequence NOUN /ær.ɪθ'mɛt.ɪk 'si.kwəns/ a sequence of numbers with a common difference. To get the next number in the sequence, add the common difference to the previous number. *Formula:* for the k^{th} term: $a_k = a_0 + d \cdot k$ where a_0 is the first term, d is the common difference and k is the number of the term. *Example:* $1, 3, 5, 7, 9, \ldots$. *Synonym: arithmetic progression.*

arithmetic series NOUN /ær.ɪθ'mɛt.ɪk 'sɪər.iz/ the sum of a finite arithmetic sequence. *Formula:*

$$S_n = a_1 n + \frac{n(n-1)}{2} d$$

where n is the number of terms, a_1 is the first term and d is the common difference. *Plural: arithmetic series.*

arm NOUN /ɑrm/ one ray that defines an angle. *Synonym: leg, definition 1.*



Arm of an Angle

arrange VERB /ə'reɪndʒ/ to place in a particular order.

arrangement NOUN /ə'reɪndʒ.mənt/ a particular ordering of objects.

array NOUN /ə'reɪ/ an arrangement of objects in rows and columns. *Synonym: matrix.*

$$\begin{matrix} 2 & -1 & 3 \\ 4 & 0 & 2 \end{matrix}$$

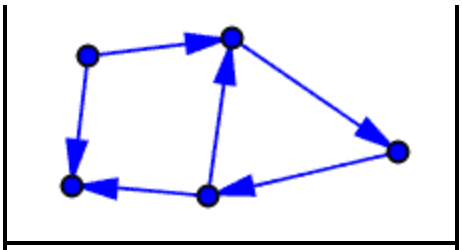
Array

arrow SYMBOL /'ær.oʊ/

1. a vector. *Example:* $\vec{a}$.
2. implies. *Example:* $P \rightarrow Q$.

3. ray. *Example:* $\overrightarrow{ab}$.
4. line. *Example:* $\overleftrightarrow{cd}$.
5. notation for a directed path in a directed graph.
6. maps to.
7. translation.

   Example: $(a,b) \to (c,d)$.



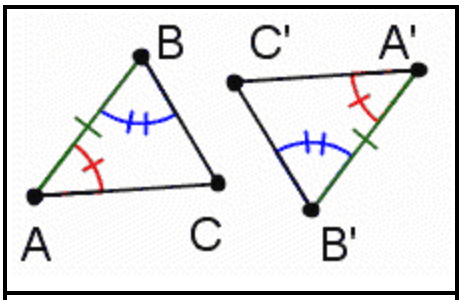
Arrow in Directed Graph

arsech ABBREVIATION *arc hyperbolic cosecant*

arsinh ABBREVIATION *arc hyperbolic sine*

artanh ABBREVIATION *arc hyperbolic tangent*

ASA congruence NOUN /eɪ es eɪ kən'gru.əns/ (angle-side-angle congruence) two triangles are congruent if two corresponding angles and the side they contain are congruent. *Math definition:* Given two triangles ΔABC and $\Delta A'B'C'$; $\angle BAC \cong \angle B'A'C'$, $\angle CBA \cong \angle C'B'A'$ and $AB \cong A'B'$ if and only if $\Delta ABC \cong \Delta A'B'C'$. *See also GeoApp!.*



ASA Congruence

ascending ADJECTIVE /ə'sən.dɪŋ/ going up; increasing. *Example:* sort in ascending numerical order: $1, 5, 6, 7, 7, 10, 12$.

assert VERB /ə'sərt/ to make a statement that is presented as true.

assertion NOUN /ə'sər.ʃən/

1. a statement that is presented as true.
2. a statement that a particular Boolean variable is true or false.

asset NOUN /'æ.sɛt/ something which has value. *Example:* a building is an asset of a company.

associative ADJECTIVE /əˈsoʊ.siˌeɪ.tɪv/ having the same result no matter how the operations are grouped. *Math definition:* a binary operator $*$ is associative if and only if for all a, b, c; $a*(b*c) \equiv (a*b)*c$.

Associative Property of Addition NOUN /əˈsoʊ.siˌeɪ.tɪv ˈprɒ.pər.ti ʌv əˈdɪ.ʃən/ addition of real and complex numbers can be grouped in any order without changing the sum. *Math definition:* $a + (b + c) \equiv (a + b) + c$. *See also GeoApp!.*

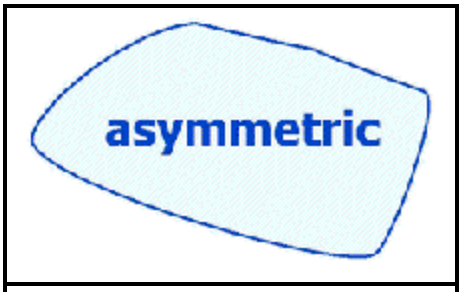
Associative Property of Multiplication NOUN /əˈsoʊ.siˌeɪ.tɪv ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən/ multiplication of real and complex numbers can be grouped in any order without changing the product. *Math definition:* $a \cdot (b \cdot c) \equiv (a \cdot b) \cdot c$.

associativity NOUN /əˈsoʊ.siˌeɪ.tɪv.ɪ.ti/ having to do with whether or not an operation is associative.

assumption NOUN /əˈsʌmp.ʃən/

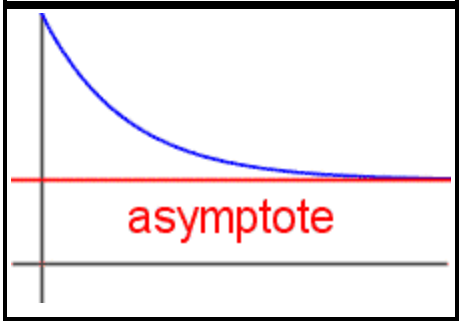
1. a statement that is taken to be true without proof. *Synonym: axiom.*
2. a criterion. *Example:* let $\angle a \cong \angle b$.

asymmetric ADJECTIVE /ˌeɪs.əˈmɛ.trɪk/ *not* symmetric about *any* line or point. *Antonym: symmetric.*



Assymetric

asymptote NOUN /ˈæ.sɪmˌtoʊt/ a straight line to which a curve get closer and closer, but never reaches. *See also GeoApp!.*



Assymptote

atan() COMPUTERS the arctangent function in many computer languages.

atto- PREFIX /ˈæ.toʊ/ 10^{-18}. *Abbreviation: a.*

Example: 3 attometer $= 3 \times 10^{-18}$ meters.
Synonym: quintillionth.

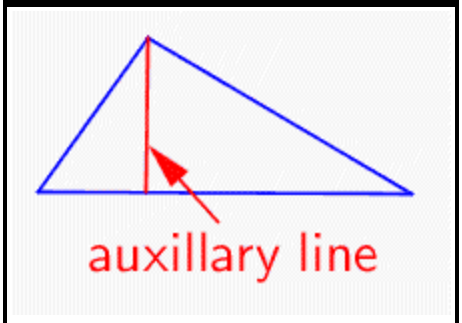
attribute NOUN /ˈæ.trɪ.but/ *See property.*

augmented matrix NOUN /ˈɒg.mɛn.təd ˈmeɪ.trɪks/ a square matrix with one column added on the right. *Plural: augmented matrices.*

$$\begin{bmatrix} 2 & 3 & -1 \\ -2 & 5 & -4 \end{bmatrix}$$

Augmented Matrix

auxiliary line NOUN /ɒgˈzɪl.yə.ri laɪn/ a line or line segment added to a figure to illustrate a relationship or property.



Auxiliary Line

average /ˈæv.rɪdʒ/

1. NOUN the center of a set of numbers, usually the arithmetic mean.
2. VERB to take the average of a set of numbers.
3. ADJECTIVE having to do with a center of a set, especially an arithmetic mean.

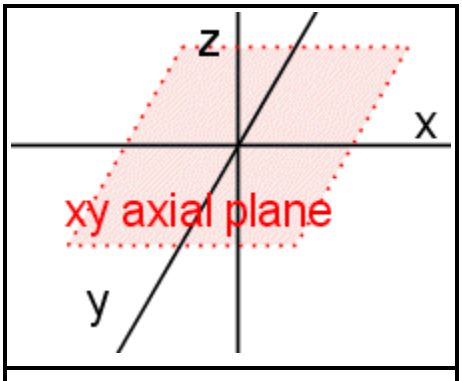
average absolute deviation NOUN /'æv.rɪdʒ æbs.ə'lut ˌdi.vi'eɪ.ʃən/ the arithmetic mean of the absolute deviations of a dataset. *Formula:* $D = \frac{d_1 + d_2 + \cdots + d_n}{n}$ where d_1, d_2, ... are the absolute deviations of each data item, and n is the total number of data items. *Synonyms: mean absolute deviation, mean absolute residual. See also absolute deviation.*

average expected payoff NOUN /'æv.rɪdʒ ɛk'spɛkt.ɛd 'peɪ.ɒf/ the amount one can expect to win on average from a gambling bet. *See also expected value.*

average rate of change NOUN /'æv.rɪdʒ 'reɪt ʌv tʃeɪndʒ/ the arithmetic mean of the amounts of change from one period to the next. *Math definition:* $\Delta_{mean} = \frac{\Delta_1 + \Delta_2 + \cdots + \Delta_{n-1}}{n-1}$ where Δ_i is the change between the i^{th} period and the $(i+1)^{\text{th}}$ period and n is the total number of periods.

axial ADJECTIVE /'æk.si.əl/ having to do with an axis. *Example:* axial symmetry.

axial plane NOUN /'æk.si.əl pleɪn/ a plane in a 3 dimensional coordinate system that contains two of the three axes. The axial plane containing the x-axis and the y-axis is called the xy-plane.



Axial Plane

axial symmetry NOUN /'æk.si.əl 'sɪm.ɪ.tri/ *See line symmetry.*

axiom NOUN /'æk.si.əm/ a statement that is taken to be true without proof. *Synonyms: assumption, postulate.*

axiomatic ADJECTIVE /ˌæk.si.əˈmæt.ɪk/ based on axioms. *Example:* axiomatic system.

axiomatic system NOUN /ˌæk.si.əˈmæt.ɪk ˈsɪs.təm/ a logical system that is based on axioms, primitives, definitions, plus theories proved from those bases. *Example:* Euclidean geometry.

Axiom of Archimedes NOUN /ˈæk.si.əm ʌv ˌɑr.kəˈmi.diz/ there is always at least one more number. *Math definition:* For every real number x, there exists a real number n such that $n > x$.

Axiom of Choice NOUN /ˈæk.si.əm ʌv tʃɔɪs/ a set can be created from an infinite collection of infinite sets.

Axiom of Extension NOUN /ˈæk.si.əm ʌv ɪkˈstɛn.ʃən/ set A equals set B if and only if they contain exactly the same elements.

Axiom of Parallels NOUN /ˈæk.si.əm ʌv ˈpær.əˌlɛlz/ *See Parallel Postulate.*

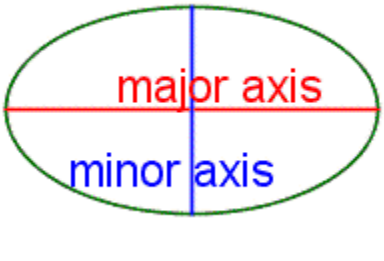
axis NOUN /ˈæk.sɪs/

1. a line with tick marks that is used to define a metric space. *Example:* x-axis.
2. a line that is used as a reference. *Example:* axis of reflection.

Plural: axes /ˈæk.siz/.

axis of abscissas NOUN /ˈæk.sɪs ʌv æbˈsɪs.əz/ *Synonym: x-axis.*

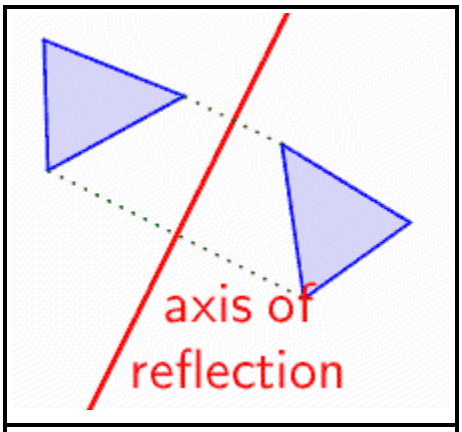
axis of an ellipse NOUN /ˈæk.sɪs ʌv ən ɪˈlɪps/ one of two line segments about which an ellipse is symmetric. *Plural: axes of an ellipse* /ˈæk.siz ʌv ən ɪˈlɪps/.



Axis of an Ellipse

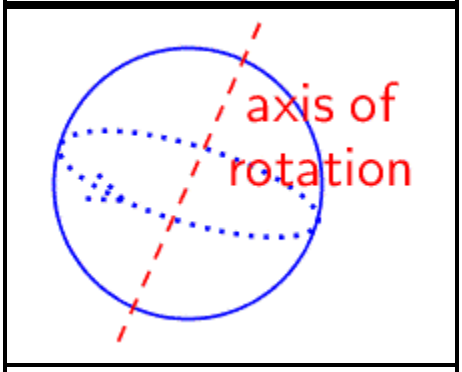
axis of ordinates NOUN /ˈæk.sɪs ʌv ˈɔrd.ɪ.nɑtz/ *See y-axis.*

axis of reflection NOUN /ˈæk.sɪs ʌv rɪˈflɛk.ʃən/ a line across which an object is reflected. *Plural: axes of reflection* /ˈæk.siz ʌv rɪˈflɛk.ʃən/. *Synonym: line of reflection.*



Axis of Reflection

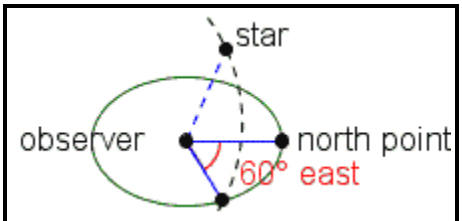
axis of rotation NOUN /ˈæk.sɪs ʌv roʊˈteɪ.ʃən/ a line about which an object rotates. *Example:* the Earth rotates around an imaginary axis passing through the North Pole and the South Pole. *Plural: axes of rotation* /ˈæk.siz ʌv roʊˈteɪ.ʃən/.



Axis of Rotation

axis of symmetry NOUN /ˈæk.sɪs ʌv ˈsɪm.ɪ.tri/ *See line of symmetry. Plural: axes of symmetry* /ˈæk.siz ʌv ˈsɪm.ɪ.tri/.

azimuth NOUN /ˈæ.zɪ.məθ/ the angle from north or south an object in the sky would be if it were on the horizon. *See also zenith.*



Azimuth

B

back substitution NOUN /bæk ˈsʌb.stɪˌtu.ʃən/ the process of substituting known values back into an equation to find the values of other unknowns. *Example:* $\begin{matrix} 3x+y=-1 \\ y=3 \end{matrix} \rightarrow 3x+1=-1 \rightarrow 3x=-4 \rightarrow x=-\frac{3}{4}.$

back to back stem and leaf plot NOUN /bæk tu bæk stɛm ænd lif plɒt/ two stem and leaf plots placed on opposite sides of a line so one can be compared with the other. *See also stemplot.*

36	5
124788	389
379	2458
6	34

Back to Back Stem and Leaf Plot

backwards ADVERB /ˈbæk.wərdz/ in the opposite direction from normal.

balance /ˈbæl.əns/

1. NOUN a state where two things are equal in some way.
2. NOUN a device for comparing the weights of two objects.
3. NOUN the current amount in an account. *Example:* the balance in a checking account.
4. VERB (equation) to keep both sides equal by adding, subtracting or multiplying both sides of the equation by the same amount, or by dividing both sides of the equation by the same nonzero amount. *Example:* $a + 5 - 5 = 6 - 5$.

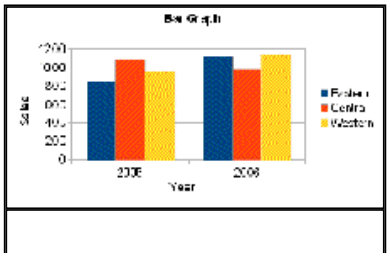
Balance

bar NOUN /bɑr/

1. a rectangular figure used to represent data.
2. a line segment over or under text. *Example:* $3.\overline{125}$.

bar chart NOUN /bɑr tʃɑrt/ *See bar graph.*

bar graph NOUN /bɑr græf/ a graph that uses parallel lines or rectangles to represent data. *Synonym: bar chart.*



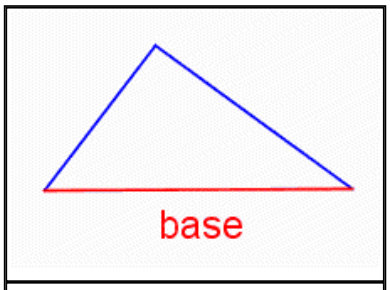
Bar Chart

bar notation NOUN /bɑr noʊ'teɪ.ʃən/ a line segment over a part of a real number showing a repeating decimal.

Example: $3.\overline{6} = 3.66666\ldots$.

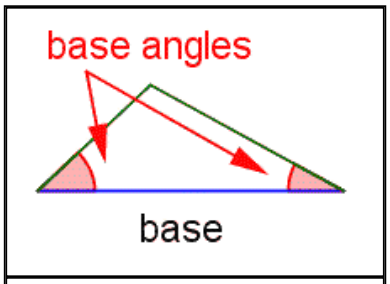
base NOUN /beɪs/

1. (exponents and logarithms) the number or variable being raised to a power. The bases in the following expressions are 'b': b^e, $\log_b x$. In $\ln\ x$, the implied base is e. In $\log\ x$, the implied base is either 10 or e.
2. (number systems) the number of different digits that are used. The decimal number system is base 10. *Synonym: radix.*
3. (geometric figures) the 'bottom' and/or 'top' of a geometric figure.
4. (time) a period of time from which all other periods of time are relative, usually the first period of time in which measurements are made. *Example:* base year.



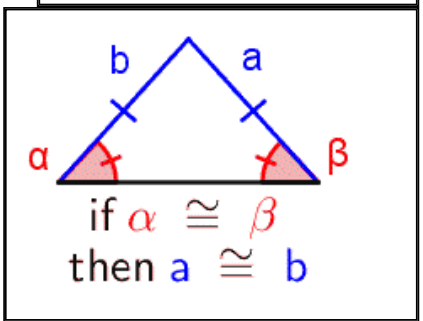
Base of a Geometric Figure

base angle NOUN /beɪs 'æŋ.gəl/ one of two angles adjacent to the base of a figure.



Base Angles

Base Angle Congruence Theorem NOUN /beɪs 'æŋ.gəl kən'gru.əns 'θɪər.əm/ if two angles of a triangle are equal, the sides opposite the equal angles are also equal. *Math definition:* if $\angle\alpha \cong \angle\beta$ then $\mathrm{a} \cong \mathrm{b}$.



Base Angle Congruent Theorem

base area NOUN /beɪs 'ɛər.i.ə/ the area of the base of a geometric solid.

base edge NOUN /beɪs ɛdʒ/ an edge of a polyhedron adjacent to the base.

base period NOUN /beɪs 'pɪər.i.əd/ a period from which indexed periods are calculated.

Base Period Example	
Period	**Month**
Base	January 2005
1	February 2005
2	March 2005

base surface area NOUN /beɪs 'sɜr.fɪs 'ɛər.i.ə/ *See base area.*

base ten block NOUN /beɪs tɛn blɔk/ a block used to represent base 10 operations.

base unit NOUN /beɪs 'yu.nɪt/ *See fundamental unit.*

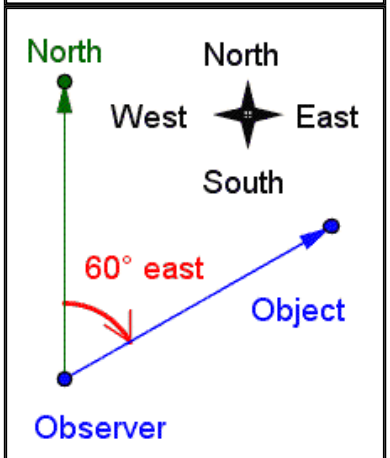
base year NOUN /beɪs yɪər/ *See base period.*

basis vectors NOUN /'beɪs.ɪs 'vɛk.tərz/ a set of vectors where any vector in a vector space can be written as a linear combination of the basis vectors.

beam balance NOUN /bim 'bæl.əns/ a device with a bar from which objects are suspended to compare their weights.

Balance

bearing NOUN /'bɛər.ɪŋ/ the direction to one object from another, as measured from true north.



Bearing

before PREPOSITION /bɪ'fɔr/

1. earlier in order or time.
2. coming previous to.

Antonym: after.

bell curve NOUN /bɛl kɜrv/ *See normal curve.*

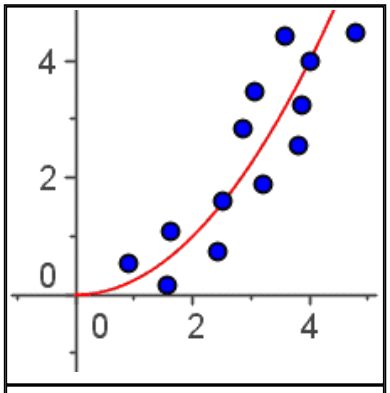
bell shaped curve NOUN /bɛl ʃeɪpt kɜrv/ *See normal curve.*

benchmark number NOUN /ˈbɛntʃ.mɑrk ˈnʌm.bər/ a number that is used as a standard of comparison in studies and tests.

Bernoulli trial NOUN /bərˈnu.li ˈtraɪ.l/ one instance of a probability experiment where the output is random and can be one of two possibilities. *Example:* the flip of a coin can be heads or tails.

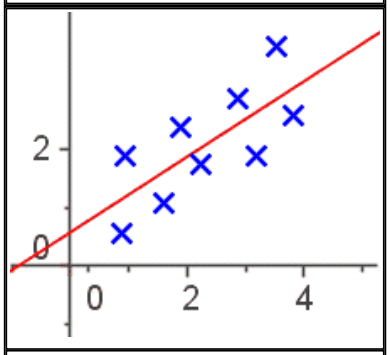
best fit NOUN /bɛst fɪt/ comes the closest to the values in a dataset.

best fit curve NOUN /bɛst fɪt kɜrv/ a curve that comes the closest to a set of data points. Best fit curves can be polynomial or trigonometric.



Best Fit Curve

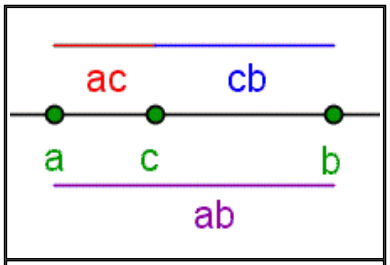
best fit line NOUN /bɛst fɪt laɪn/ a line that comes the closest to a set of data points.



Best Fit Line

beta NOUN /ˈbeɪ.tə/ (American English) /ˈbi.tə/ (British English) the Greek letter β, often used to represent an angle.

between PREPOSITION /bɪˈtwin/ having something on both sides. *Math definition:* Given three points a, b, and c, point c is between points a and b if and only if $ac + cb = ab$. *See also Segment Addition Postulate, GeoApp!.*



Between

bi- PREFIX /baɪ/ two. *Example:* binary – having two parts.

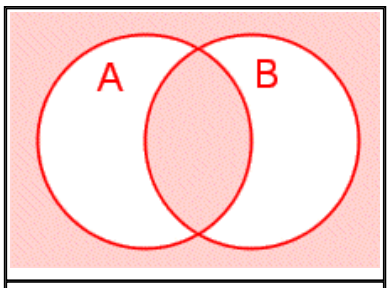
bias NOUN /ˈbaɪ.əs/ a systematic distortion of a sample.

biased ADJECTIVE /ˈbaɪ.əst/ having or showing a distortion.

biased question NOUN /'baɪ.əst 'kwɛs.tʃən/ a question that influences the answer one way or another. *Example:* “Have you stopped hitting your brother yet?”.

biased sample NOUN /'baɪ.əst 'sɑm.pəl/ a sample that is distorted by a non-scientific selection of the sample.

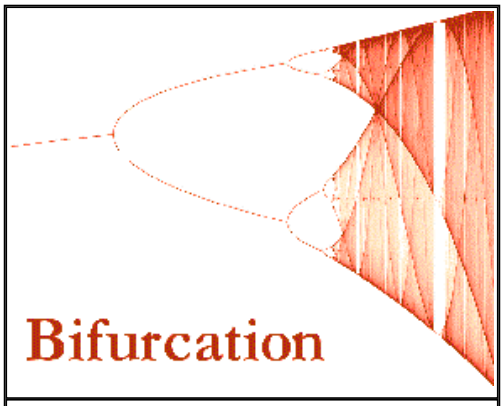
biconditional ADJECTIVE /ˌbaɪ.kən'dɪ.ʃə.nl/ two propositions are either both true or both false. *Notations:* P *if and only if* Q, $P \Leftrightarrow Q$, $P \equiv Q$. *Synonym: if and only if.*



Biconditional

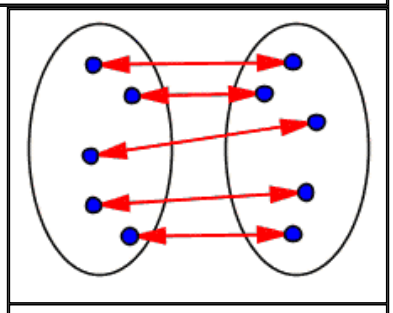
bifurcate VERB /'baɪ.fərˌkeɪt/ to divide into two branches.

bifurcation NOUN /'baɪ.fərˌkeɪ.ʃən/ a dividing into two branches.



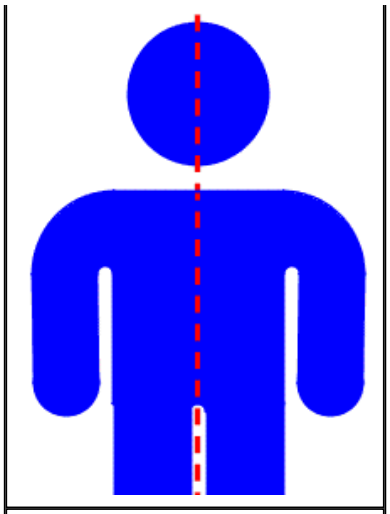
Bifurcation

bijection NOUN /baɪ'dʒɛk.ʃən/ a relation between sets where each member of a set is related to exactly one member of the other set. *Synonyms: one to one correspondence, one to one function.*


Bijection

bilateral ADJECTIVE /baɪ'læˌtər.l/ having two sides.

bilateral symmetry NOUN /baɪ'læˌtər.l 'sɪm.ɪ.tri/ symmetry about a line that bisects the figure. *See also line symmetry.*



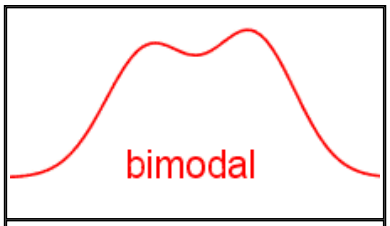
Bilateral Symmetry

billion ADJECTIVE, NOUN /'bɪl.yən/ the number $10^9 = 1{,}000{,}000{,}000$. *Synonym: giga-.*

International Note: The term 'billion' is not used the same in all countries or in all languages. In the short scale, 1 billion = 10^9 = 1,000,000,000. Canada, United Kingdom and the United States use the short scale. In the long scale, 1 billion = 10^{12} = 1,000,000,000,000.

billionth ADJECTIVE, NOUN /'bɪl.yənθ/ $10^{-9} = 0.000000001$.
Synonym: nano-.

bimodal distribution NOUN /ˌbaɪ'moʊd.əl dɪ'strɪ.byu.ʃən/ a distribution with two 'humps'.



Bimodal Distribution

binary ADJECTIVE /'baɪ.nɛr.i/

1. having two parts.
2. (sets) having exactly two elements. *Example:* $\{0,1\}$.
3. having 2 as a base. *Example:* binary number.

binary digit NOUN /'baɪ.nɛr.i 'dɪdʒ.ɪt/ *See binary numeral.*

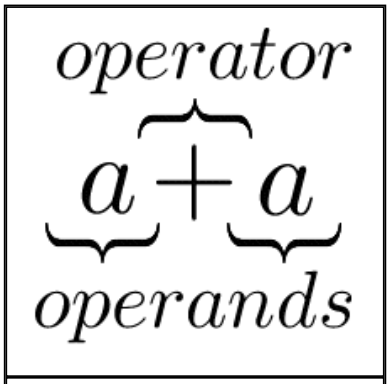
binary logarithm NOUN /'baɪ.nɛr.i 'lɔ.gəˌrɪð.əm/ a logarithm in base 2. *Example:* $\log_2 14 \approx 3.81$.

binary notation NOUN /'baɪ.nɛr.i noʊ'teɪ.ʃən/ *See binary numeral.*

binary number NOUN /'baɪ.nɛr.i 'nʌm.bər/ *See binary numeral.*

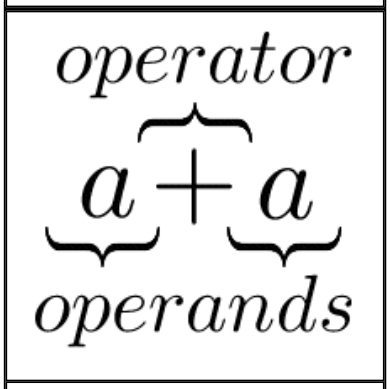
binary numeral NOUN /ˈbaɪ.nɛr.i ˈnum.ər.əl/ a number written in a base 2 number system which uses the binary digits 0 and 1 as the only digits. *Example:* $101_2 = 1\times2^2 + 0\times2^1 + 1 = 4 + 0 + 1 = 5_{10}$.

binary operation NOUN /ˈbaɪ.nɛr.i ˌɒ.pəˈreɪ.ʃən/ an operation that takes two operands. *Example:* In $a + b$ the binary operation is addition.



Binary Operation

binary operator NOUN /ˈbaɪ.nɛr.i ˈɒ.pəˌreɪ.tər/ an operator that takes two operands as arguments. *Example:* $a + b$ where '+' is a binary operator and a and b are the two operands.



Binary Operator

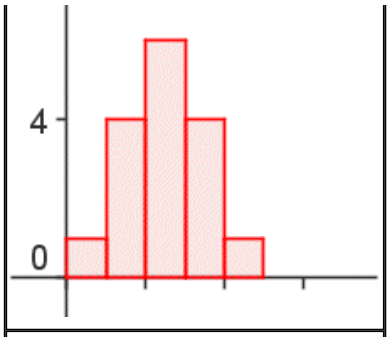
binomial /baɪˈnoʊ.mi.əl/

1. NOUN a polynomial with exactly two terms. *Example:* $\mathrm{m} + \mathrm{n}$.
2. ADJECTIVE an outcome space where there are exactly two possible outcomes.

binomial coefficient NOUN /baɪˈnoʊ.mi.əl ˌkoʊ.əˈfɪ.ʃənt/ a coefficient of a term of a polynomial created by raising a binomial to a positive integer power. *Example:* In $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$ and the binomial coefficients are $1, 3, 3, 1$ respectively.

binomial distribution NOUN /baɪˈnoʊ.mi.əl dɪˈstrɪ.byu.ʃən/ the probability distribution of a binomial experiment. *Formula:* The probability of k successes in n trials where the probability of success in each trial is p:

$$P(n, k) = \binom{n}{k} p^{n-k} (1-p)^k.$$



Binomial Distribution

binomial expansion NOUN /baɪ'noʊ.mi.əl ɛk'spæn.ʃən/ an expansion of a binomial using the Binomial Theorem.

Example: $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$.

binomial experiment NOUN /baɪ'noʊ.mi.əl ɛɪk'spɛr.ə.mənt/ an experiment in probability where the outcome will be one of exactly two possibilities. *Example:* flipping a coin has two possible outcomes: heads or tails.

Binomial Theorem NOUN /baɪ'noʊ.mi.əl 'θɪər.əm/ a rule for expanding $(a + b)^n$ which predicts the coefficient of a term of a binomial raised to an integer power. *Math definition:*

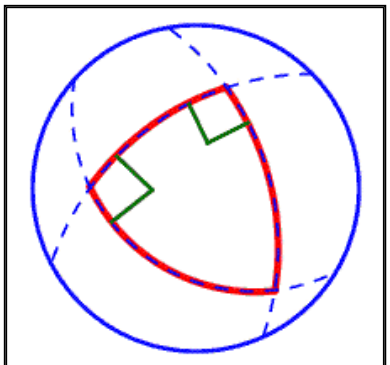
$$(a+b)^n = \sum_{k=0}^{n} \binom{m}{i} a^{n-k}b^k$$

$$= \binom{n}{0} a^n + \binom{n}{1} a^{n-1}b^1 + \binom{n}{2} a^{n-2}b^2 + \cdots + \binom{n}{-1} ab^{n-1} + \binom{n}{n} b^n \text{ where } \binom{n}{m} = \frac{n!}{(n-m)\,!m!}.$$

See also Pascal's triangle.

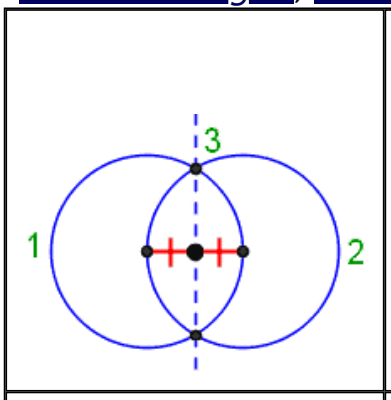
biquadratic NOUN /ˌbaɪ.kwɒ'dræt.ɪk/ *See quartic.*

birectangular ADJECTIVE /baɪ.rɛk'tæŋ.gyə.lər/ (spherical geometry) having two right angles.

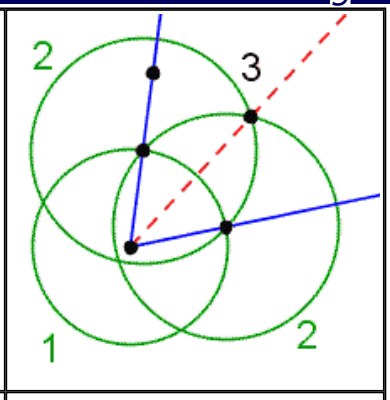


Birectangular

bisect VERB /baɪ'sɛkt/ to cut into two equal halves. *See also [How to Bisect an Angle!](), [How to Bisect a Line Segment!]().*



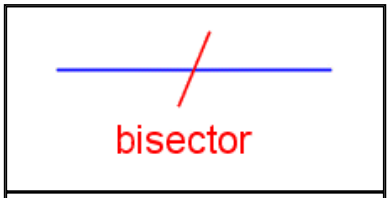
Bisect a Line Segment



Bisect an Angle

bisection algorithm NOUN /baɪ'sɛk.ʃən 'æl.gəˌrɪ.ðəm/ a method for approximating a root of an equation by bisecting an interval, then selecting the subinterval which contains the root.

bisector NOUN /baɪ'sɛk.tər/ something that cuts an object into two equal halves.



Segment Bisector

bit NOUN /bɪt/ the digit 0 or 1 in a binary numeral.

Boolean ADJECTIVE /'bu.li.ən/ having to do with Boolean algebra.

Boolean algebra NOUN /'bu.li.ən 'æl.dʒə.brə/ an algebra where each variable can take only one of two values and that has the operations AND, OR and NOT. The two values are usually 0 and 1, false and true, or off and on.

Boolean function NOUN /'bu.li.ən 'fʌŋk.ʃən/ a function that takes one or more Boolean values and returns a Boolean value.

Example: $\mathrm{AND}(P,Q)$ means '$P \text{ AND } Q$'.

Boolean operation table NOUN /'bu.li.ən ˌɒ.pə'reɪ.ʃən 'teɪ.bəl/ *See [truth table]().*

Boolean operator NOUN /'bu.li.ən 'ɒ.pəˌreɪ.tər/

1. the operators AND (∧), OR (∨), and NOT (¬) and any operator that can be written as a combination of AND, OR, and NOT.
2. an operator that takes one or more boolean values and returns a boolean value.

Boolean value NOUN /ˈbu.li.ən ˈvæl.yu/ either 0 or 1, or false or true. In some computer languages boolean values are integers where 0 represents false, and all nonzero integers represent true.

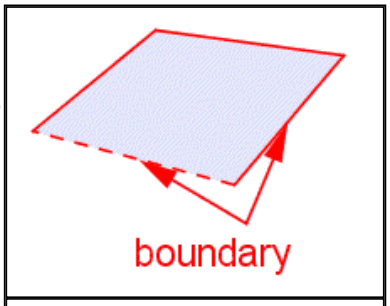
Boole, George PERSON /bul dʒɔrdʒ/ (1815-1864) an English mathematician most noted for discovering and describing Boolean logic.

borrow VERB /ˈbɒ.roʊ/ *See regroup.*

bound NOUN /baʊnd/

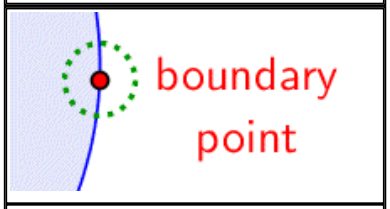
1. a number that is either greater than every number in a set or less than every number in a set. *See also supremum, infimum, upper bound, lower bound, least upper bound, greatest lower bound.*
2. *See boundary.*

boundary NOUN /ˈbaʊn.dri/ all points that are between the interior points and the exterior points of a geometric figure. *Math definition:* The set of boundary points of a geometric figure. *Synonyms: edge* (2-D), *face* (3-D), *surface* (3-D), *frontier.*



Boundary

boundary point NOUN /ˈbaʊn.dri pɔɪnt/ a point on the boundary of a figure or a set. A boundary point may or may not be a member of a set. *Math definition:* A point is a boundary point of a set if and only if every neighborhood of the point contains at least one point in the set and at least one point not in the set.



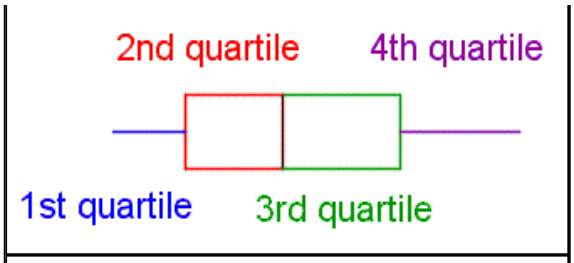
Boundary Point

bounded ADJECTIVE /ˈbaʊn.dɪd/ having a boundary in all directions; *not* infinite in extent; having an end. *Synonym: finite. Antonym: unbounded.*

box NOUN /bɒks/

1. a rectangle used to enclose a figure.
2. a rectangle used to represent data.

box and whisker plot NOUN /bɒks ænd ʰwɪs.kər plɒt/ a way to graph data that shows the distribution of the data. The 1st quartile is drawn as a line segment, the 2nd and 3rd quartiles are drawn as boxes, and the 4th quartile is drawn as a line segment. *Synonym: boxplot.*



Box and Whisker Plot

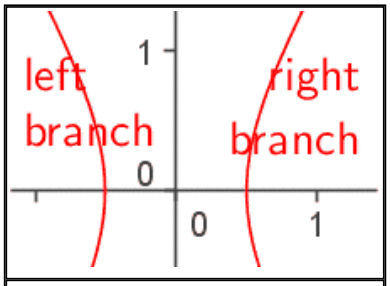
boxplot NOUN /'bɒks.plɒt/ *See box and whisker plot.*

brace NOUN /breɪs/

1. one of a pair of marks '{ }' used to group operations and to mark the ends of sets. *Synonyms: curly brace, grouping symbol.*
2. *See bracket.*

bracket NOUN /'bræk.ɪt/ one of a pair of marks '[ ]' used to group operations and to mark the beginning and end of matrices. *Synonyms: grouping symbol, square brace.*

branch NOUN /brɑntʃ/ each piece of a disconnected graph.



Branch

breadth NOUN /brɛdθ/ *See width.*

budget /'bʌdʒ.ɪt/

1. VERB to estimate expected income and expenses for a given period of time.
2. NOUN an estimate of expected income and expenses for a given period of time.

budgeting ADJECTIVE /'bʌdʒ.ɪt.ɪŋ/ the process of estimating income and expenses for a future period of time.

by inspection NOUN /baɪ ɪn'spɛk.ʃən/ to find the answer to a simple problem by looking at it.

byte NOUN /baɪt/ eight bits of ones and zeros. *Example:* 10010111_2.

C

c ABBREVIATION
1. centi-. *Example:* centimeter = 100 meters.
2. cup

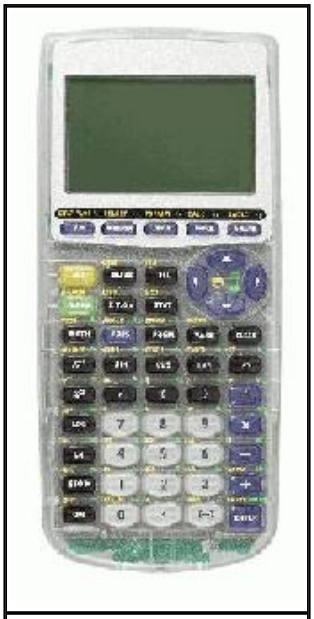
C
1. ABBREVIATION *See degree Celsius.*
2. SYMBOL 100 in Roman numerals.

cal ABBREVIATION See calorie.

Cal ABBREVIATION See kilocalorie.

calculate VERB /ˈkæl.kyəˌleɪt/ to compute values. *Example:* calculate the sum of five and seven: $5 + 7 = 12$. *Synonym: compute.*

calculator NOUN /ˈkæl.kyəˌleɪ.tər/ a device that performs calculations.



Calculator

calculus NOUN /ˈkæl.kyə.ləs/ a branch of mathematics that deals with integration, differentiation and infinitesimals.

calendar NOUN /ˈkæl.ən.dər/ a table showing dates laid out in rows and columns.

calorie NOUN /ˈkæl.ə.ri/ the amount of energy equal to 4.184 joules. *Abbreviation: cal.*

Calorie NOUN /ˈkæl.ə.ri/ a kilocalorie, an amount of energy equal to 4184 joules. *Abbreviation: Cal.*

cancel VERB /ˈkæn.səl/ to simplify by removing.

cancelation NOUN /ˈkæn.səl.eɪ.ʃən/ the process of simplifying expressions by removing common factors or by removing sums equal to zero. *Examples:* $\frac{12}{5} \cdot \frac{3}{4} = \frac{3 \cdot \cancel{4}}{5} \cdot \frac{3}{\cancel{4}} = \frac{3 \cdot 3}{5} = \frac{9}{5}$, $y + 6 = x - 5 \rightarrow y + \underbrace{6 - 6}_{zero sum} = x - 5 - 6 \rightarrow y = x - 11.$

candela NOUN /kænˈdɛl.ə/ a unit of measure of the brightness of light (luminous intensity). *Abbreviation: cd.*

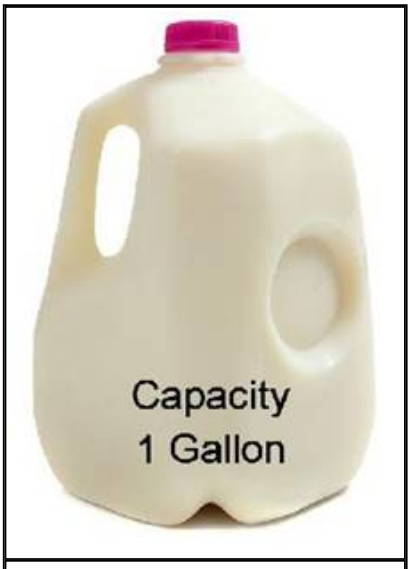
canonical ADJECTIVE /ˈkə.nɒ.nɪk/ in simplest or standard form. *Example:* a canonic equation.

Cantor, Georg Ferdinand Ludwig Philipp PERSON /ˈkæn.tɔr dʒɔrdʒ ˈfɜr.dnˌænd ˈlʌd.wɪg ˈfɪl.ɪp/ (1845-1918) a Russian mathematician known for proving that the set of rational numbers is countable.

Cantor's Axiom NOUN /ˈkæn.tɔrz ˈæk.si.əm/ *See Ruler Postulate.*

cap NOUN /kæp/ the symbol ∩ used to show intersection of sets. *Notation:* $A \cap B$.

capacity NOUN /kæˈpæs.ɪ.ti/ how much a container can hold; a volume.



Capacity

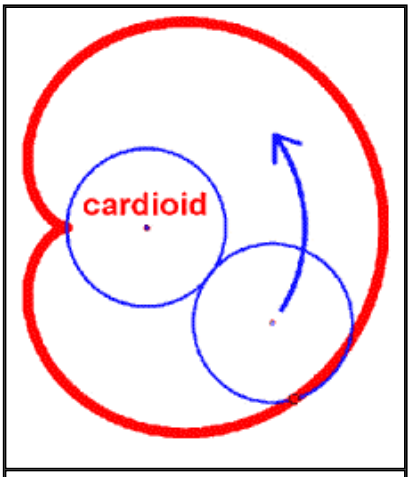
cardinal ADJECTIVE /ˈkɑrd.nl/ having to do with the size of a set.

cardinality NOUN /ˌkɑr.dəˈnæl.ɪ.ti/ the size of a set. For finite sets, the number of members in the set. For infinite sets, one of $\aleph_0$, $\aleph_1$, $\aleph_2$, ... where $\aleph_0$ is the cardinality of a set with a one to one correspondence with the set of natural numbers.

cardinal number NOUN /ˈkɑrd.nl ˈnʌm.bər/ the number of elements in a set such as $1, 2, 3, \ldots$ for finite sets or $\aleph_0, \aleph_1, \aleph_2, \ldots$ for infinite sets.

cardioid NOUN /ˈkɑr.diˌɔɪd/ a figure that can be drawn by tracing a point on the edge of a circle that is rolling around another circle of the same size.

Equation: $x = a(2 \cdot \cos t - \cos 2t)$, $y = a(2 \cdot \sin t - \sin 2t)$.



Cardioid

Carroll diagram NOUN /ˈkɛər.l ˈdaɪ.ə.græm/ a diagram that groups things into yes/no groups.

carry VERB /ˈkɛər.i/ when adding numbers, to add the tens digit from the sum of a column of numbers to the next column. *See regroup.*

Cartesian ADJECTIVE /kɑrˈti.ʒən/

1. having to do with a rectangular coordinate system.
2. attributed to or named after René Descartes.

Cartesian axis NOUN /kɑrˈti.ʒən ˈæk.sɪs/ *See x-axis, y-axis.*

Cartesian coordinate NOUN /kɑrˈti.ʒən koʊˈɔr.dnɪt/ *See rectangular coordinate.*

Cartesian coordinate system NOUN /kɑrˈti.ʒən koʊˈɔr.dnɪt ˈsɪs.təm/ *See rectangular coordinate system.*

Cartesian geometry NOUN /kɑrˈti.ʒən dʒiˈɒ.mɪ.tri/ *See analytic geometry.*

Cartesian plane NOUN /kɑrˈti.ʒən pleɪn/ *See coordinate plane.*

Cartesian product NOUN /kɑrˈti.ʒən ˈprɒ.dəkt/ a set of ordered pairs made of each and every member of set A paired with each and every member of set B. *Notations:* $A \times B$, $A \times A = A^2$. *Example:* $A = \{a_1, a_2\}$, $B = \{b_1, b_2, b_3\}$. $A \times B = \{(a_1, b_1), (a_1, b_2), (a_1, b_3), (a_2, b_1), (a_2, b_2), (a_2, b_3$.

Cartesian space NOUN /kɑr'ti.ʒən speɪs/ an n-dimensional metric space based on Euclidean geometry.

case NOUN /keɪs/ one of several situations into which a problem can be divided. *Example:* case 1: $a<b$; case 2: $a=b$; case 3: $a>b$.

casting out nines NOUN /'kæs.tɪŋ aʊt naɪnz/ a method of checking the correctness of the sum of a list of numbers.

categorical ADJECTIVE /ˌkæt.ɪ'gɔr.ɪ.kəl/ having to do with a division into categories.

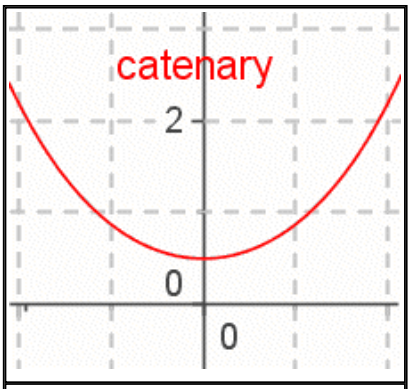
categorical data NOUN /ˌkæt.ɪ'gɔr.ɪ.kəl 'deɪ.tə/ (probability and statistics) data which has been divided into categories. *Example:* data divided into age groupings. *Synonym:* *qualitative data*.

category NOUN /ˌkæt.ɪ'gɔr.i/ a distinct class into which data items are divided. *Example:* age 12-16.

catenary NOUN /'kæt.nˌɛr.i/ the shape a wire makes when hanging from two poles.

Equation: $f(x) = a\cosh\left(\frac{x-h}{a}\right) + k$

where a effects the steepness of the catenary, h moves the catenary left and right and k moves the catenary up and down.



Catenary

Cavalieri, Bonaventura Francesco PERSON /ˌkɑ.vɑ'lyɛr.i boʊnˌæv.ən'tə fræn'tʃɛs.koʊ/ (1598-1647) an Italian mathematician who is know for his work in infinitesimals, including Cavalieri's principle.


Cavalieri, Bonaventura

Cavalieri's principle NOUN /ˌkɑ.vɑ'lyɛr.iz 'prɪn.sə.pəl/ if the areas of each cross section and the heights of two solids are equal, then the volumes are equal. *Example:* A stack of pennies. Even if one slides a penny over, the total volume of the stack remains constant.

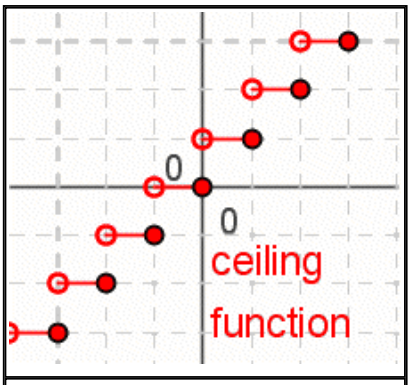

Cavalieri's Principle

cd ABBREVIATION See candela.

ceil(), ceiling() COMPUTERS represents the ceiling function in some computer languages.

ceiling NOUN /ˈsil.ɪŋ/ an upper limit.

ceiling function NOUN /ˈsil.ɪŋ ˈfʌŋk.ʃən/ returns the smallest integer greater than or equal to a real number. *Notation:* $\lceil x \rceil$.



Ceiling Function

cell NOUN /sɛl/ a single box in a table containing data.

Celsius NOUN /ˈsɛlˌsi.əs/ *See degree Celsius.*

Celsius, Anders PERSON /ˈsɛlˌsi.əs ˈɑn.dərs/ (1701–1744) a Swedish astronomer who invented the Celsius temperature scale.


Anders Celsius

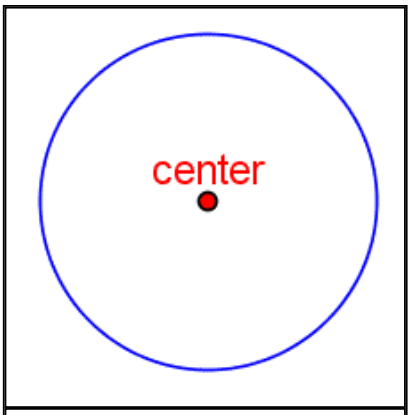
census NOUN /ˈsɛnˌsəs/ data from an entire population, rather than a sample. *Antonym: sample.*

cent NOUN /sɛnt/ an amount of money equal to 1/100 of a dollar. *Notation: ¢. Synonyms: penny, pence (UK).*

center NOUN /ˈsɛn.tər/

1. a point that has a symmetric relationship to a geometric figure.
2. an element that has a symmetric relationship to a set.

center of a circle NOUN /ˈsɛn.tər ʌv eɪ ˈsɜr.kəl/ the point that is equidistant from all the points of a circle. *See also Parts of a Circle!.*

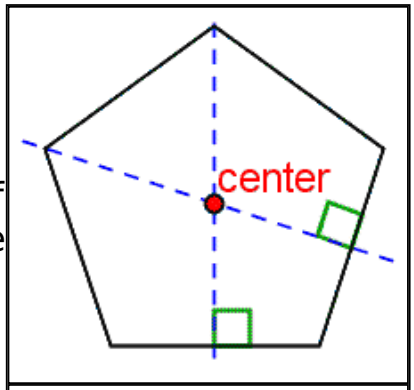


Center of a Circle

center of a dataset NOUN /ˈsɛn.tər ʌv eɪ ˈdeɪ.tə.sɛt/ a value around which data in a dataset is clustered. *Example:* arithmetic mean. *See also central tendency.*

center of area NOUN /ˈsɛn.tər ʌv ˈɛər.i.ə/ the point upon which a 2-dimensional object will balance. *Synonym: centroid.*

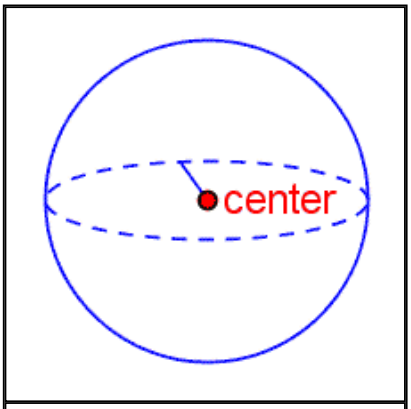
center of a regular polygon NOUN /ˈsɛn.tər ʌv eɪ ˈrɛg.yə.lər ˈpɒl.iˌgɒn/ the point at the exact middle of a regular polygon. The center of a regular polygon is at the intersection of the perpendicular bisectors of any two sides of the regular polygon that are not opposite each other. The center of a regular polygon is also the incenter, the circumcenter and the center of area or centroid of the regular polygon. *See also GeoApp!.*



Center of a Regular Polygon

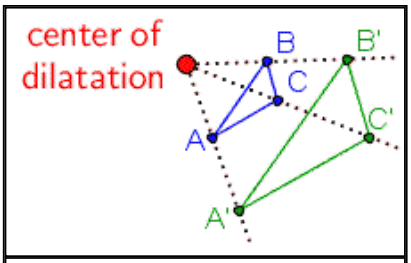
center of a set NOUN /ˈsɛn.tər ʌv eɪ sɛt/ *See center.*

center of a sphere NOUN /ˈsɛn.tər ʌv eɪ sfɪər/ a point from which all points on the sphere are equidistant.



Center of a Sphere

center of dilation NOUN /ˈsɛn.tər ʌv daɪˈleɪ.ʃən/ the point from which a dilation is measured.

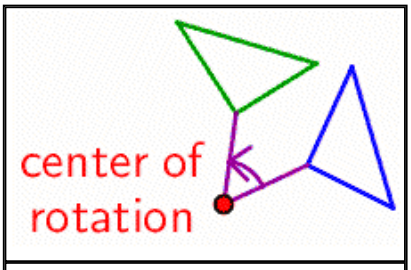


Center of Dilation

center of gravity NOUN /ˈsɛn.tər ʌv ˈgræv.ɪ.ti/ *See center of mass.*

center of mass NOUN /ˈsɛn.tər ʌv mæs/ of a three dimensional solid, the point that can be used to calculate gravitational attraction for the object. *Synonyms: center of gravity, centroid.*

center of rotation NOUN /ˈsɛn.tər ʌv roʊˈteɪ.ʃən/ a fixed point about which an object is rotated.



Center of Rotation

centi- PREFIX /ˈsɛn.tə/ $10^{-2} = 0.01$. *Abbreviation: c, definition 1. Example:* $4 \text{ centimeters} = 4 \times 10^{-2} \text{ meters} = 0.04 \text{ meters}$. *Synonym: hundredth, definition 2.*

centigrade NOUN /ˈsɛn.tə.greɪd/ *See degree Celsius.*

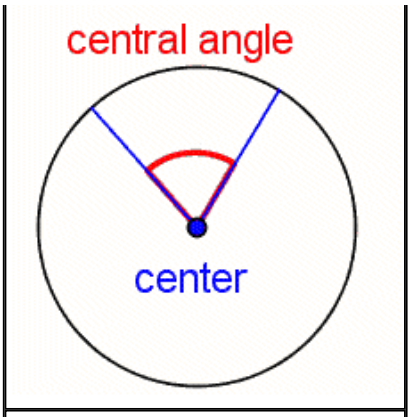
centimeter NOUN /ˈsɛn.təˌmi.tər/ a unit of measure of distance. *Abbreviation: cm. Formulas:* $100 \text{ cm} = 1 \text{ meter}$, $2.2 \text{ cm} \approx 1 \text{ inch}$.

central ADJECTIVE /ˈsɛn.trəl/

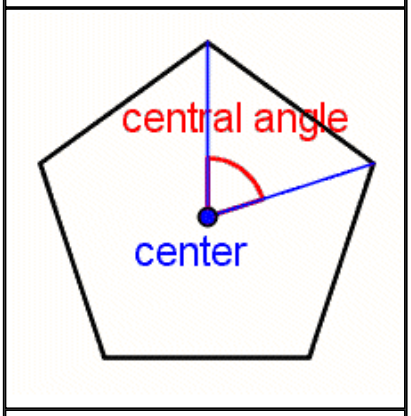
1. being at or near a center. *Example:* central angle.
2. having to do with a center. *Example:* central tendency.

central angle NOUN /ˈsɛn.trəl ˈæŋ.gəl/

1. (of a circle) an angle inscribed in a circle with the vertex at the center of the circle.
2. (of a regular polygon) the angle between two line segments extending from the center of a regular polygon to two adjacent vertices. *See also GeoApp!.*



Central Angle of a Circle

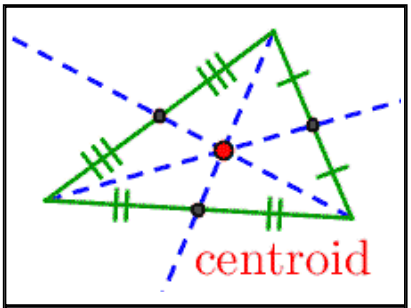


Central Angle of a Polygon

central tendency NOUN /ˈsɛn.trəl ˈtɛn.dən.si/ the likelihood that data will cluster around a value. A value around which the data is clustered is called a center of the data set. *See also* *measure of central tendency*.

centroid NOUN /ˈsɛn.trɔɪd/

1. the center of area of a 2-dimensional figure.
2. the center of mass of a 3-dimensional figure.
3. the point where the medians of a triangle intersect.



Centroid

century NOUN /ˈsɛn.tʃər.i/ one hundred years.

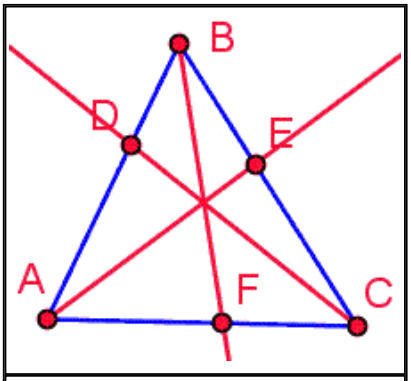
Formula: $100 \text{ years} = 1 \text{ century}$.

certain ADJECTIVE /ˈsɜr.tn/

1. sure to happen. *Example:* a certain event. *Antonym:* *impossible*.
2. a specific item or element. *Example:* a certain triangle. *Antonym:* *any*.

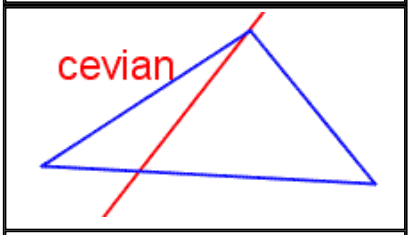
certain event NOUN /'sɜr.tn ɪ'vɛnt/ an event that will always happen. A certain event has a probability of 1. *Math definition:* e is a certain event if and only if $P(e) = 1$. *Antonym: impossible event.*

Ceva's Theorem NOUN /'sɛ.vʌz 'θɪər.əm/ given a triangle ABC, and points D, E, and F that lie on line segments AB, BC, and CA respectively, lines AE, BF and DC are concurrent if and only if $\frac{AD}{DB} \cdot \frac{BE}{EC} \cdot \frac{CF}{FA} = 1$.



Ceva's Theorem

cevian NOUN /'sɛ.vi.ən/ any line passing through a vertex of a triangle and the side opposite the vertex.



Cevian

chain NOUN /tʃeɪn/ a group of objects that are linked one to the next to the next and so on.

chain rule NOUN /tʃeɪn rul/ if two propositions each imply a third proposition, then they imply each other. If $P \rightarrow Q$ and $Q \rightarrow R$ then $P \rightarrow R$. *Example:* A $\frac{\text{square}}{P}\ \frac{\text{has}}{\rightarrow}\ \frac{\text{four congruent sides}}{Q}$. Any polygon with $\frac{\text{four congruent sides}}{Q}\ \frac{\text{has}}{\rightarrow}$ $\frac{\text{diagonals that bisect each other}}{R}$. Therefore, a $\frac{\text{square}}{P}$ $\frac{\text{has}}{\rightarrow}\ \frac{\text{diagonals that bisect each other}}{R}$.

chance NOUN /tʃæns/ the likelihood, probability, or odds that an event will happen.

change /tʃeɪndʒ/
1. NOUN the difference between two objects.
2. VERB (with object) to make something different.
3. VERB (without object) to become different in some way.

change of base formula NOUN /tʃeɪndʒ ʌv beɪs 'fɔr.myə.lə/ a formula used to change the base of a logarithm: $\log_a x = \frac{\log_b x}{\log_b a}$.

Example: $\log_{11} 5 = \frac{\log_{10} 5}{\log_{10} 11} \approx \frac{0.6989}{1.041} \approx 0.6712$.

chaos NOUN /'keɪ.ɒs/
1. the tendency to have a large change in output given a small change in input.
2. the unpredictability of many natural systems.

chaos theory NOUN /'keɪ.ɒs 'θɪər.i/ the study of systems that generate widely differing output from small changes in input.

chaotic ADJECTIVE /keɪ'ɒt.ɪk/ having a tendency to generate widely differing output given small changes in input. *Example:* weather is a chaotic system.

characteristic NOUN /'kɛər.ə.ktər˛ɪ.stɪk/
1. *See property.*
2. the whole part of a base 10 logarithm. *Example:* the characteristic of $\log_{10} 642 \approx \underline{2}.80753$ is 2.

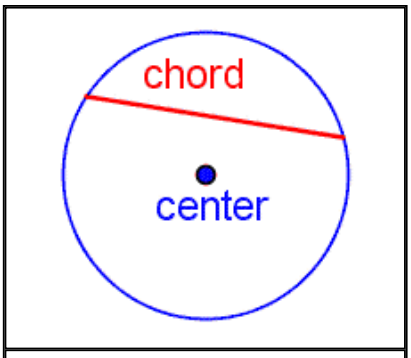
charge NOUN /tʃɑrdʒ/ what must be paid for goods or services.

chart NOUN /tʃɑrt/ a table, graph or diagram describing data. *See also graph, bar graph, pie chart.*

check VERB /tʃɛk/
1. to verify; to look over. *Synonym: verify.*
2. to compare results with the original problem. *Example:* check a solution. *Synonym: validate.*

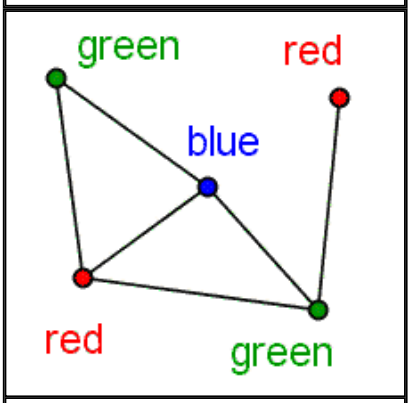
check a solution VERB /tʃɛk eɪ soʊ'lu.ʃən/ to substitute a solution back into the original equation or inequality to verify that it is a valid solution. If the equation or inequality is true, then the solution is valid. *Example:* is $x = 3$ a solution of $x^2 - x - 6 = 0$? Check: $3^2 - 3 - 6 \stackrel{?}{=} 0 \rightarrow 9 - 3 - 6 \stackrel{?}{=} 0 \rightarrow 0 = 0$. Yes, $x = 3$ is a solution.

chord NOUN /kɔrd/ a line segment connecting two different points on a curve. *See also GeoApp!.*



Chord

chromatic number NOUN /kroʊˈmæ.tɪk ˈnʌm.bər/ the smallest number of colors that can be used to color the nodes of a graph so that no two same-colored nodes are connected by an edge.



Chromatic Number

chronological ADJECTIVE /kroʊ.noʊˈlɒdʒ.ɪ.kəl/ arranged in the order of time that things happened.

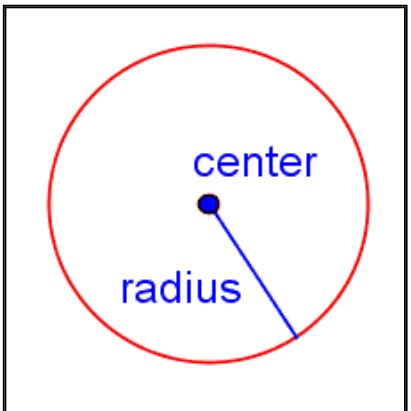
chronological order NOUN /kroʊ.noʊˈlɒdʒ.ɪ.kəl ˈɔr.dər/ an ordering where things are arranged in the order of time that they happen.

cipher NOUN /ˈsaɪ.fər/ (American English)

1. a method of converting plain text to enciphered text.
2. a message that has been enciphered.

Synonym: cypher (British English).

circle NOUN /ˈsɜr.kəl/ the set of all points in a plane that are a given distance from a center point. *See also Parts of a Circle!.*

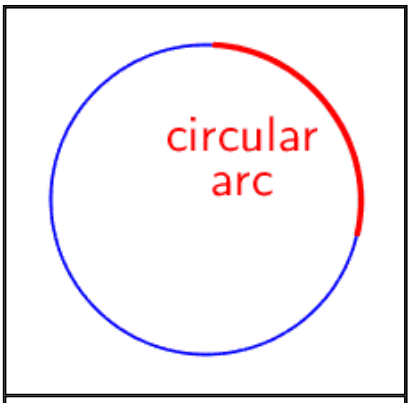


Circle

circle graph NOUN /ˈsɜr.kəl græf/ *See pie chart.*

circular ADJECTIVE /ˈsɜr.kyə.lər/
1. having to do with a circle.
2. shaped like a circle.
3. being part of a circle.

circular arc NOUN /ˈsɜr.kyə.lər ɑrk/ an arc that is a portion of the circumference of a circle.

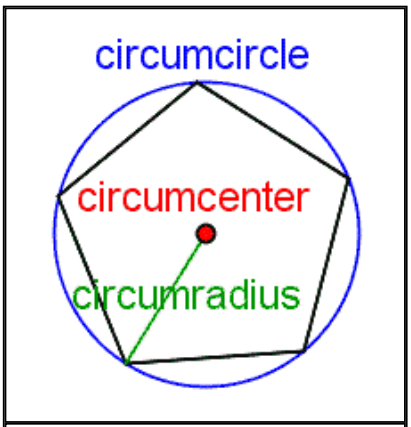


Circular Arc

circular function NOUN /ˈsɜr.kyə.lər ˈfʌŋk.ʃən/ *See trigonometric function.*

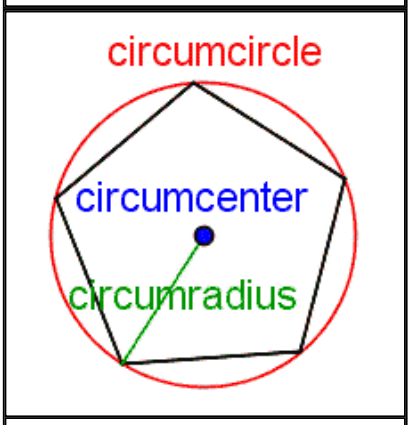
circum- PREFIX /ˈsɜr.kəm/
1. around the outside.
2. surrounding.

circumcenter NOUN /ˈsɜr.kəm.sɛn.tər/ the center of the circle that intersects all vertices of a regular polygon, a cyclic polygon or a triangle. *See also GeoApp!.*



Circumcenter

circumcircle NOUN /ˈsɜr.kəmˌsɜr.kəl/ the circle that intersects all of the vertices of a regular polygon, a cyclic polygon or a triangle. *See also GeoApp!.*



Circumcircle

circumference NOUN /sərˈkʌm.fər.əns/
1. the edge of a circle.
2. the length of the edge of a circle. *Formula:* $C = 2\pi r$ where r is the radius of the circle.

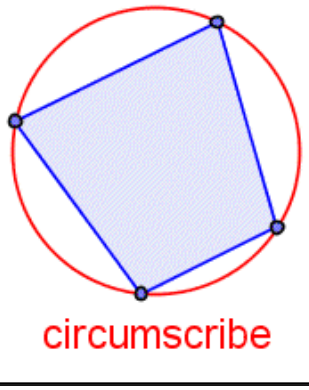
See also Parts of a Circle!.

circumradius NOUN /ˌsɜr.kəmˈreɪ.di.əs/
1. the radius of a circumcircle.
2. the length of the radius of a circumcircle.

Plural: circumradii /ˌsɜr.kəmˈreɪ.di.aɪ/. *See also GeoApp!.*

circumscribable ADJECTIVE /ˌsɜr.kəmˈskraɪb.ə.bl/ (polygon) a circle can be drawn around a polygon that intersects all of its vertices exactly once.

circumscribe VERB /ˈsɜr.kəmˌskraɪb/ to draw a circle around a geometric figure that intersects as many of the figure's vertices as possible.



Circumscribe

claim NOUN /kleɪm/ *See proposition.*

class NOUN /klæs/ a set of objects having particular properties. *Example:* acute angles are a class of angles whose measure is less than a right angle. *Synonym: subset.*

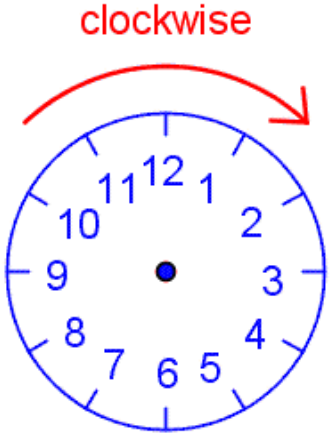
classification NOUN /ˌklæs.ə.fɪˈkeɪ.ʃən/
1. one class into which objects are sorted.
2. the act of sorting into classes.

classify VERB /ˈklæs.əˌfaɪ/ to sort into classes.

class interval NOUN /klæs ˈɪn.tər.vəl/ (statistics) an interval of values that are assigned to a class. *Example:* ages 3-8.

clock arithmetic NOUN /klɒk əˈrɪθ.mə.tɪk/ *See modular arithmetic.*

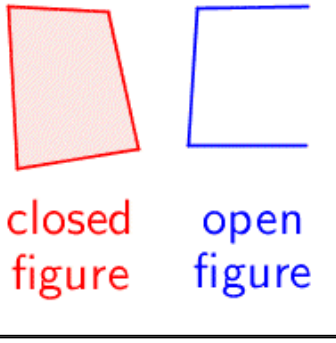
clockwise ADJECTIVE, ADVERB /ˈklɒkˌwaɪz/ a rotation in the same direction that the hands of an analog clock turn.
Antonyms: counterclockwise (American English), *anticlockwise* (British English).



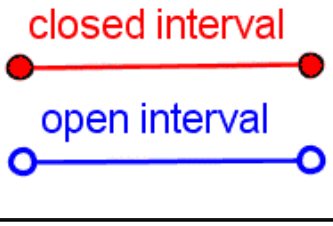
Clockwise

closed ADJECTIVE /kloʊzd/

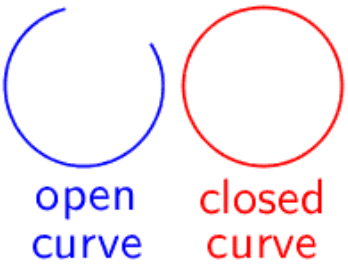
1. (figure) having a boundary that completely encloses an area; having a boundary that can be traced from any point by any path and always return to the original point without retracing. *Antonym: open.*
2. (set) given a set and an operation on the members of the set, the result of the operation is still in the set. *Example:* the set of integers is closed with respect to addition. *Antonym: open.*
3. (interval) both the endpoints of the interval are included in the interval. *Example:* $0 \leq x \leq 9$. *Antonym: open.*
4. (curve) the end point of the curve is the same as the start point. A curve that completely encloses an area. *Antonym: open.*
5. (dot) having the interior filled in, showing a closed side of an interval.



Closed Figure



Closed Interval



Closed Curve

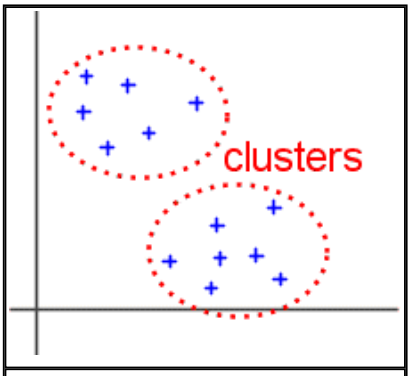
closure NOUN /ˈkloʊ.ʒər/

1. the condition of being closed or not closed.
2. a mathematical property such that the result of an operation on two members of a set is itself in the set.

closure property NOUN /ˈkloʊ.ʒər ˈprɒ.pər.ti/ given a set and an operation on members of the set, the result of the operation is in the set. *Math definition:* Given an operation $*$ on set G, if for every $a, b \in G$, $a*b = c$ if and only if $c \in G$, then set G is closed with respect to $*$. *Example:* Given two real numbers a and b, then $a + b$ is a real number.

cluster /ˈklʌs.tər/

1. NOUN a subset of data whose values crowd together.
2. NOUN a natural grouping in a population.
3. VERB to crowd together.



Cluster

clustering NOUN /ˈklʌs.tər.ɪŋ/

1. a tendency for some data to crowd together.
2. a method of estimating a sum when a group of values are close. *Example:* $6.2 + 5.8 + 5.9 \approx 6.0 + 6.0 + 6.0 = 18$.

cluster sampling NOUN /ˈklʌs.tər ˈsɑm.plɪŋ/ a sample taken randomly from within natural groupings in a population. *Example:* a population is divided into age groupings, then random samples are taken from each age grouping.

cm ABBREVIATION See centimeter.

co- PREFIX /koʊ/

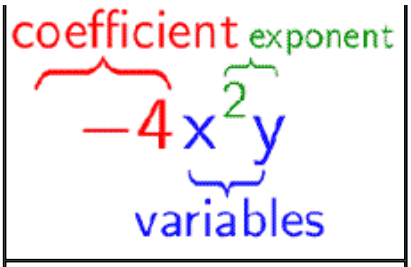
1. with.
2. together.
3. jointly.

code NOUN /koʊd/

1. information that has been encrypted.
2. a method of encryption.

coefficient NOUN /ˌkoʊ.əˈfɪ.ʃənt/

1. a number in a term that may be multiplied by one or more variables. *Example:* In $3x^2 + x - 2$ the coefficients are 3, 1, and -2 respectively. 1 is an implied coefficient, -2 is a constant term.
2. a number that gives a measure of some property. *Example:* correlation coefficient.



Coefficient

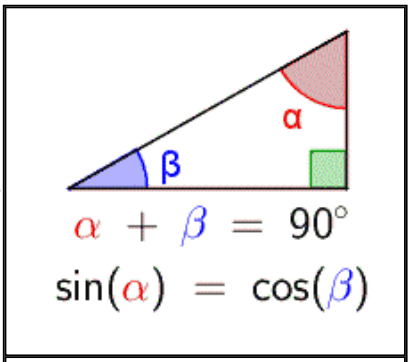
coefficient of correlation NOUN /ˌkoʊ.əˈfɪ.ʃənt ʌv ˌkɒr.əˈleɪ.ʃən/ *See correlation coefficient.*

cofactor NOUN /ˈkoʊˌfæk.tər/ the signed minor of an element of a matrix. If the sum of the row number and column number is odd, the sign is positive, otherwise it is negative. *Example:*

$$\begin{bmatrix} 3 & -2 & 1 \\ 0 & 3 & -1 \\ -2 & -1 & 4 \end{bmatrix} \xrightarrow{cofactor_{2,2}} + \begin{vmatrix} 3 & 1 \\ -2 & 4 \end{vmatrix}$$

$$= 3 \cdot 4 - 1 \cdot (-2) = 12 + 2 = 14.$$

cofunction NOUN /ˈkoʊˌfʌŋk.ʃən/ one of pair of related trigonometric functions such as sine and cosine, or secant and cosecant where the value of one function for a certain angle is equal to the value of the other function for the complement of the angle.



Cofunction

cofunction identity NOUN /ˈkoʊˌfʌŋk.ʃən aɪˈdɛn.tɪ.ti/ a trigonometric identity that relates cofunctions. *See also Trigonometric Identities.*

coincide VERB /ˌkoʊ.ɪnˈsaɪd/
1. to occupy the same place.
2. to have one or more points in common.

See also GeoApp!.

coincidental NOUN /koʊˌɪn.sɪˈdɛn.tl/
1. occupying the same place.

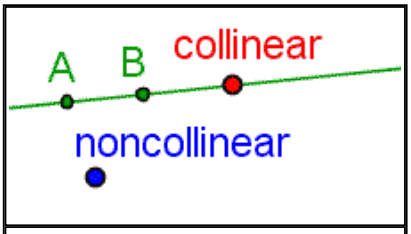
2. sharing one or more points.

See also GeoApp!.

collect VERB /kə'lɛkt/ to gather together in one group.

collection NOUN /kə'lɛk.ʃən/ a group of objects where one can tell if an object is in the group or not; an identifiable group of objects. *See also set.*

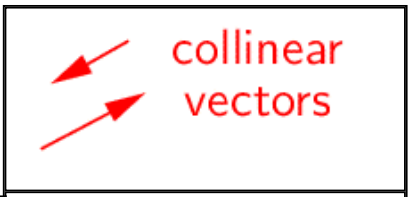
collinear ADJECTIVE /koʊ'lɪn.i.ər/ all are contained by the same line. *Antonym: noncollinear.*



Collinear

collinearity NOUN /koʊ'lɪn.i.ɛər.ɪ.ti/ whether or not objects are contained by the same line.

collinear vectors NOUN /koʊ'lɪn.i.ər 'vɛk.tərz/ vectors that go in the same direction or in opposite directions; vectors that are non-zero scalar multiples of each other. *Math definition:* Vector u is collinear with vector v if and only if, for some nonzero real number a, $u = a \cdot v$.



Collinear vectors

column NOUN /'kɒl.əm/

1. a set of values arranged vertically.
2. a box whose height shows quantity.

column graph NOUN /'kɒl.əm græf/ *See bar graph.*

column matrix NOUN /'kɒl.əm 'meɪ.trɪks/ a matrix with exactly one column. *Plural: column matrices* /'kɒl.əm 'meɪ.trɪˌsiz/. *Synonym: column vector.*

$$\begin{bmatrix} -2 \\ 7 \\ 4 \end{bmatrix}$$
Column Matrix

column operation NOUN /'kɒl.əm ˌɒ.pə'reɪ.ʃən/ one of a set of rules for manipulating the columns of a matrix without changing the solution of a linear system represented by the matrix:

- Any two columns can be swapped.
- Any column can be multiplied by a nonzero scalar.
- Any column can be added to another column.

column rank NOUN /ˈkɒl.əm reɪŋk/ the number of linearly independent columns in a matrix.

column vector NOUN /ˈkɒl.əm ˈvɛk.tər/ *See column matrix.*

com- PREFIX /kɒm/

1. with.
2. together.
3. jointly.

combination NOUN /ˌkɒm.bəˈneɪ.ʃən/

1. (probability) the number of different ways a certain number of members of a set can be arranged when order is not important. The combinations of $\{a,b,c\}$ taken two at a time are $\{a,b\}$, $\{a,c\}$, $\{b,c\}$. *Formula:* $\binom{n}{r} = \frac{n!}{(n-r)\,!r!}$, where n is the total number of objects, and r is the number of objects selected.
2. a selection of objects when order is *not* important.
3. (linear algebra) *See linear combination.*

combination notation NOUN /ˌkɒm.bəˈneɪ.ʃən noʊˈteɪ.ʃən/ a notation for combinations in the form $n\mathrm{C}r$ where n is the number of objects that can be selected and C is the number of objects that are selected.

combinatorial analysis NOUN /kɒmˌbə.nəˈtɔr.i.əl ˌæˈnæl.ɪ.sɪs/ the study of counting, combination and permutation, particularly for statistics and probability. *Synonym: combinatorics.*

combinatorics NOUN /kɒmˌbə.nəˈtɔr.ɪks/ *See combinatorial analysis.*

combine VERB /ˈkɒm.baɪn/ to bring together using a rule.

combine like terms VERB /ˈkɒm.baɪn laɪk tɜrmz/ to bring terms with the same variables and exponents together by adding the coefficients and copying the variables and exponents.

comma separator NOUN /ˈkɒm.ə ˈsɛp.əˌreɪ.tər/ a comma used to group digits of a number. *Examples:* 3, 203, 152. *See also thousands separator.*

commission NOUN /kəˈmɪ.ʃən/ a fee charged for performing work, often a percentage of a transaction.

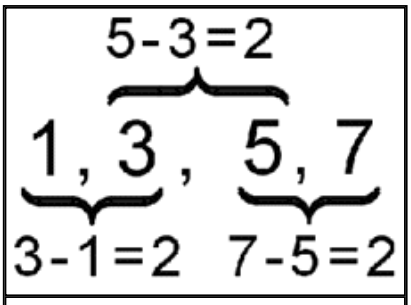
Formula: $\text{total} \times \text{rate} = \text{commission}$. *Example:* The auctioneer receives a 10% commission on everything sold at the auction.

common ADJECTIVE /ˈkɒm.ən/

1. the same for all instances. *Example:* common factors.
2. sharing something. *Example:* common point.

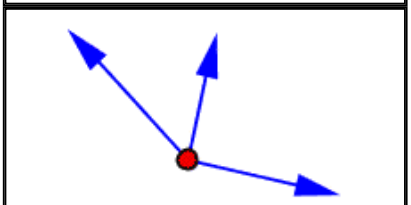
common denominator NOUN /ˈkɒm.ən dɪˈnɒm.əˌneɪ.tər/ a common multiple of two or more denominators; a number that can be evenly divided by two or more denominators. *Example:* some common denominators of the fractions $3/6$ and $4/5$ are 30, 60, 90 ($6\times5=30$, $6\times5\times2=60$, $6\times5\times3=90$). *See also least common denominator.*

common difference NOUN /ˈkɒm.ən ˈdɪfr.əns/ in an arithmetic sequence, the constant difference between a term and the term before it. *Formula:* $d = a_n - a_{n-1}$. *Example:* the common difference of $\{1, 3, 5, 7, \ldots\}$ is 2.

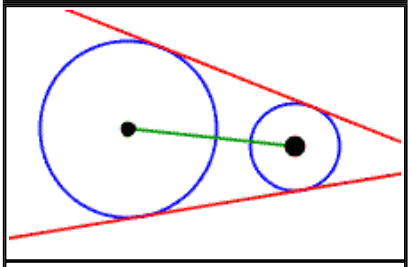


Common Difference

common endpoint NOUN /ˈkɒm.ən ˈɛndˌpɔɪnt/ a point at an end of two or more objects that is shared by all of the objects.


Common Endpoint

common external tangent NOUN /ˈkɒm.ən ɪkˈstɜr.nl ˈtæn.dʒənt/ a line that is tangent to two circles that does *not* intersect the line segment between the centers of the circles.


Common External Tangents

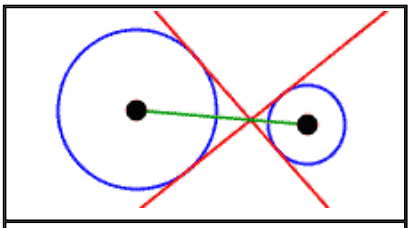
common factor NOUN /ˈkɒm.ən ˈfæk.tər/

1. an integer that is a factor of two or more other integers. *Example:* the common factors of 4 and 12 are 1, 2 and 4.

2. an expression that is a factor of two or more other expressions. *Example:* $x-1$ is a common factor of $(x-1)(x+3)$ and $(x-4)(x-1)$.

common fraction NOUN /ˈkɒm.ən ˈfræk.ʃən/ a fraction whose numerator and denominator are integers. *Examples:* $\frac{3}{7}, \frac{9}{4}$. *Synonym: vulgar fraction.*

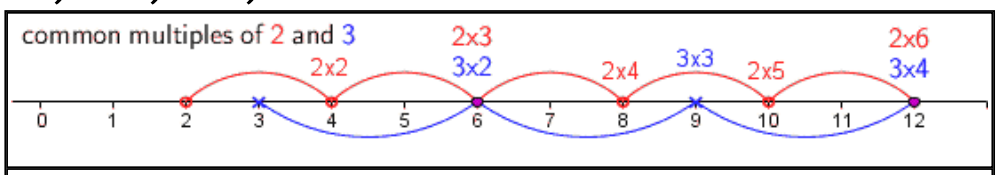
common internal tangent NOUN /ˈkɒm.ən ɪnˈtɜr.nl ˈtæn.dʒənt/ a line that is tangent to two circles and that intersects the line segment between the centers of the circles.



Common Internal Tangents

common logarithm NOUN /ˈkɒm.ən ˈlɔ.gəˌrɪð.əm/ a logarithm with base 10. *Abbreviation: log. Example:* $\log a = \log_{10} a$. *See also logarithm.*

common multiple NOUN /ˈkɒm.ən ˈmʌl.tə.pəl/ a number or expression that is a multiple of two or more other numbers or expressions. *Example:* the common multiples of 2 and 3 are $6, 12, 18, \ldots$.



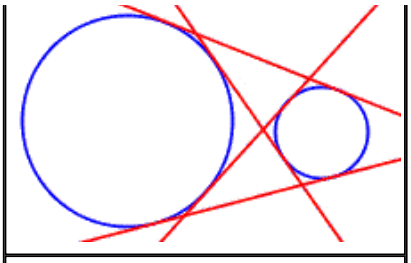
Common Multiples

common point NOUN /ˈkɒm.ən pɔɪnt/ a point that is shared by two or more objects.

common ratio NOUN /ˈkɒm.ən ˈreɪ.ʃoʊ/ in a geometric sequence, the constant ratio between any term and the term after it. *Example:* the common ratio of the geometric sequence $\{2, 6, 18\}$ is 3.

common side NOUN /ˈkɒm.ən saɪd/ a ray or line segment that is shared by two objects.

common tangent NOUN /ˈkɒm.ən ˈtæn.dʒənt/ a line that is tangent to two circles.



Common Tangents

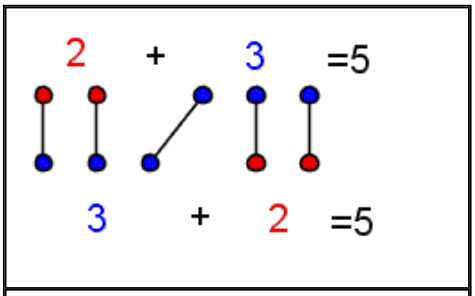
commutative ADJECTIVE /ˈkɒm.yuˌtə.tɪv/ it doesn't matter the order in which an operation is performed. *Math definition:* a binary operation $*$ on members of a set A is commutative if and only if for every $a, b \in A; a * b \equiv b * a$. *Example:* addition of real numbers is commutative since $a + b \equiv b + a$.

commutative group NOUN /ˈkɒm.yuˌtə.tɪv grup/ a group where the operation on the group is commutative. *Example:* the set of real numbers under addition is a commutative group. *Synonym:* *Abelian group*.

Commutative Property of Addition NOUN /ˈkɒm.yuˌtə.tɪv ˈprɒ.pər.ti ʌv əˈdɪ.ʃən/ addition can be performed in any order. *Math definition:* for any real or complex numbers a and b,

$a + b \equiv b + a$.

Example: $2 + 3 = 5 = 3 + 2$.

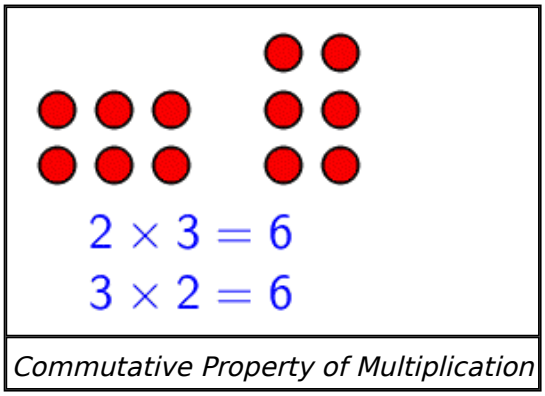


Commutative Property of Addition

Commutative Property of Multiplication NOUN /ˈkɒm.yuˌtə.tɪv ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən/ multiplication can be performed in any order. *Math definition:* for any real or complex numbers a and b,

$ab \equiv ba$.

Example: $2 \cdot 3 = 6 = 3 \cdot 2$.

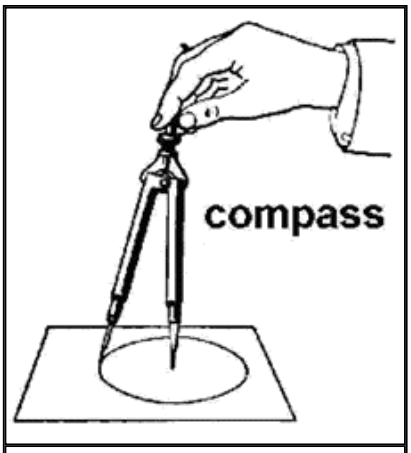


Commutative Property of Multiplication

compare VERB /ˈkʌm.pɛr/ to look at in order to note what is the same and what is different.

comparison NOUN /ˌkʌmˈpɛr.ɪ.sən/ a statement of what is different and what is the same.

compass NOUN /ˈkʌm.pəs/ a tool that can draw a circle and copy a distance.



Compass

compatible ADJECTIVE /kəmˈpæt.ə.bəl/ can be used together. *Antonym: incompatible.*

compatible matrices NOUN /kəmˈpæt.ə.bəl ˈmeɪ.trɪˌsiz/ matrix A is compatible with matrix B if the number of columns of matrix A is the same as the number of rows of matrix B. If matrices A and B are compatible, then multiplication of A by B is defined. *Example:*

Compatible Matrices

$$\begin{bmatrix} -2 & 3 & 1 \\ 4 & -3 & 0 \end{bmatrix} \cdot \begin{bmatrix} 3 & -2 \\ -1 & -4 \\ 0 & 1 \end{bmatrix} = \begin{bmatrix} -9 & -7 \\ 16 & 4 \end{bmatrix}$$

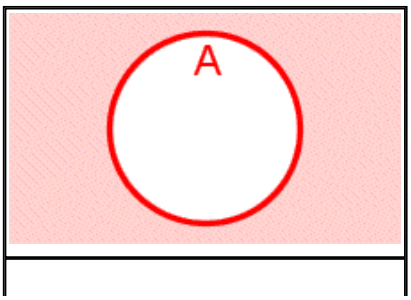
$$2 \times \overbrace{3 \cdot 3}^{} \times 2 \qquad = 2 \times 2$$

Antonym: incompatible matrices.

compatible number NOUN /kəmˈpæt.ə.bəl ˈnʌm.bər/ two numbers that are easy to divide. *Example:* 6 and 3 are compatible numbers since $6 \div 3 = 2$.

complement NOUN /ˈkɒm.plə.mənt/

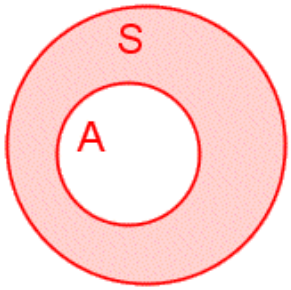
1. (sets) all elements that are *not* members of a set. *Notation:* A'.
2. (sets) the complement of set A in set S is the set of all elements that are



members of set S, but *not* members of set A. *Notation:* A/S.

3. (events) given an event e, one or more other events that will happened if and only if event e does *not* happen. *Example:* when flipping a coin, heads is the complement of tails.
4. (angle) given angle α, another angle β such that $\mathrm{m}\angle\alpha + \mathrm{m}\angle\beta = 90°$.

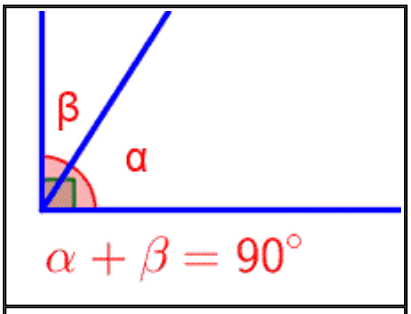
Complement of a Set



Complement of A in S

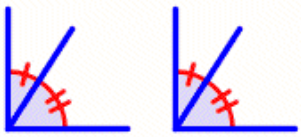
complementary ADJECTIVE /ˌkɒm.plə'mɛn.tər.i/ having the property of being complements of each other.

complementary angle NOUN /ˌkɒm.plə'mɛn.tər.i 'æŋ.gəl/ one of two angles that, when taken together, make a right angle. Angles do *not* have to be next to each other to be complementary. *Math definition:* $\angle\alpha$ is complementary to $\angle\beta$ if and only if $\mathrm{m}\angle\alpha + \mathrm{m}\angle\beta = 90°$. *See also GeoApp!.*



Complementary Angles

Complementary Angle Congruence Theorem NOUN /ˌkɒm.plə'mɛn.tər.i 'æŋ.gəl kən'gru.əns 'θɪər.əm/ angles that are complementary to the same angle or to congruent angles are congruent. *Math definition:* if $\angle\alpha$ is complementary to $\angle\beta$ and $\angle\alpha$ is complementary to $\angle\gamma$, then $\angle\beta \cong \angle\gamma$.



Complementary Angle Congruence Theorem

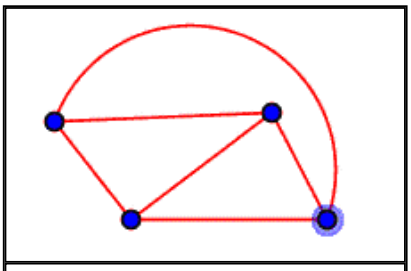
complementary event NOUN /ˌkɒm.plə'mɛn.tər.i ɪ'vɛnt/ one of a set of events where exactly one of the events must happen in any single trial. *Notation:* e' *(read "complement of e").* *Formula:* $P(e) = 1 - P(e')$ and $P(e') = 1 - P(e)$. *Example:* when flipping a coin, either a heads or a tails must happen. Heads and tails are complementary events.

complement theorems NOUN /'kɒm.plə.mənt 'θɪər.əmz/

1. The complement of the intersection of two sets equals the union of the complements of the sets. $(A \cap B)' = A' \cup B'$ (de Morgan's Theorem).
2. The complement of the union of two sets equals the intersection of the complements of the sets. $(A \cup B)' = A' \cap B'$ (de Morgan's Theorem).
3. $A \setminus (B \cap C) = (A \setminus B) \cup (A \setminus C)$
4. $A \setminus (B \cup C) = (A \setminus B) \cap (A \setminus C)$

complete /kəm'plit/

1. ADJECTIVE (axiomatic system) each valid statement can be proved to be true.
2. ADJECTIVE (graph) a graph where each node is connected to every other node by a unique edge.
3. VERB to finish.



Complete Graph

Antonym: incomplete.

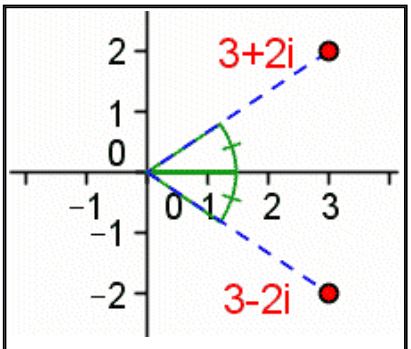
complete the square VERB /kəm'plit ðə skwɛər/ an algorithm used to transform a quadratic equation into vertex form, or solve a quadratic equation.

complex ADJECTIVE /kəm'plɛks/

1. not simple. *Example:* complex curve. *Antonym: simple.*
2. made up of two or more parts. *Example:* complex fraction. *Synonym: compound.*
3. having to do with a complex number.

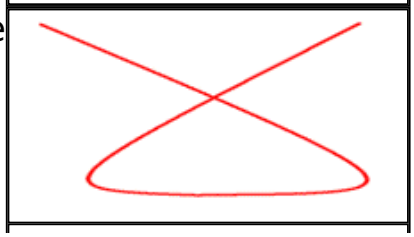
complex conjugate NOUN /kəm'plɛks 'kɒn.dʒəˌgeɪt/ one of two complex numbers of the form $a + bi$ and $a - bi$.

Notation: $\overline{a+bi}$. *Formula:* $\overline{a+bi} = a-bi$. *Example:* $\overline{-3+2i} = -3-2i$.



Complex Conjugate

complex curve NOUN /kəm'plɛks kɜrv/ a curve that crosses itself. *Antonym: simple curve.*



Complex Curve

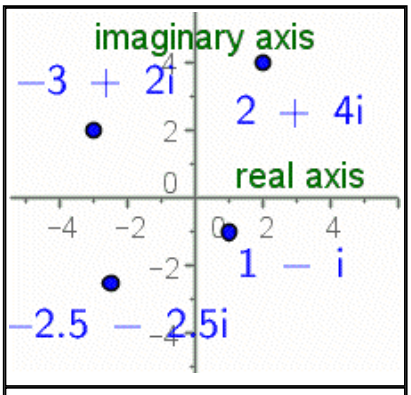
complex fraction NOUN /kəm'plɛks 'fræk.ʃən/ *See compound fraction.*

complex inequality NOUN /kəm'plɛks ˌɪn.ɪ'kwɒl.ɪ.ti/ *See compound inequality.*

complex integer NOUN /kəm'plɛks 'ɪn.tɪ.dʒər/ *See Gaussian integer.*

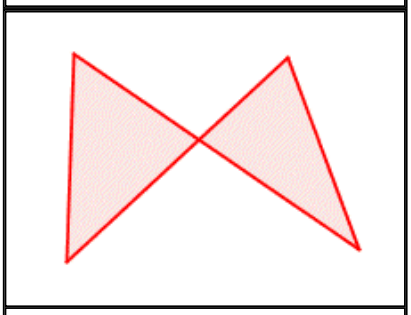
complex number NOUN /kəm'plɛks 'nʌm.bər/ a number that has a real part and an imaginary part; a number in the form $a + b\mathrm{i}$ where $i = \sqrt{-1}$ and a and b are real numbers. *Example:* $5 - 3\mathrm{i} = 5 - 3\sqrt{-1}$. *See also Operations on Complex Numbers.*

complex plane NOUN /kəm'plɛks pleɪn/ a rectangular coordinate system on which complex numbers are plotted. The horizontal axis represents the real part of the complex number. The vertical axis represents the imaginary part of the complex number. *Synonym: Argand diagram.*



Complex Plane

complex polygon NOUN /kəm'plɛks 'pɒl.iˌgɒn/ a polygon whose sides intersect each other. *Antonym: simple polygon.*


Complex Polygon

complex valued ADJECTIVE /kəm'plɛks 'væl.yud/ having variables that can be complex numbers. *See also real valued.*

complex variable NOUN /kəm'plɛks 'vɛər.i.ə.bəl/ a variable that has complex numbers for values.

component NOUN /kəm'poʊ.nənt/

1. a distinct part of a whole.
2. one of two vectors parallel to mutually perpendicular axes whose sum equals the given vector. In $<a,b>$, $<a,0>$ is the

horizontal component and $<0,b>$ is the vertical component.

compose VERB /ˈkəm.poʊz/

1. to combine together by a rule. *Antonym: decompose.*
2. (functions) to form a composite function. *Example:* compose $f(x)$ and $g(x)$: $f \circ g(x)$.

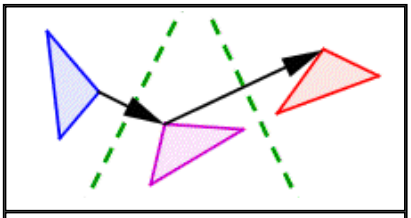
composite ADJECTIVE /kɒmˈpɒz.ɪt/

1. not prime; can be factored. *Example:* composite number.
2. made from more than one distinct part. *Example:* composite function.

composite function NOUN /kɒmˈpɒz.ɪt ˈfʌŋk.ʃən/ the function of a function; if $f(x)$ and $g(x)$ are functions, $f(g(x))$ is a function composed of $f(x)$ and $g(x)$. *Notation:* $f \circ g(x) = f(g(x))$. *Synonym: compound function. See also GeoApp!.*

composite number NOUN /kɒmˈpɒz.ɪt ˈnʌm.bər/ an integer that is *not* a prime number. *Example:* 12 is a composite integer since $12 = 2 \cdot 2 \cdot 3$. *Synonym: rectangular number. Antonym: prime number.*

composite of reflections NOUN /kɒmˈpɒz.ɪt ʌv rɪˈflɛk.ʃənz/ two or more reflections performed in a certain order. *See also GeoApp!.*



Composite of Reflections

composition NOUN /ˌkɒm.pəˈzɪ.ʃən/ the act of combining together by a rule. *Antonym: decomposition.*

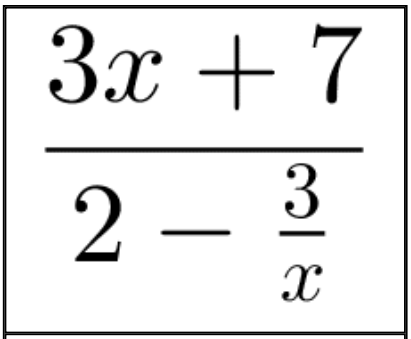
composition of functions NOUN /ˌkɒm.pəˈzɪ.ʃən ʌv ˈfʌŋk.ʃənz/ the act of forming a composite function.

compound /ˈkɒm.paʊnd/

1. ADJECTIVE more than one instance combined together, perhaps by a rule. *Example:* compound inequality. *Synonym: complex.*
2. VERB to add interest to the principal of a loan.

compound event NOUN /ˈkɒm.paʊnd ɪˈvɛnt/ one of two or more events taken together. *Example:* A blue ball is picked (event 1) and a red ball is picked (event 2).

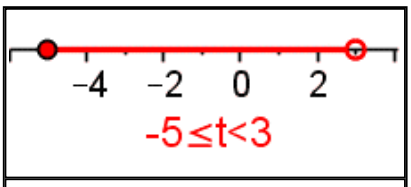
compound fraction NOUN /ˈkɒm.paʊnd ˈfræk.ʃən/ a fraction that has at least one other fraction in the numerator or denominator. *Synonym: complex fraction.*



Compound Fraction

compound function /ˈkɒm.paʊnd ˈfʌŋk.ʃən/ *See composite function.*

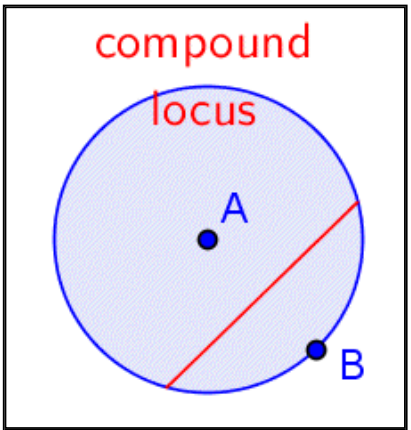
compound inequality NOUN /ˈkɒm.paʊnd ˌɪn.ɪˈkwɒl.ɪ.ti/ an inequality that has more than one inequality operator. *Example:* $-5 \leq t < 3$ means $-5 \leq t$ and $t < 3$. *Synonym: complex inequality.*



Compound Inequality

compound interest NOUN /ˈkɒm.paʊnd ˈɪn.trɪst/ interest that is added to the principal of a loan, so that future interest is calculated on prior interest plus principal. *Formula:* $P = P_0\left(1 + \frac{i}{n}\right)^{t \cdot n}$ where P_0 is the initial principal, i is the nominal interest rate, n is the number of compounding periods per year, and t is the number of years. *Antonym: simple interest. See also GeoApp!.*

compound locus NOUN /ˈkɒm.paʊnd ˈloʊ.kəs/ a locus with more than one condition. *Example:* The illustration is a compound locus whose conditions are: 1) all points equidistant from A and B that 2) lie in the disk centered at A with radius AB. *Plural: compound loci* /ˈkɒl.əm ˈloʊ.saɪ/.



Compound Locus

compound sentence NOUN /ˈkɒm.paʊnd ˈsɛn.təns/ *See compound statement.*

compound statement NOUN /ˈkɒm.paʊnd ˈsteɪt.mənt/ two or more statements connected with logical operators such as 'and' and 'or'. *Example:* A square is a quadrilateral and a square is equilateral.

compression NOUN /kəmˈprɛ.ʃən/ a geometric transformation where the image is smaller than the preimage. *Synonym: contraction.*

computation NOUN /ˌkɒm.pyuˈteɪ.ʃən/ a calculation, usually with numbers.

> **Historical Note**: Mahavira, an Asiatic Indian mathematician who lived about 850 C.E. described the uses of computation in his book *Ganita-Sara-Sangraha* (i. 13-14):
>
> "The number, the diameter and the circumference of islands, oceans and mountains; the extensive dimensions of the rows of habitations and halls belonging to the inhabitants of the world, of the interspace, of the world of light, of the world of the gods and to the dwellers in hell, and miscellaneous measurements of all sorts — all these are made out by means of computation."
>
> Translated from Sanskrit by G. Thibaut. G. R. Kaye. *Indian Mathematics (1915)*.

compute VERB /kəmˈpyut/ to calculate a result, usually with a electronic or mechanical device. *Example:* Compute the difference of 5 and 3: $5 - 3 = 2$. *Synonym: calculate.*

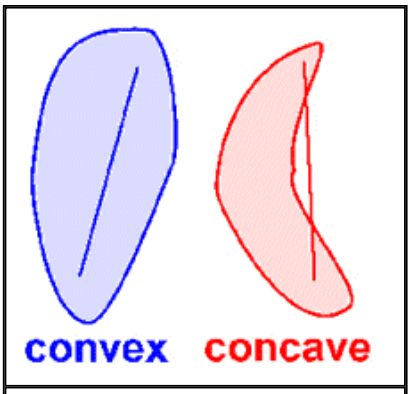
computer NOUN /kəmˈpyu.tər/ a device used to calculate, usually with an electronic processor.

Computer

con- PREFIX /kɒn/

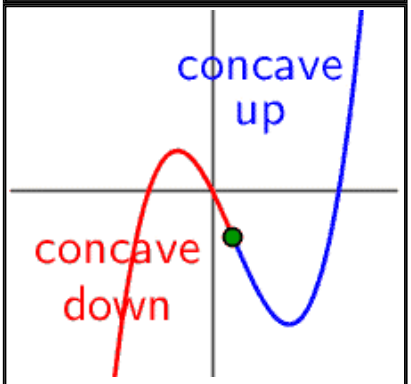
1. with.
2. together.
3. jointly.

concave ADJECTIVE /ˈkɒn.keɪv/ arched in. *Math definition:* A shape is concave if a line segment can be drawn between two points in the shape and the line segment is not completely contained within the shape. *Antonym: convex.*



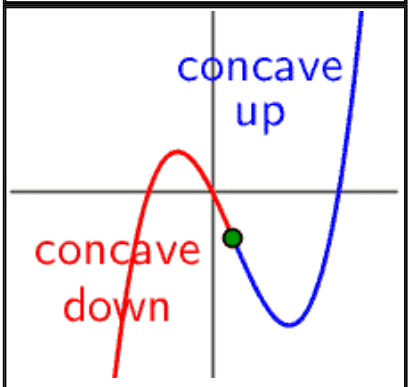
Concave

concave down ADJECTIVE /ˈkɒn.keɪv daʊn/ the slopes of the tangents to the function are decreasing; a line segment drawn between any two points will be entirely below the curve. *Antonym: concave up. See also GeoApp!.*



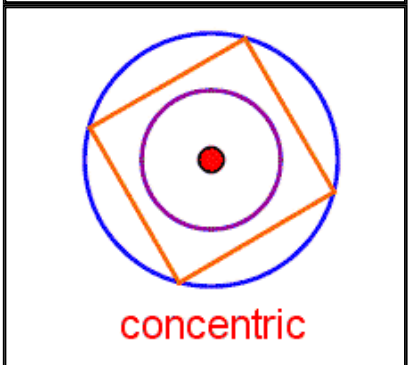
Concave Up, Concave Down

concave up ADJECTIVE /ˈkɒn.keɪv ˈʌp/ the slopes of the tangents to the function are increasing; a line segment drawn between any two points will be entirely above the curve. *Antonym: concave down. See also GeoApp!.*



Concave Up, Concave Down

concentric ADJECTIVE /kənˈsɛn.trɪk/ having the same center. *Antonym: eccentric. See also GeoApp!.*



Concentric

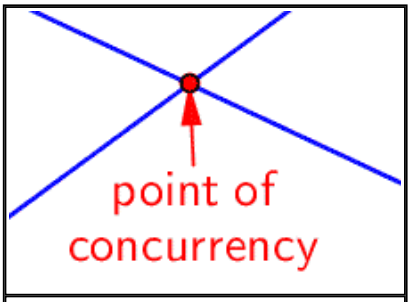
conclude VERB /kən'klud/ to arrive at a logical result.

conclusion NOUN /kən'klu.ʒən/ a statement proved or supported by a set of mathematical arguments. *Format:* If proposition and proposition then conclusion. *Example:* If $\underbrace{\text{a shape is a rectangle}}_{\text{proposition}}$ and $\underbrace{\text{the sides are congruent}}_{\text{proposition}}$, then $\underbrace{\text{the shape is also a square}}_{\text{conclusion}}$.

concurrence NOUN /kən'kɜr.əns/ the meeting of geometric figures at a common point.

concurrency NOUN /kən'kɜr.ən.si/ having to do with whether or not points are shared.

concurrent ADJECTIVE /kən'kɜr.ənt/ sharing one or more points. A point that is shared is called a point of concurrency. *See also GeoApp!*.



Concurrent

condition NOUN /kən'dɪ.ʃən/

1. a requirement that is imposed. *Example:* Let α be an angle less than $90°$. *Synonym: criterion*.
2. a context for judging truth.

conditional ADJECTIVE /kən'dɪ.ʃə.nl/ dependent upon a condition.

conditional convergence NOUN /kən'dɪ.ʃə.nl kən'vɜr.dʒəns/ a convergent series is conditionally convergent if, when its terms are replaced with their absolute values, the new series diverges.

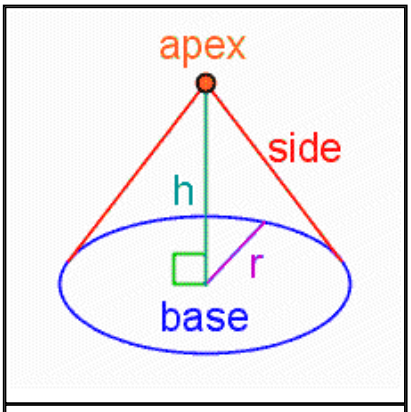
Example: $1 - \frac{1}{2} + \frac{1}{3} - \frac{1}{4} + \cdots$ is conditionally convergent since $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \cdots$ diverges.

conditional equation NOUN /kən'dɪ.ʃə.nl ɪ'kweɪ.ʒən/ an equation that is true only for some values of the variables.
Example: $3 + x = 2$ is true only when $x = -1$.
Antonym: identity.

conditional probability NOUN /kən'dɪ.ʃə.nl ˌprɒb.ə'bɪl.ɪ.ti/ the probability of an outcome of an event where the outcome is dependent on another event. *Notation:* $P(a|b)$ (read 'the probability of a given b'). *Example:* A jar contains 5 red balls and 3 blue balls. A red ball is picked and not put back. What is the probability that the next ball is also a red ball?

conditional statement NOUN /kən'dɪ.ʃə.nl 'steɪt.mənt/ a statement that a claim is true if certain criteria are met. *Format:* If criterion then claim. *Example:* If $\underbrace{\text{a quadrilateral is a rectangle}}_{\text{criterion}}$ then $\underbrace{\text{the sides meet at right angles}}_{\text{claim}}$.

cone NOUN /koʊn/ a 3-dimensional geometric figure with either a circle or an ellipse for a base and a side that comes to a point.



Cone

configuration NOUN /kənˌfɪg.yə'reɪ.ʃən/ an arrangement of objects.

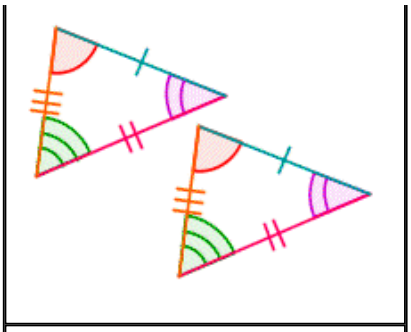
configure VERB /kən'fɪgˌyər/ to arrange objects according to a rule.

congruence NOUN /kən'gru.əns/
1. the state of being congruent or not congruent.
2. having the same remainder when divided by a particular integer.

congruence transformation NOUN /kən'gru.əns 'træns.fərˌmeɪ.ʃən/ a geometric transformation where the pre-image is congruent with the image. *Examples:* reflection, translation, rotation.

congruent ADJECTIVE /kən'gru.ənt/

1. coinciding at all points when one is placed on top of the other. *See also GeoApp!.*
2. having the same measure.
3. (modulo) having the same remainder when divided by a given integer. *Example:* 10 and 20 are congruent modulo 5.



Congruent

Notation: ≅.

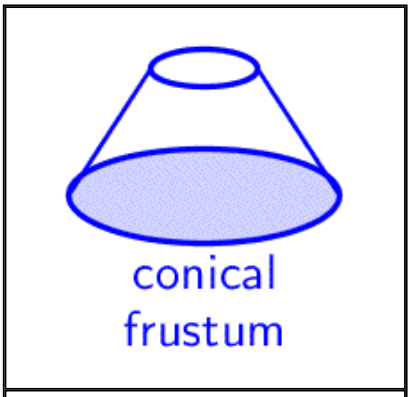
Congruent Corresponding Angles Postulate NOUN /kən'gru.ənt ˌkɒr.ə'spɒn.dɪŋ 'æŋ.gəlz 'pɒs.tʃə.lɪt/ *See Corresponding Angles Postulate.*

conic /'kɒn.ɪk/

1. ADJECTIVE having to do with a cone.
2. ADJECTIVE cone-like in shape.
3. NOUN a conic section.

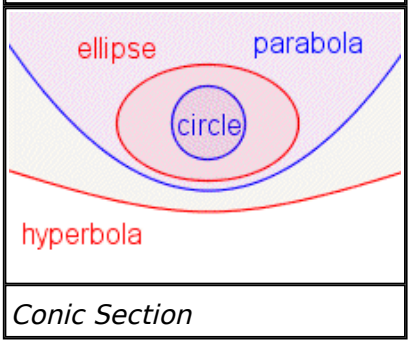
conical ADJECTIVE /'kɒn.ɪ.kl/ cone-like in shape.

conical frustum NOUN /'kɒn.ɪ.kl 'frʌs.təm/ a cone with its top cut off parallel to the base. *See also truncated cone.*



Conical Frustum

conic section NOUN /'kɒn.ɪk 'sɛk.ʃən/ One of a : circle, ellipse, hyperbola and parabola. A figure formed by intersecting the surface of a double cone with a plane.

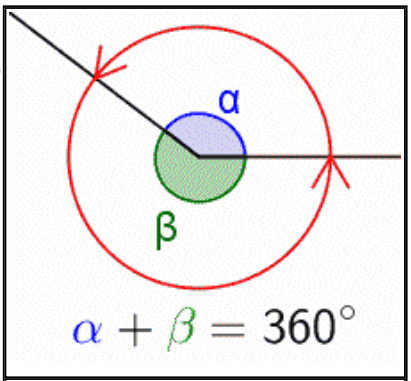


Conic Section

conjecture NOUN /kən'dʒɛk.tʃər/ a statement that is consistent with known data, has *not* been proved true, and has *not* been proved false. *Synonym: admissible hypothesis.*

conjugate ADJECTIVE /ˈkɒn.dʒəˌgeɪt/ having one or more properties in common, but some property the opposite. *Examples:* conjugate axis, conjugate roots.

conjugate angles NOUN /ˈkɒn.dʒəˌgeɪt ˈæŋ.gəlz/ two angles that together make one full circle: $360°$ or 2π rad. *Synonym: explementary angles.*



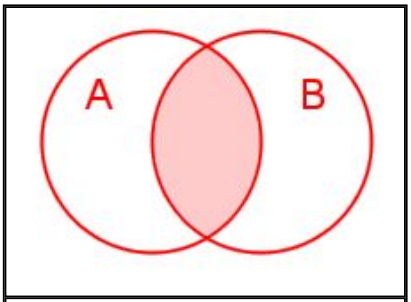
Conjugate Angles

conjugate axis NOUN /ˈkɒn.dʒəˌgeɪt ˈæk.sɪs/ *See minor axis.*

conjugate of a complex number NOUN /ˈkɒn.dʒəˌgeɪt ʌv eɪ kəmˈplɛks ˈnʌm.bər/ *See complex conjugate.*

conjugate roots NOUN /ˈkɒn.dʒəˌgeɪt rutz/ two related complex roots of a polynomial with real coefficients in the form $a+bi$ and $a–bi$. *Example:* $3+2i$ and $3-2i$.

conjunction NOUN /kənˈdʒʌŋk.ʃən/ two statements joined by an AND operator. A conjunction is true if and only if both of the statements are true. *Notation:* ^. *Synonym: and.*



Conjunction

Conjunction		
A	B	$A \wedge B$
false	false	false
false	true	false
true	false	false
true	true	true

connect VERB /kəˈnɛkt/ to join two objects by sharing a point with each.

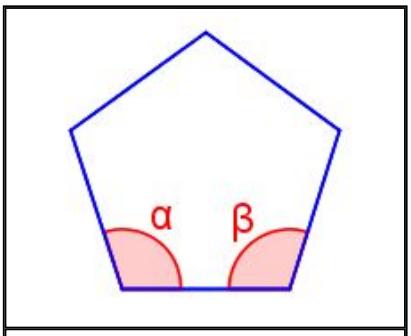
connected ADJECTIVE /kəˈnɛk.tɪd/ sharing at least one point. *Antonym: disconnected.*

consecutive ADJECTIVE /kənˈsɛk.yə.tɪv/

1. immediately following one another. *Example:* 1, 2, 3 and 4 are consecutive integers.
2. *See adjacent.*

consecutive angles NOUN /kən'sɛk.yə.tɪv 'æŋ.gəlz/

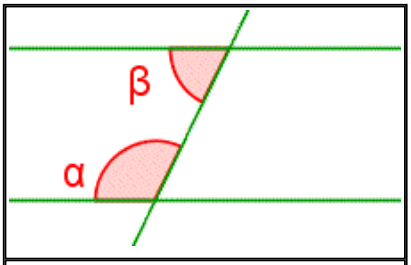
1. *See consecutive interior angles.*
2. angles that share a side.



Consecutive Angles

consecutive integers NOUN /kən'sɛk.yə.tɪv 'ɪn.tɪ.dʒərz/ a set of integers where each one is exactly one more that the last. *Example:* 3, 4, 5, 6 are consecutive integers.

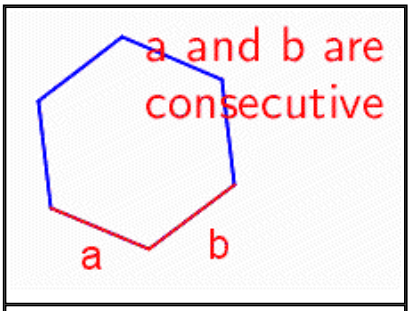
consecutive interior angles NOUN /kən'sɛk.yə.tɪv ɪn'tɪər.i.ər 'æŋ.gəlz/ if two lines are cut by a transversal, the consecutive interior angles are a pair of interior angles on the same side of the transversal.



Consecutive Interior Angles

Consecutive Interior Angles Theorem NOUN /kən'sɛk.yə.tɪv ɪn'tɪər.i.ər 'æŋ.gəlz 'θɪər.əm/ if two parallel lines are cut by a transversal, then each pair of consecutive interior angles are supplementary.

consecutive sides NOUN /kən'sɛk.yə.tɪv saɪdz/ two sides of a polygon that share a vertex. *Synonym: adjacent sides.*



Consecutive Sides

consequent NOUN /'kɒn.sɪˌkwɛnt/ the conclusion of a logical statement; the second of two statements in an if-then relationship: *If antecedent then consequent*. *Example:* If $\underbrace{\text{if you like carrots}}_{\text{antecedent}}$, then $\underbrace{\text{you will like my salad}}_{\text{consequent}}$. *See also implication.*

conservation NOUN /kɒn.sər'veɪ.ʃən/ keeping some attribute the same. *Example:* conservation of distance.

consistent ADJECTIVE /kən'sɪs.tənt/

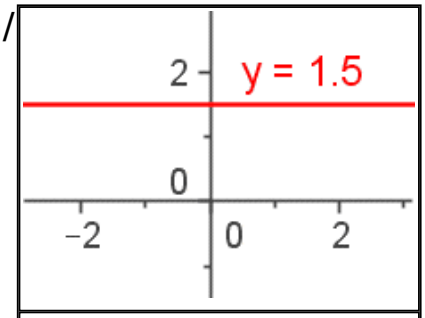
1. having parts that agree with each other.
2. (set of equations) at least one solution exists that satisfies all equations in the set.
3. (logical system) can *not* generate contradictions.

Antonym: inconsistent.

constant /'kɒn.stənt/

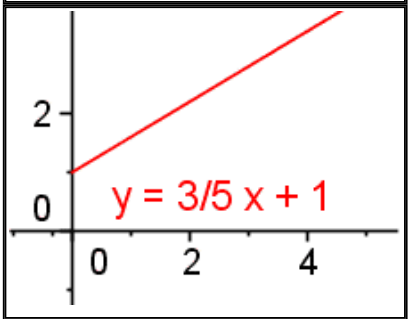
1. NOUN a value that does *not* change. *Example:* the speed of light.
2. NOUN a letter representing a value that does *not* change. *Example:* $\pi \approx 3.14159$.
3. ADJECTIVE unchanging.
4. ADJECTIVE uniform. *Example:* constant growth.

constant function NOUN /'kɒn.stənt 'fʌŋk.ʃən/ a function that always returns the same constant value. *Formula:* $f(x) = a$. *Example:* $f(x) = 3$.



Constant Function

constant growth NOUN /'kɒn.stənt groʊθ/ growth that happens at a constant rate each time period. *Formula:* $y = at + y_0$ where a is the constant of variation and y_0 is the initial value at $t = 0$. *Synonyms: arithmetic growth, linear growth.*

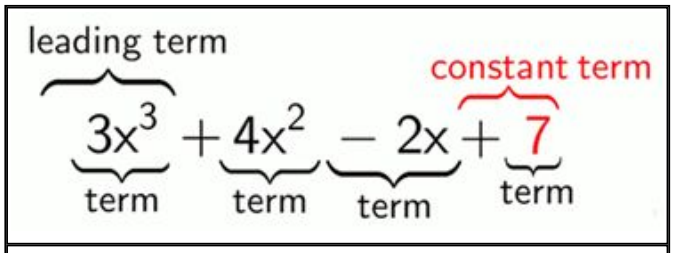


Constant Growth

constant of proportion NOUN /ˈkɒn.stənt ʌv prəˈpoʊr.ʃən/ *See constant of variation.*

constant of variation NOUN /ˈkɒn.stənt ʌv ˌvɛər.iˈeɪ.ʃən/ the ratio by which the input and output vary in direct variation and constant growth. m in $y = mx + b$. *Synonyms: constant of proportion, slope.*

constant term NOUN /ˈkɒn.stənt tɜrm/ the term of a polynomial that has no variables.



Constant Term

constrain VERB /kənˈstreɪn/ to limit or restrict.

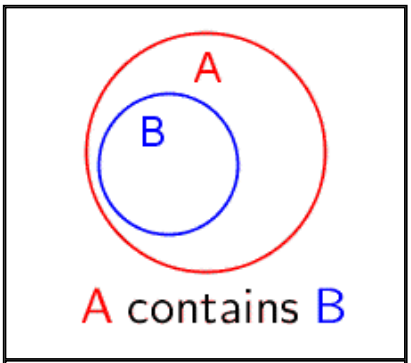
constraint NOUN /kənˈstreɪnt/ a limitation or restriction. *Example:* $x > 0$. *See also criterion, condition.*

construct VERB /kənˈstrʌkt/ to build according to a set of rules. *Example:* use a compass to construct a circle.

construction NOUN /kənˈstrʌk.ʃən/ an object built according to a set of rules. *Example:* the construction of a square.

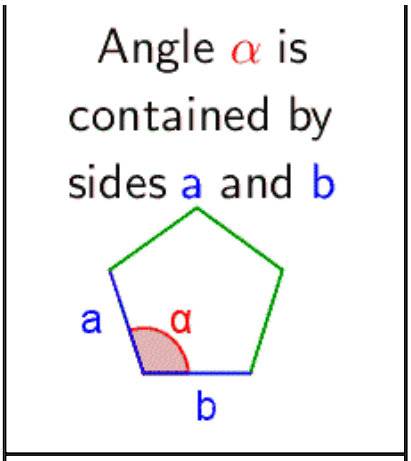
contain VERB /kənˈteɪn/

1. to include within a volume, area or set. *Synonym: subset.*
2. to enclose on both sides. *Example:* Angles α and β contain side a.



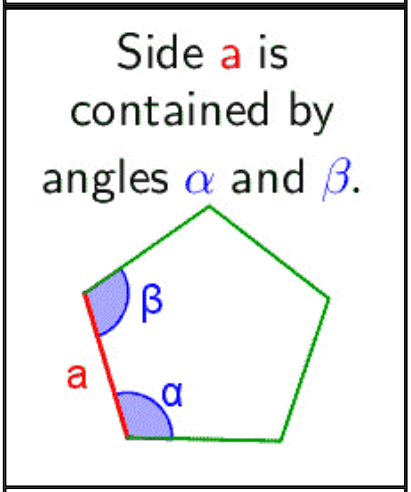
Contain

contained angle NOUN /kənˈteɪnd ˈæŋ.gəl/ an angle between two adjacent sides. *Example:* In the illustration, $\angle\alpha$ is contained by sides a and b.



Contained Angle

contained side NOUN /kən'teɪnd saɪd/ a side between two adjacent vertices. *Example:* In the illustration, side a is contained by angles α and β.



Contained Side

context NOUN /kən'tɛkst/ a particular situation; the circumstances in which an event happens.

continue ADJECTIVE /kən'tɪn.yu/ to keep on doing the same thing.

continued ADJECTIVE /kən'tɪn.yud/ going on without interruption.

continued fraction NOUN /kən'tɪn.yud 'fræk.ʃən/ the sum of a number and a fraction whose denominator is the sum of a number and a fraction and so on.

$$1+\frac{1}{1+\frac{1}{1+\ldots}}$$

Continuous Function

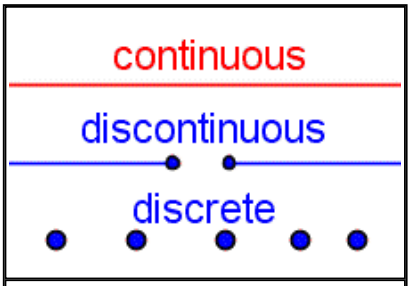
continued product NOUN /kən'tɪn.yud 'prɒ.dəkt/ the product of three or more factors, including infinite products. *Examples:* $1\cdot2\cdot3\cdot4$, $a_1\cdot a_2\cdot a_3\cdot\ldots$

continued sum NOUN /kən'tɪn.yud sʌm/ the sum of three or more addends, including infinite sums. *Examples:* $1+2+3+4$, $a_1+a_2+a_3+\ldots$.

continuity NOUN /ˌkɒn.tn'u.ɪ.ti/ having to do with whether or not something is continuous.

continuous ADJECTIVE /kən'tɪn.yu.əs/
1. without break; uninterrupted.
2. not discrete.

Antonyms: discrete, discontinuous.



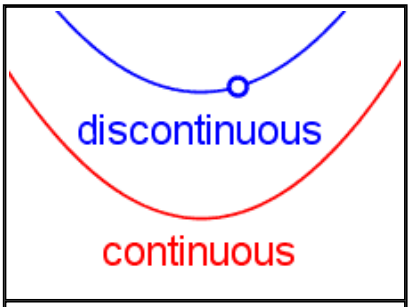
Continuous

continuous compounding NOUN /kən'tɪn.yu.əs 'kɒm.paʊn.dŋ/ compounding interest on a continuous basis.

Formula: $P = P_0e^{r \cdot t}$ where P_0 is the initial principal, e is Euler's number, r is the interest rate per time period, and t is the number of time periods.

continuous data NOUN /kən'tɪn.yu.əs 'deɪ.tə/ data that can take on any value in an interval. *Example:* height, but *not* age. *Antonym: discrete data.*

continuous function NOUN /kən'tɪn.yu.əs 'fʌŋk.ʃən/ a function that does *not* have breaks in it; a function that is defined on the entire domain.



Continuous Function

continuous random variable NOUN /kən'tɪn.yu.əs 'ræn.dəm 'vɛər.i.ə.bəl/ *See continuous variable.*

continuous variable NOUN /kən'tɪn.yu.əs 'vɛər.i.ə.bəl/ a variable that can take on any value of continuous data, as opposed to discrete data. *Synonym: continuous random variable. Antonym: discrete variable.*

continuum NOUN /kən'tɪn.yu.əm/ an unbroken, continuous set. *Example:* The set of real numbers is a continuum. Space-time is called “the continuum”. *Plural: continua* /kən'tɪn.yu.ə/.

contra- PREFIX /ˈkɒn.trə/ against; opposite

contraction NOUN /kənˈtræk.ʃən/ *See compression.*

contradict VERB /ˌkɒn.trəˈdɪkt/ to state two things, both of which can *not* be true. *Example:* The statement "a is an integer" contradicts the statement "a is not an integer.".

contradiction NOUN /ˌkɒn.trəˈdɪk.ʃən/ a statement that can *not* be true if prior statements are true. *Example:* $\underbrace{\text{The line is straight.}}_{\text{statement}}$, $\underbrace{\text{The line is } \textit{not} \text{ straight.}}_{\text{contradiction}}$. *Synonym: paradox.*

contraposition NOUN /ˌkɒn.trə.pəˈzɪ.ʃən/ the inference drawn from a contrapositive statement.

contrapositive NOUN /ˌkɒn.trəˈpɒz.ɪ.tɪv/ the contrapositive of the statement 'if P then Q' is 'if not P then not Q'. *Example:* 'If $\underbrace{\text{the house is green}}_{\text{P}}$ then $\underbrace{\text{it must be mine}}_{\text{Q}}$' is the contrapositive of the statement 'If $\underbrace{\text{the house is } \textit{not} \text{ green}}_{\textit{not}\ \text{P}}$ then $\underbrace{\text{it must } \textit{not} \text{ be mine}}_{\textit{not}\ \text{Q}}$'.

control group NOUN /kənˈtrol grup/ a group that is *not* affected by an experiment; a group that receives a placebo. *Antonym: experimental group.*

convenience sample NOUN /kənˈvin.yəns ˈsɑm.pəl/ a sample taken from a part of a population that is easy to sample. A convenience sample is *not* a scientific sample. *Example:* A sample taken from people in a shopping mall. *Synonym: accidental sample.*

convention NOUN /kənˈvɛn.ʃən/

1. a way things are usually done.
2. an accepted way of doing things.

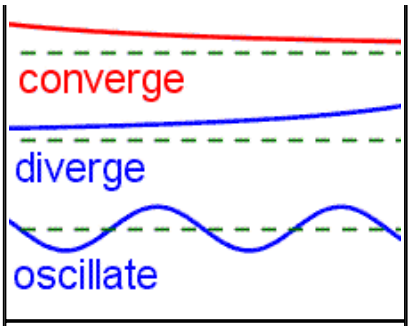
Example: By convention, polynomials are written with the highest degree term on the left.

conventional ADJECTIVE /kənˈvɛn.ʃə.nl/ goes along with the way things are usually done.

converge VERB /kənˈvɜrdʒ/

1. to come closer and closer to a fixed value. *Example:* $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}, \ldots$ converges to zero since each term is closer to zero than the last.
2. to come closer and closer together. *Example:* two lines converging.

Antonym: diverge.



Converge

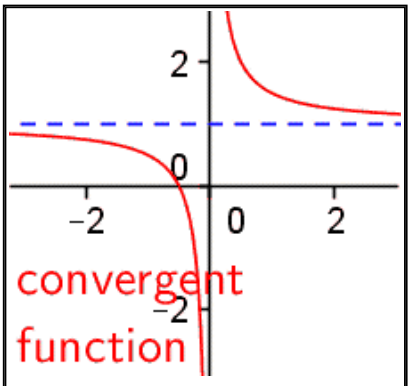
converge absolutely VERB /kən'vɜrdʒ ˌæb.sə'lut.li/ a series is said to converge absolutely if the sum of the absolute values of the terms is convergent. *Math definition:* $\sum_{n=0}^{\infty} a_n$ converges absolutely if $\sum_{n=0}^{\infty} |a_n|$ converges.

convergence NOUN /kən'vɜr.dʒəns/ having to do with whether or not something converges.

convergent ADJECTIVE /kən'vɜrdʒ.ənt/
1. drawing closer and closer one to another.
2. drawing closer and closer to a fixed value.

Antonym: divergent.

convergent function NOUN /kən'vɜrdʒ.ənt 'fʌŋk.ʃən/ the value of the function draws close to a numeric value as the argument tends towards positive or negative infinity. *Example:* The function $f(x) = \frac{1}{x} + 1$ is convergent since its value approaches 1 as x approaches positive and negative infinity. *Antonyms: divergent function, oscillating function.*



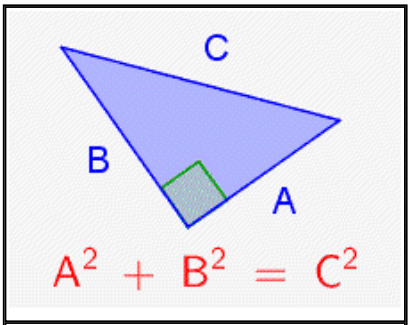
Convergent Function

convergent sequence NOUN /kən'vɜrdʒ.ənt 'si.kwəns/ a sequence that converges; an ordered list of numbers where the numbers get closer and closer to a particular value. *Example:* The sequence $\left\{1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \cdots\right\}$ converges to 0. *Antonym: divergent sequence.*

convergent series NOUN /kən'vɜrdʒ.ənt 'sɪər.iz/ a series that converges; as more and more numbers are added to the partial sum, the partial sum gets closer and closer to a particular value. *Example:* The series $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \cdots$ converges to 1. *Plural: convergent series. Antonym: divergent series. See also GeoApp!.*

converse NOUN /'kɒn.vɜrs/ the converse of the statement 'if P then Q' is the statement 'if Q then P'. If a statement *and* its converse are both true, the relationship is an implication. *Example:* "If it is an apple, then it is sweet," is the converse of "If it is sweet, then it is an apple."

converse of the Pythagorean Theorem NOUN /'kɒn.vɜrs ʌv ðə pɪˌθæg.ə'ri.ən 'θɪər.əm/ if A, B and C are the lengths of sides of a triangle and $A^2 + B^2 = C^2$, then the triangle is a right triangle and the side with length C is the hypotenuse.

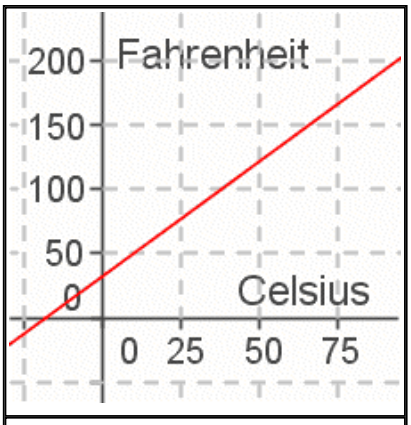


Pythagorean Theorem

conversion NOUN /kən'vɜr.ʒən/ the act of changing from one form to another, related form. *Example:* Conversion of degrees Fahrenheit to kelvin.

conversion factor NOUN /kən'vɜr.ʒən 'fæk.tər/ a number that is multiplied by a quantity that changes the unit of measure of that quantity. *Example:* the conversion factor to change inches to feet is $\frac{1 \text{ ft}}{12 \text{ in}}$. So $36 \text{ in} = 36 \text{ } \cancel{\text{in}} \cdot \frac{1 \text{ ft}}{12 \text{ } \cancel{\text{in}}} = \frac{36}{12} \text{ ft} = 3 \text{ ft}$. *Synonym: conversion ratio.*

conversion graph NOUN /kən'vɜr.ʒən græf/ a graph that can be used to convert between units of measure.



Conversion Graph

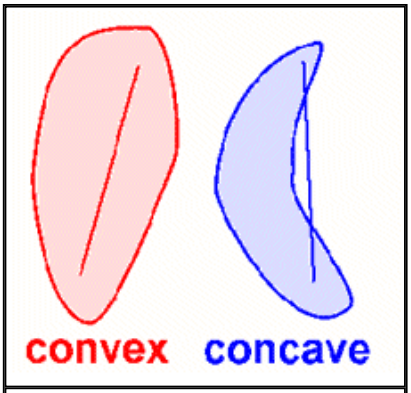
conversion ratio NOUN /kən'vɜr.ʒən 'reɪ.ʃoʊ/ *See conversion factor.*

conversion table NOUN /kən'vɜr.ʒən 'teɪ.bəl/ a table containing representative values of units of measure used to convert from one unit of measure to another.

convert VERB /kən'vɜrt/

1. to change from one form to another, usually equivalent, form. *Example:* Convert a fraction to a decimal. *Synonym: transform.*
2. to change from one unit of measure to another, related unit of measure. *Example:* Convert meters to kilometers.

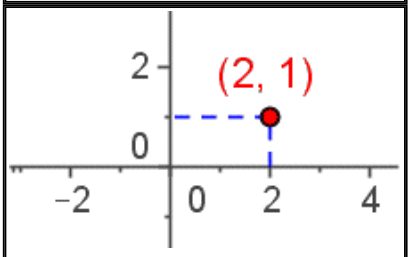
convex ADJECTIVE /kɒn'vɛks/ arching out. *Math definition:* A shape is convex if any line segment drawn between any two points in the shape is completely contained within the shape. *Antonym: concave.*



Convex

coordinate /koʊ'ɔr.dnɪt/

1. NOUN a location in a coordinate system. *Example:* In a 2-dimensional rectangular coordinate system, the coordinate $(2,1)$ refers to the location at $x = 2$ and $y = 1$.
2. ADJECTIVE having to do with a coordinate system.



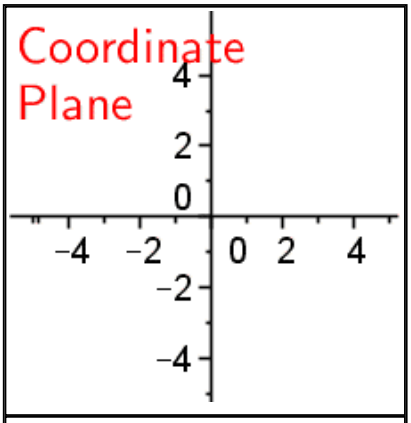
Coordinate

coordinate axis NOUN /koʊˈɔr.dnɪt ˈæk.sɪs/ an axis in a coordinate system. *Examples:* x-axis, y-axis, z-axis. *Plural: coordinate axes* /koʊˈɔr.dnɪt ˈæk.siz/. *Synonym: axis.*

Coordinated Universal Time NOUN /koʊˈɔr.dnˌeɪt.ɪd ˌyu.nəˈvɜr.səl taɪm/ a time standard that includes addition or subtraction of leap seconds each year. *Abbreviation: CUT. Synonym: zulu time. See also Greenwich Mean Time.*

coordinate geometry NOUN /koʊˈɔr.dnɪt dʒiˈɒ.mɪ.tri/ *See analytic geometry.*

coordinate plane NOUN /koʊˈɔr.dnɪt pleɪn/ a plane defined by two number lines intersecting at right angles. *Synonym: Cartesian plane.*

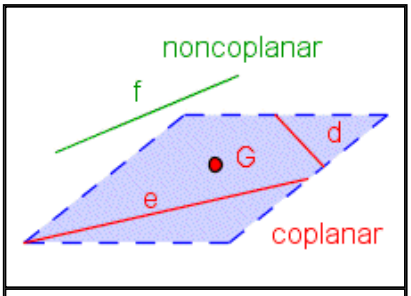


Coordinate Plane

coordinate proof NOUN /koʊˈɔr.dnɪt pruf/ a proof that uses figures in a coordinate system and algebra.

coordinate system NOUN /koʊˈɔr.dnɪt ˈsɪs.təm/ a geometric space where a location is identified by a coordinate. *See also rectangular coordinate system, polar coordinate system.*

coplanar ADJECTIVE /koʊˈpleɪ.nər/ contained in the same plane. *Example:* In the figure, c, d, and G are coplanar. f is not coplanar with c, d, and G. *Antonym: noncoplanar. See also GeoApp!.*

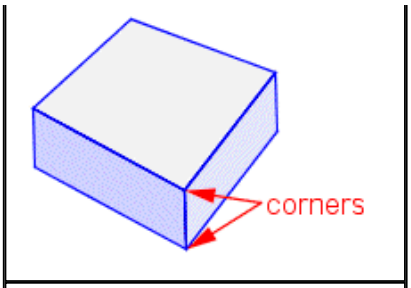


Coplanar

coprime ADJECTIVE /ˈko.praɪm/ having no common factors other than 1. *Example:* 10 and 21 are coprime. *Synonym: relatively prime.*

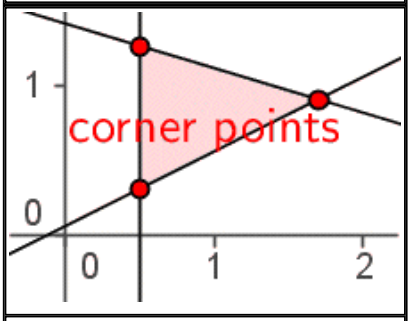
corner /ˈkɔr.nər/

1. NOUN where two or more intersecting line segments or surfaces meet.
2. ADJECTIVE on a corner.



Corner

corner point NOUN /ˈkɔr.nər pɔɪnt/ a point formed by the intersection of boundary lines or surfaces.



Corner Points

Corner Point Principle NOUN /ˈkɔr.nər pɔɪnt ˈprɪn.sə.pəl/ a maximum or minimum of a feasible region of a linear system of inequalities will always be a corner point.

corner view NOUN /ˈkɔr.nər vyu/ *See perspective view.*

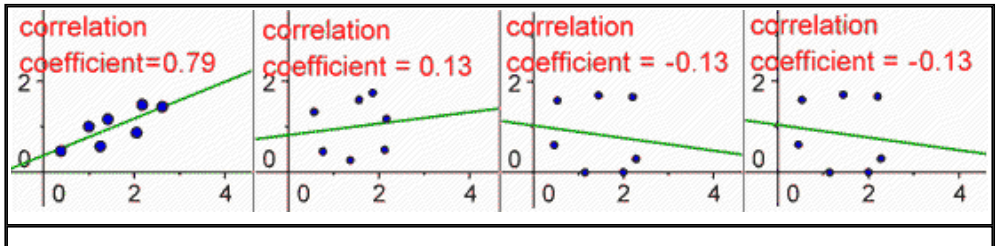
corollary NOUN /ˈkɒr.əˌlɛr.i/ a theorem that can be proved easily from a more important theorem.

correction NOUN /kɒrˈək.ʃn/ an adjustment to an estimate or measurement that makes the estimate more accurate.

correlate VERB /ˌkɒr.əˈleɪt/ to find relations between two variables in a dataset.

correlation NOUN /ˌkɒr.əˈleɪ.ʃən/ a measure of the strength and direction of a relation between two variables in a dataset.

correlation coefficient NOUN /ˌkɒr.əˈleɪ.ʃən ˌkoʊ.əˈfɪ.ʃənt/ a number that measures how close of a relation exists between two variables. A correlation coefficient close to 1 indicates a strong positive correlation. A correlation coefficient close to -1 indicates a strong negative correlation. A correlation coefficient close to 0 indicates a weak correlation.



Correlation Coefficient

correspond VERB /ˌkɒr.əˈspɒnd/

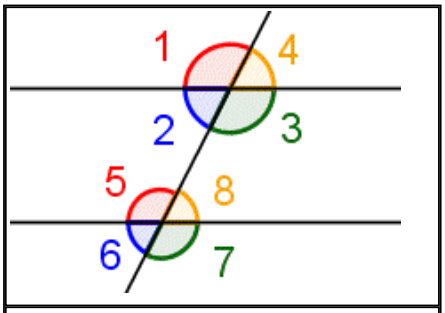
1. to have a relationship such that a change in one predicts a change in the other.
2. to be in the same relative position on two figures or two parts of the same figure.

correspondence NOUN /ˌkɒr.əˈspɒn.dəns/ a relationship between two objects or variables.

corresponding ADJECTIVE /ˌkɒr.əˈspɒn.dɪŋ/

1. having the same relationship with respect to the whole.
2. being in the same relative position on two figures or two parts of the same figure.

Corresponding Angles Postulate NOUN /ˌkɒr.əˈspɒn.dɪŋ ˈæŋ.gəlz ˈpɒs.tʃə.lɪt/ if two parallel lines are cut by a transversal, then each pair of corresponding angles is congruent.



Corresponding Angles Postulate

corresponding elements of matrices NOUN /ˌkɒr.əˈspɒn.dɪŋ ˈɛl.ə.məntz ʌv ˈmeɪ.trɪˌsiz/ elements at the same row and column of two or more matrices.

$a_{1,1}$ corresponds with $b_{1,1}$;

$a_{1,2}$ corresponds with $b_{1,2}$;

$a_{2,1}$ corresponds with $b_{2,1}$;

$a_{2,21}$ corresponds with $b_{2,2}$.

$$A = \begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{bmatrix}$$

$$B = \begin{bmatrix} b_{1,1} & b_{1,2} \\ b_{2,1} & b_{2,2} \end{bmatrix}$$

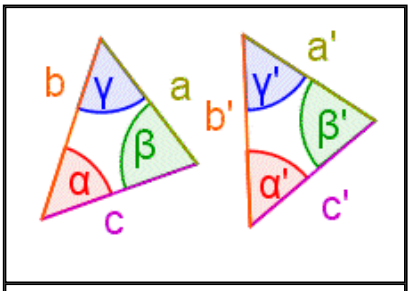
Corresponding Elements of Matrices

corresponding parts NOUN /ˌkɒr.əˈspɒn.dɪŋ pahrtz/ parts of two similar figures that are each in the same relative positions as the other.

Corresponding Parts of Congruent Figures are Congruent NOUN /ˌkɒr.əˈspɒn.dɪŋ pahrtz ʌv kənˈgru.ənt ˈfɪg.yərz ɑr kənˈgru.ənt/ if two geometric figures are congruent, then each pair of corresponding parts of those figures are congruent.
Acronym: CPCFC.

Corresponding Parts of Congruent Triangles are Congruent NOUN /ˌkɒr.əˈspɒn.dɪŋ pahrtz ʌv kənˈgru.ənt ˈtraɪˌæŋ.gəlz ɑr kənˈgru.ənt/ if two triangles are congruent, then each pair of corresponding parts of those triangles are congruent. *Acronym: CPCTC.*

corresponding parts of geometric figures NOUN /ˌkɒr.əˈspɒn.dɪŋ pahrtz ʌv ˌdʒi.əˈmɛt.rɪk ˈfɪg.yərz/ parts of two geometric figures that are in the same relative positions.



Corresponding Parts

cos ABBREVIATION See cosine.

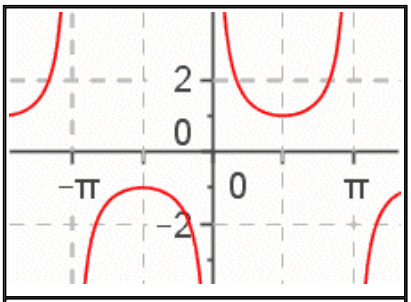
cos() COMPUTERS the cosine function in most computer languages. *Example:* `y = cos(x)`.

cos^{-1} ABBREVIATION See arccosine.

cosecant NOUN /koʊˈsi.kænt/ the multiplicative inverse of the sine. *Abbreviation: csc. Formula:*

$$\csc\alpha = \frac{1}{\sin\alpha} = \frac{\text{hypotenuse}}{\text{opposite}}$$

. See also GeoApp!.



Cosecant

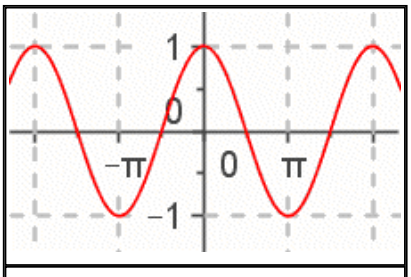
cosh ABBREVIATION See hyperbolic cosine.

cosh() COMPUTERS represents the hyperbolic cosine function in most computer languages. *Example:* `y = cosh(x)`.

cosine NOUN /ˈkoʊ.saɪn/ in a right triangle, the ratio of the adjacent side to the hypotenuse. *Abbreviation: cos. Formula:*

$$\cos\alpha = \frac{\text{adjacent}}{\text{hypotenuse}}$$

. See also GeoApp!.



Cosine

cosine rule NOUN /ˈkoʊ.saɪn rul/ *See Law of Cosines.*

cost NOUN /kɒst/ the amount paid for something.
Synonym: wholesale price.

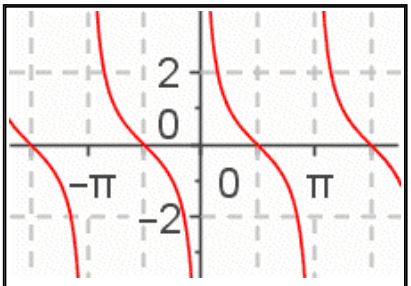
cost of goods sold NOUN /kɒst ʌv gʊdz soʊld/ the direct cost of items sold.

cot ABBREVIATION See cotangent.

cot() COMPUTERS represents the cotangent function in most computer languages. *Example:* `y = cot(x)`.

cot^{-1} ABBREVIATION See arccotangent.

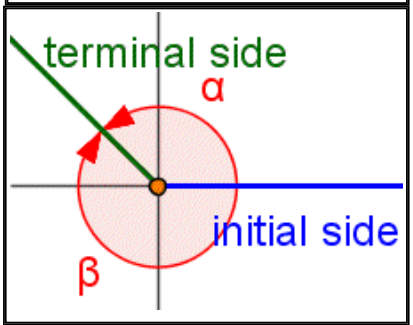
cotangent NOUN /ˈkoʊ.tæn.dʒənt/ the multiplicative inverse of the tangent. *Abbreviation: cot. Formula:* $\cot\alpha = \frac{1}{\tan\alpha} = \frac{\text{adjacent}}{\text{opposite}}$. *See also GeoApp!.*



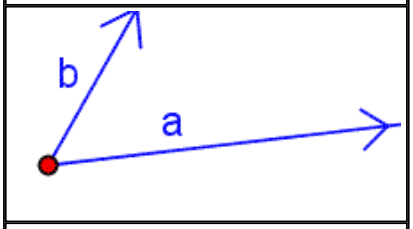
Cotangent

coterminal ADJECTIVE /ˌkoʊˈtɜr.mə.nl/
1. having a common ending boundary.
2. of two two angles, having the same initial line and the same terminal line.
   Formula: $m\angle\alpha = 2\pi k \cdot m\angle\beta,\ k \in \mathbb{Z}$.
3. of rays, having a common end point.

Synonym: coterminous.



Coterminal Angles



Coterminal rays

coterminous ADJECTIVE /ˌkoʊˈtɜr.mə.nəs/ *See coterminal.*

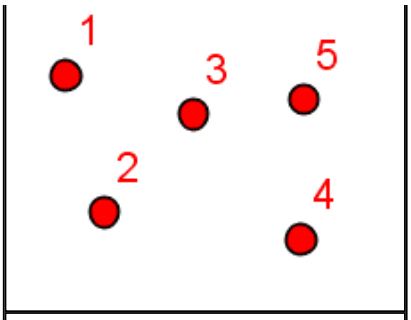
coth ABBREVIATION See hyperbolic cotangent.

coth() COMPUTERS represents the hyperbolic cotangent function on most computer languages. *Example:* `y = coth(x);`.

count VERB /kaʊnt/
1. to associate natural numbers with a collection of objects starting with 1.

Example: Count the number of apples in the basket. *Synonym:* *enumerate*.

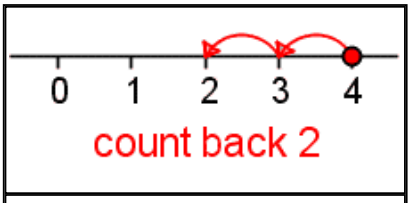
2. to recite the natural numbers in order. *Example:* Count from 1 to 10.



Count

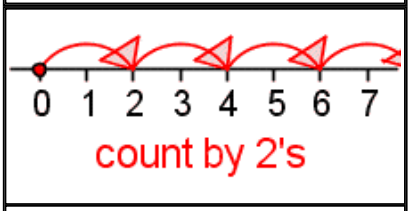
countable ADJECTIVE /ˈkaʊn.tə.bəl/ can be placed in a one to one correspondence with the natural numbers. *Example:* the set of integers. *Synonym:* *denumerable*. *Antonyms:* *uncountable*, *nondenumerable*.

count back VERB /kaʊnt bæk/ to count backwards on a number line, usually for subtraction.



Count Back

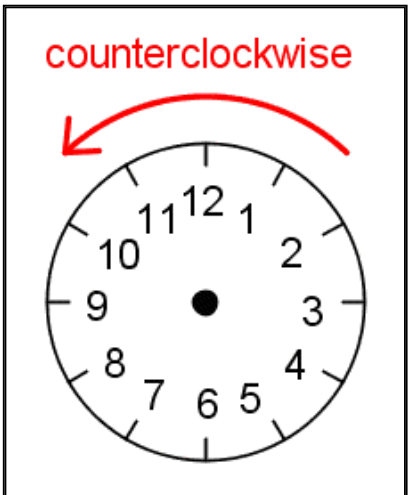
count by VERB /kaʊnt baɪ/ to count every 2nd, 3rd, etc. integer. *Example:* count by 2's: 2, 4, 6, ... *Synonym:* *skip count*.



Count By

counter- PREFIX /ˈkaʊn.tər/ going against; opposite. *Example:* counterexample.

counterclockwise ADJECTIVE /ˌkaʊn.tərˈklɒk.waɪz/ (American English) in the opposite direction that the hands of an analog clock turn. *Synonym:* *anticlockwise* (British English). *Antonym:* *clockwise*.



Counterclockwise

counterexample NOUN /ˈkaʊn.tər.ɪgˌzæm.pəl/ an example that disproves a proposition.

counting number NOUN /ˈkaʊnt.ɪŋ ˈnʌm.bər/ *See natural number.*

counting principle NOUN /ˈkaʊnt.ɪŋ ˈprɪn.sə.pəl/ the size of the sample space of a set of independent events is the product of the size of the sample space of each of the events. *Formula:* $S(e_1, e_2, \ldots, e_n) = S(e_1) \cdot S(e_2) \cdot \ldots \cdot S(e_1)$. *Example:* There are 3 blue balls and 2 red balls. How many different ways are there to select one blue ball, put it back, then select one red ball? $3 \cdot 2 = 6$. *Synonym: fundamental counting principle.*

count on VERB /kaʊnt ɒn/ to continue counting on a number line, as in addition.

CPCFC ACRONYM See Corresponding Parts of Congruent Figures are Congruent.

CPCTC ACRONYM See Corresponding Parts of Congruent Triangles are Congruent.

cps ABBREVIATION See cycles per second.

Cramer's rule NOUN /ˈkreɪ.mərz rul/ an algorithm for solving square linear systems using determinants.

create VERB /kriˈeɪt/ to bring into being.

crest NOUN /krɛst/ the very top of a wave.

criterion NOUN /kraɪˈtɪər.iən/ a condition that must be true for the rest to apply. *Example:* In the statement “You will clean your room before playing with your friends,” the criterion is “you will clean your room”. *Plural: criteria* /kraɪˈtɪər.i.ə/. *Synonyms: condition, constraint. See also assumption.*

critical thinking NOUN /ˈkrɪ.tɪ.kəl ˈθɪŋk.ɪŋ/ a way of thinking that examines statements using logic.

cross multiplication NOUN /krɔs ˌmʌl.tə.plɪˈkeɪ.ʃən/ multiplying each numerator by the denominator on the other side of the equal sign. *Math definition:* if $\frac{a}{b} = \frac{c}{d}$ then $ad = bc$. *Example:*

$$\frac{3y}{4} = \frac{3}{2} \rightarrow 3y \cdot 2 = 3 \cdot 4 \rightarrow 6y = 12 \rightarrow y = 2.$$

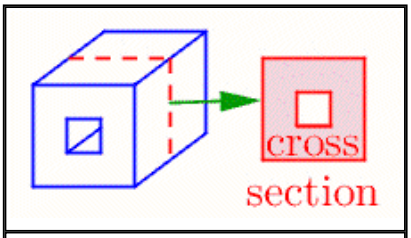
Synonym: cross product, definition 2.

cross product NOUN /krɔs ˈprɒ.dəkt/

1. a method of multiplying vectors. *Notation:* $u \times v$.
   Formula: $\langle a_1,a_2,a_3\rangle \times \langle b_1,b_2,b_3\rangle = \langle a_2b_3 - a_3b_2,\ a_3b_1 - a_1b_3,\ a_1b_2 - a_2b_1\rangle$.
   Example: $\langle -1,2,3\rangle \times \langle 2,-3,1\rangle = \langle 2\cdot 1 - 3\cdot -3,\ 3\cdot 2 - -1\cdot 1,\ -1\cdot -3 - 2\cdot 2\rangle = \langle 2 + 9,\ 6 + 1,\ 3 - 4\rangle = \langle 11,7,-1\rangle$.
   Synonym: vector product.
2. *See cross multiplication.*

cross section NOUN /krɔs 'sɛk.ʃən/

1. (geometry) a 2-dimensional figure formed by intersecting a 3-dimensional figure with a plane, often at right angles to an axis.
2. (statistics) a representative sample.



Cross Section

csc ABBREVIATION See cosecant.

csc() COMPUTERS represents the cosecant function in most computer languages. *Example:* `y = csc(x)`.

csc^{-1} ABBREVIATION See arccosecant.

csch ABBREVIATION See hyperbolic cosecant.

csch() COMPUTERS represents the hyperbolic cosecant function in most computer languages. *Example:* `y = csch(x)`.

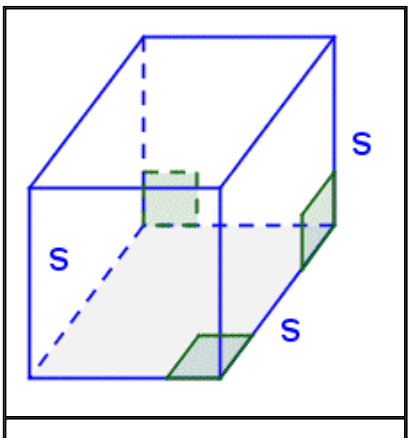
cu ABBREVIATION See cubic.

cub- PREFIX /kyub/

1. having to do with a cube (geometric figure).
2. having an exponent of 3.

cube /kyub/

1. NOUN (geometry) a 3-dimensional figure whose edges are all the same length and whose faces are congruent squares. *See also Net!.*
2. NOUN (algebra) a value multiplied by itself three times; a value raised to the power of 3. *Example:* t^3.



3. VERB (algebra) to multiply a value by itself three times; to raise a value to the power of 3.
4. ADJECTIVE having to do with a cube.
5. ADJECTIVE shaped like a cube.
6. ADJECTIVE multiplied by itself three times.

cube function NOUN /kyub 'fʌŋk.ʃən/ the function $f(x) = x^3$.

cube root NOUN /kyub rut/ a number that, when multiplied by itself three times, equals the original value. *Notations:* $\sqrt[3]{x}$, $x^{\frac{1}{3}}$. *Math definition:* $y = \sqrt[3]{x}$ if and only if $x = y^3$. *Example:* $\sqrt[3]{8} = 2$ since $2^3 = 8$.

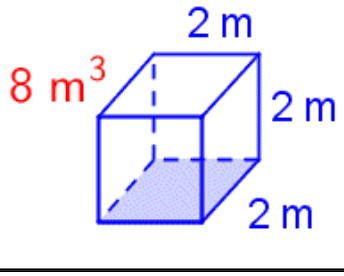
cubic /'kyu.bɪk/

1. ADJECTIVE having to do with an exponent of 3. *Abbreviation: cu. Examples:* x^3, ft^3 (cubic feet).
2. NOUN a cubic equation.
3. ADJECTIVE having to do with a cube.

cubic equation NOUN /'kyu.bɪk ɪ'kweɪ.ʒən/ an equation of a cubic polynomial. *Example:* $y = 2x^3 - 2x + 1$.

cubic function NOUN /'kyu.bɪk 'fʌŋk.ʃən/ a function of a cubic polynomial. *Example:* $f(x) = x^3 + 2x - 3$.

cubic measure NOUN /'kyu.bɪk 'mɛ.ʒər/ a measure in three dimensions where all of the dimensions have the same unit of measure.

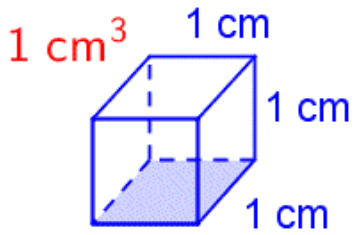


Cubic Measure

cubic meter NOUN /'kyu.bɪk 'mi.tər/ a unit of measure of volume measuring 1 meter on each side. *Example:* $1\ \text{m}^3$.

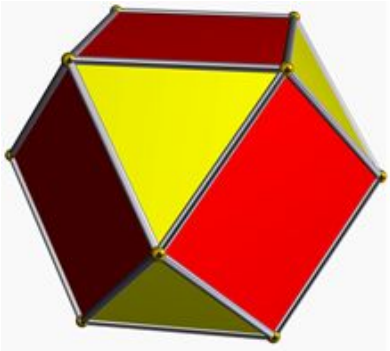
cubic polynomial NOUN /'kyu.bɪk ˌpɒl.ə'noʊ.mi.əl/ a polynomial of degree 3. *Example:* $3x^3 - 4x^2 + 2x + 1$.

cubic unit NOUN /'kyu.bɪk 'yu.nɪt/ a unit of measure of volume. *Example:* $1\text{ cm} \times 1\text{ cm} \times 1\text{ cm} = 1\text{ cm}^3$.



Cubic Unit

cuboctahedron NOUN /'kyub˛ɒk.tə.hi.drən/ a polyhedron whose faces are six congruent squares and eight congruent equilateral triangles.



Cuboctahedron

cuboid NOUN /'kyu.bɔɪd/ *See rectangular solid.*

cumulative ADJECTIVE /'kyu.myə.lə.tɪv/ adding up over time; combined effect. *Example:* the cumulative effect of illegal drug use.

cumulative error NOUN /'kyu.myə.lə.tɪv 'ɛr.ər/

1. an error that does *not* decrease with additional observations.
2. the combined effect of multiple errors, especially in arithmetic operations.

cumulative frequency NOUN /'kyu.myə.lə.tɪv 'fri.kwən.si/ (statistics) the sum of the frequencies below or equal to a certain value.

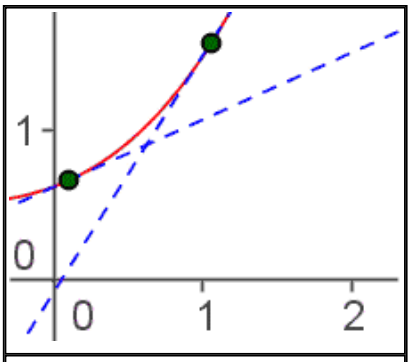
cup NOUN /kʌp/

1. (sets) the symbol $\cup$ which represents the union of sets.
2. (measure) a unit of measure of volume. *Abbreviation: c.*
   Formulas: $1\text{ cup} = 8\text{ fluid ounces}$,
   $2\text{ cups} = 1\text{ pint}$, $4\text{ cups} = 1\text{ quart}$,
   $1\text{ cup} \approx .237\text{ liters}$.

curly brace NOUN /'kɜr.li breɪs/ *See brace.*

currency NOUN /'kɜr.ən.si/ something that is used as money.

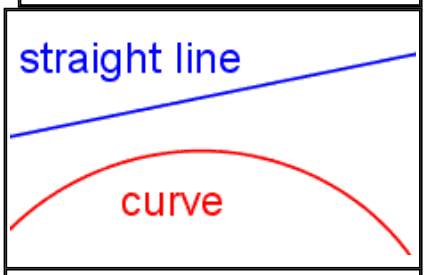
curvature NOUN /ˈkɜr.və.tʃər/ how much something curves; how fast the slope of a line tangent to a curve changes as the point of tangency moves along the curve.



Curvature

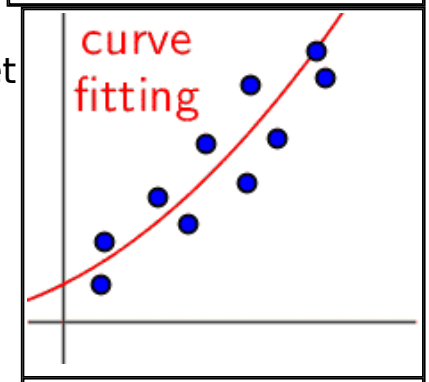
curve /kɜrv/

1. NOUN a continuous, one-dimensional set of points.
2. VERB to move on a path that is *not* straight.



Curve

curve fitting NOUN /kɜrv ˈfɪt.ɪŋ/ any method of calculating an equation that best fits a set of data points.



Curve Fitting

customary ADJECTIVE /ˈkʌs.təˌmɛr.i/ based on common practice.
Example: Gallon is a customary unit.

customary measurement system NOUN /ˈkʌs.təˌmɛr.i ˈmɛʒ.ər.mənt ˈsɪs.təm/ the measurement system based on feet, miles, gallons and cups still in use in the United States.

customary unit NOUN /ˈkʌs.təˌmɛr.i ˈyu.nɪt/ one of the units of measure from the customary measurement system.
Examples: feet, miles, gallons.

cut VERB /kʌt/

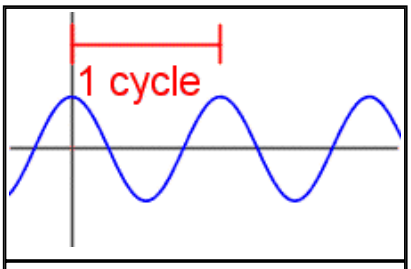
1. to intersect.
2. to divide into two or more parts.

CUT ACRONYM See Coordinated Universal Time.

cut off VERB /kʌt ɒf/ to remove a part of a larger object by intersecting it with a plane. Everything on one side of the plane is 'cut off'.

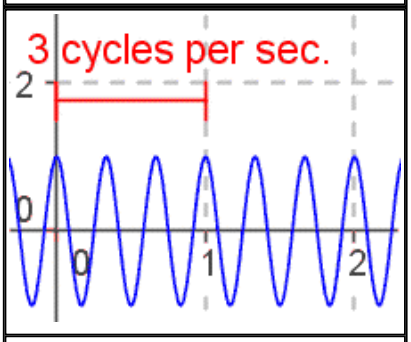
cycle NOUN /'saɪk.əl/

1. the period of time over which a set of events repeats.
2. of a periodic function, the smallest part that repeats.
3. a system that repeats over time. *Example:* water cycle.



Cycle

cycles per second NOUN /'saɪ.kəlz pər 'sɛ.kənd/ the number of times a complete cycle happens each second. *Abbreviation: cps. Formula:* $\text{cps} = \frac{\#\text{ cycles}}{\#\text{ seconds}}$. *See also frequency.*

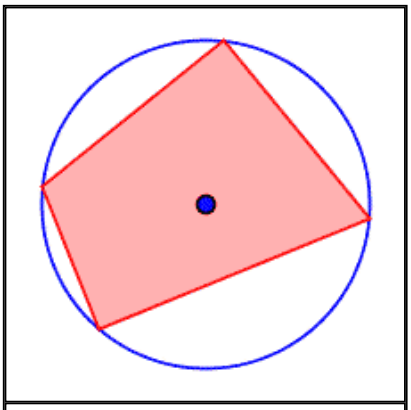


Cycles per Second

cyclic ADJECTIVE /'sɪk.lɪk/

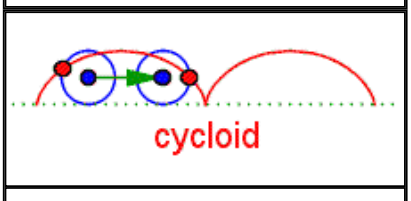
1. having to do with a circle.
2. repeating at regular intervals.

cyclic polygon NOUN /'sɪk.lɪk 'pɒl.iˌgɒn/ a polygon whose vertices lie on a common circle; a polygon that is circumscribable. *See also GeoApp!.*


Cyclic Polygon

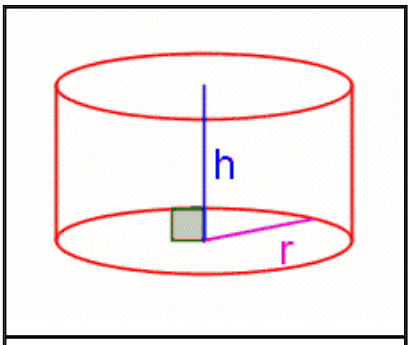
cycloid NOUN /'saɪ.klɔɪd/ a curve generated by a point on the circumference of a circle as it rolls along a line.

Equation: $x = r(t - \sin t)$, $y = r(1 - \cos t)$.



Cycloid

cylinder NOUN /ˈsɪl.ɪn.dər/ a 3-dimensional geometric figure with circular, congruent and parallel bases and straight sides. *See also GeoApp!, Net!.*

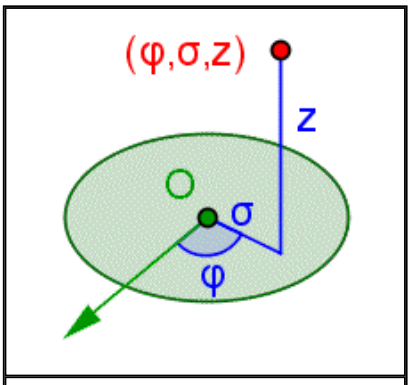


Cylinder

cylindrical ADJECTIVE /sɪlˈɪnˌdrɪ.kəl/
1. shaped like a cylinder.
2. having to do with a cylinder.

cylindrical coordinate NOUN /sɪlˈɪnˌdrɪ.kəl koʊˈɔr.dnɪt/ a coordinate using polar coordinates in the x-y axial plane and a height parallel with the z-axis.

Notation: (φ,σ,z) where φ is the angle in the x-y axial plane, σ is the radius and z is the height.



Cylindrical Polar Coordinates

cypher NOUN /ˈsaɪ.fər/ (British English) *See cipher.*

D

d ABBREVIATION See deci-.

D SYMBOL 50 in Roman numerals.

da ABBREVIATION See deka-.

data NOUN /ˈdeɪ.tə/ a set of facts used in analysis or associated with a study of a population. *Singular: datum* /ˈdeɪ.tʌm/.

data analysis NOUN /ˈdeɪ.tə ˌæˈnæl.ɪ.sɪs/ performing calculations on data in order to arrive at conclusions about a population. *Plural: data analyses* /ˈdeɪ.tə əˈnæl.əˌsiz/.

data collection NOUN /ˈdeɪ.tə kəˈlɛk.ʃən/ gathering data from various sources into one organized collection.

data item NOUN /ˈdeɪ.tə ˈaɪ.təm/ a single row in a dataset.

data point NOUN /ˈdeɪ.tə pɔɪnt/ a single row in a dataset; a single item of data in a dataset.

dataset NOUN /ˈdeɪ.tə.sɛt/ a collection of related numbers and facts, usually organized into rows and columns.

date NOUN /ˈdeɪt/ a day, month and year. Dates are written in years since a reference date, months since the start of the year, and days since the start of the month. *Example:* 25 January, 1964.

day NOUN /deɪ/ a period of time equal to the time it takes for the Earth to rotate once on its axis.

Formulas: $365¼ \text{ days} \approx 1 \text{ year}$,

$24 \text{ hours} = 1 \text{ day}$

day of the week NOUN /deɪ ʌv ðə wik/ Sunday, Monday, Tuesday, Wednesday, Thursday, Friday or Saturday.

de- PREFIX /dɛ/

1. undo.
2. not.
3. reverse.

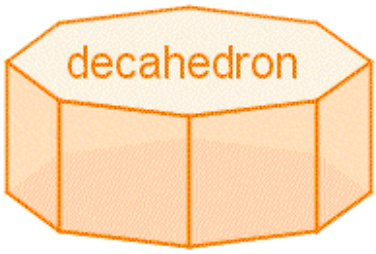
deca- PREFIX /ˈdɛk.ə/ ten. *See also deka-.*

decade NOUN /ˈdɛ.keɪd/ a period of time equal to 10 years.

decagon NOUN /'dɛk.əˌgɒn/ any ten sided polygon. *See also GeoApp!.*

Decagon

decahedron NOUN /ˌdɛk.ə'hi.drən/ any polyhedron with 10 faces. *See also Net!.*



Decahedron

decay NOUN /dɪ'keɪ/ the gradual breaking down of a substance.

decay factor NOUN /dɪ'keɪ 'fæk.tər/ a number that shows how fast decay is happening. *Formula:* In $y = ab^x$, $0<b<1$, the decay factor is b.

deci- PREFIX /'dɛs.ə/ one tenth of; $\frac{1}{10} = 0.1 = 10^{-1}\,10^{-1}$.

Abbreviation: d.

Example: 2 decigram $= 2\times10^{-1}$ grams $= 0.2$ grams. *Synonym: tenth, definition 1.*

decile NOUN /'dɛ.sɪl/ one of nine values that divides a dataset into ten parts.

decimal /'dɛs.ə.məl/

1. NOUN a number written in base 10.
2. NOUN a decimal separator '.' or ','.
3. ADJECTIVE having do with numbers written in base 10.
4. ADJECTIVE based on the number 10.

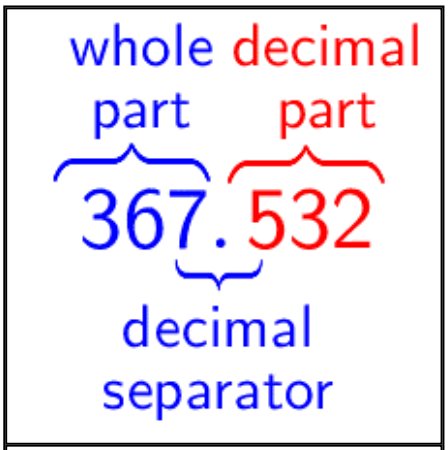
decimal digit NOUN /'dɛs.ə.məl 'dɪdʒ.ɪt/ one of the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, and 9 used to write decimal numerals.

decimal fraction NOUN /ˈdɛs.ə.məl ˈfræk.ʃən/ a fraction where the denominator is a power of 10. *Example:* $\frac{37}{100}$.

decimal number NOUN /ˈdɛs.ə.məl ˈnʌm.bər/ *See decimal numeration.*

decimal numeration NOUN /ˈdɛs.ə.məl ˌnum.əˈreɪ.ʃən/ a real number expressed in base 10 that may use a decimal separator. *Examples:* 532.4, 5, 12.3, 3.72.

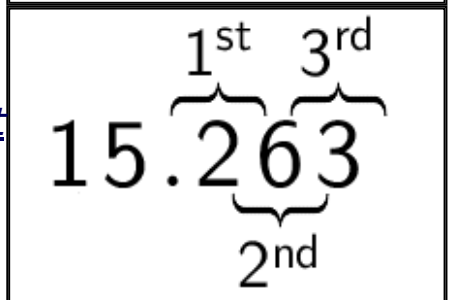
decimal part NOUN /ˈdɛs.ə.məl pɑrt/ the part of a decimal number to the right of the decimal separator. *Example:* $.47$ in 53.47.



Decimal Part

decimal place NOUN /ˈdɛs.ə.məl pleɪs/

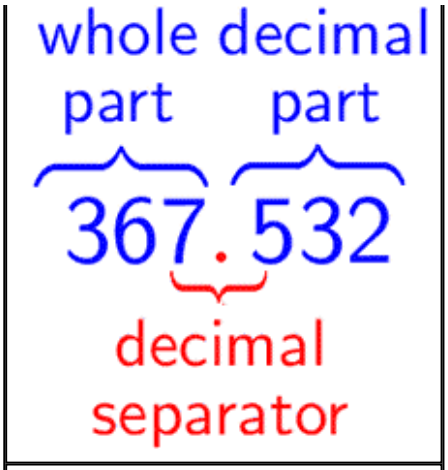
1. the position of a digit to the right of a decimal separator. *Synonym: digit position.*
2. the number of digits to the right of a decimal separator kept when rounding. *Example:* Round to 3 decimal places.



Decimal Place

decimal point NOUN /ˈdɛs.ə.məl pɔɪnt/ *See decimal separator.*

decimal separator NOUN /ˈdɛs.ə.məl ˈsɛp.əˌreɪ.tər/ a period or comma in a decimal number separating the whole part from the decimal part. In United Kingdom, Canada and the United States, a period, called a decimal point, is used.



Decimal Separator

decipher VERB /diˈsaɪ.fər/ (American English) to convert enciphered text to plain text using a method such as transposition of letters. *Synonym: decypher* (British English). *Antonym: encipher.*

decipherment NOUN /diˈsaɪ.fər.mənt/ the act of deciphering. *Antonym: encipherment.*

decision NOUN /dɪˈsɪ.ʒən/ a conclusion that is the result of thinking.

decision making NOUN /dɪˈsɪ.ʒən ˈmeɪ.kɪŋ/ the process of thinking about something and coming to a conclusion.

declination NOUN /ˌdɛ.kləˈneɪ.ʃən/ the slope of a line or plane from a vertical or horizontal reference line or plane.

decompose VERB /ˌdi.kɒmˈpoʊz/ to break into parts by a rule. *Antonym: compose.*

decomposition NOUN /ˌdi.kɒm.pəˈzɪʃ.ən/ the act of breaking into parts by a rule. *Antonym: composition.*

decrease /dɪˈkris/

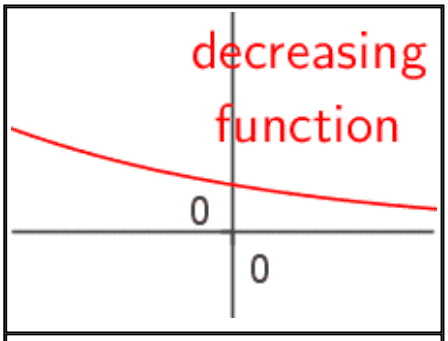
1. VERB to reduce by a certain amount. Keyword for subtraction. *Synonym: subtract.*
2. VERB to become less and less; to become smaller and smaller.
3. NOUN the amount, proportion or percentage by which a value decreases.

Antonym: increase.

decrease by PREPOSITION /dɪ'kris baɪ/ reduce by a quantity. Key phrase for subtraction. *Antonym: increase by.*

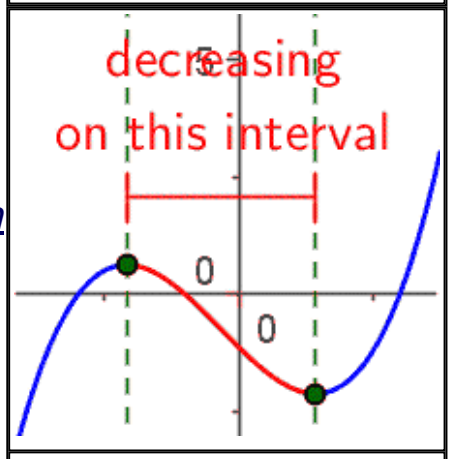
decreasing ADJECTIVE /dɪ'kris.ɪŋ/ going down; becoming less. *Antonym: increasing.*

decreasing function NOUN /dɪ'kris.ɪŋ 'fʌŋk.ʃən/ a function whose values become less as the function argument increases. *Math definition:* if $a > b$, then $f(a) < f(b)$. *Antonym: increasing function.*



Decreasing Function

decreasing on an interval ADJECTIVE /dɪ'kris.ɪŋ ɒn ən 'ɪn.tər.vəl/ a function whose values become less as the independent variable increases on a subdomain. *Antonym: increasing on an interval.*



Decreasing on an Interval

decreasing sequence NOUN /dɪ'kris.ɪŋ 'si.kwəns/ a sequence of real numbers where each term is less that its preceding term. *Example:* $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots$. *Antonym: increasing sequence.*

decrypt VERB /di'krɪpt/ to convert encrypted text to plain text using an encryption key. *Antonym: encrypt.*

decryption NOUN /di'krɪp.ʃən/ the act of decrypting. *Antonym: encryption.*

decypher VERB /di'saɪ.fər/ (British English) *Synonym: decipher* (American English).

deduce VERB /dɪ'dus/ to arrive at a conclusion by deduction.

deduct VERB /dɪˈdʌkt/
1. to subtract from. Keyword for subtraction.
2. to come to a conclusion using premises.

deduction NOUN /dɪˈdʌk.ʃən/
1. using agreed upon premises to support a conclusion.
2. the conclusion of an argument.
3. an amount subtracted from a total.
   Example: Total - Deduction = Net.

deductive ADJECTIVE /dɪˈdʌk.tɪv/ based on deduction.
Example: deductive reasoning.

deductive reasoning NOUN /dɪˈdʌk.tɪv ˈriz.nɪŋ/ a form of logic that starts with premises and proceeds to conclusions based on those premises. *Example:*
- All men are mortal (premise).
- Socrates is a man (premise).
- So, Socrates is mortal (conclusion or deduction).

deficient number NOUN /dəˈfɪʃ.ənt ˈnʌm.bər/ an integer whose sum of its proper divisors is less than the integer itself. *Example:* $1+2+5 < 10$. *See also abundant number, perfect number.*

define VERB /dəˈfaɪn/ to state the properties that belong to a particular object or class of objects, especially necessary properties. *Example:* A line segment is defined as a continuous portion of a line between two end points.

defined ADJECTIVE /dəˈfaɪnd/
1. having a known mathematical meaning.
2. having an explicit definition.

Antonym: undefined.

definition NOUN /ˌdɛf.əˈnɪ.ʃən/ a statement of the properties that belong to an object. *Example:* a square is a:
- quadrilateral (property)
- with congruent sides (property)
- whose sides meet at right angles (property).

degenerate
1. ADJECTIVE /dɪˈdʒɛn.ər.ɪt/ changed to a simpler form.
   Example: a line segment is a degenerate case of a

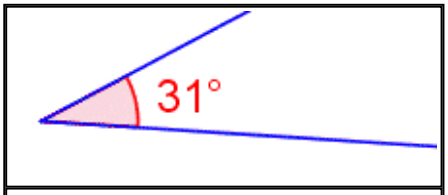
rectangle with a zero width.

2. VERB /dɪ'dʒɛ.nəˌreɪt/ to change to a simpler form. *Example:* when the radius of a circle becomes 0, the circle degenerates into a point.

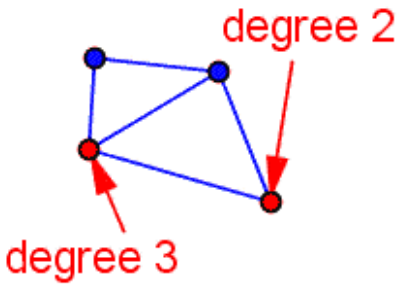
degenerate conic NOUN /dɪ'dʒɛn.ər.ɪt 'kɒn.ɪk/ a point, line, or pair of intersecting lines generated when a plane intersects a double cone through its vertex.

degree NOUN /də'gri/

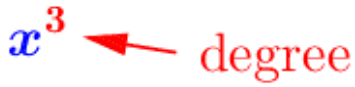
1. (of an angle) a unit of measure of angles. 360° equals one full circle. *Notation:* ^{o}.
2. (of a variable) the exponent of a variable.
3. (of a term) the sum of the degrees of variables in the term.
4. (of an expression or polynomial) the greatest degree of any term in an expression. *Example:* The polynomial $x^4 - 3x^2 + 2$ has a degree of 4.
5. (of a node) the number of paths that meet at a node of a network graph.
6. (temperature) a unit of measure of temperature. One of degree Fahrenheit, degree Celsius, or kelvin. *Notations:* ^{o}C (degree Celsius), ^{o}F (degree Fahrenheit), K (degree Kelvin).



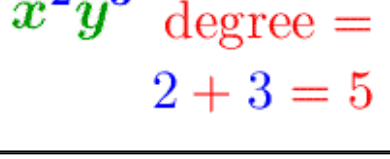
Degree of an Angle



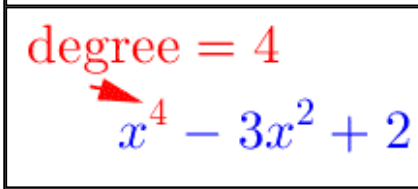
Degree of a Node



Degree of a Variable

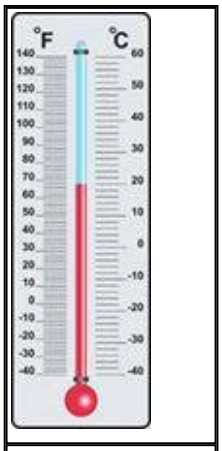


Degree of a Term



Degree of an Expression

degree Celsius NOUN /də'gri 'sɛlˌsi.əs/ a unit of measure of temperature. 0°C is the freezing temperature of water at sea level. 100°C is the boiling temperature of water at sea level. *Notation:* $^{\circ}C$ (degree Celsius). *Formula:* $C = \frac{5}{9}(F - 32)$, $F = \frac{9}{5}C + 32$ where F is degrees Fahrenheit.



Thermometer

degree Fahrenheit NOUN /də'gri 'fær.ənˌhaɪt/ a unit of measure of temperature. 32°F is the freezing temperature of water at sea level. 212°F is the boiling temperature of water at sea level. *Notation:* $^{\circ}F$ (degree Fahrenheit). *Formula:* $F = \frac{9}{5}C + 32$, $C = \frac{5}{9}(F - 32)$ where C is degrees Celsius.

degree kelvin NOUN /də'gri 'kɛl.vɪn/ *See kelvin.*

degree of accuracy NOUN /də'gri ʌv 'æk.yər.ə.si/ the number of significant digits in a measurement.

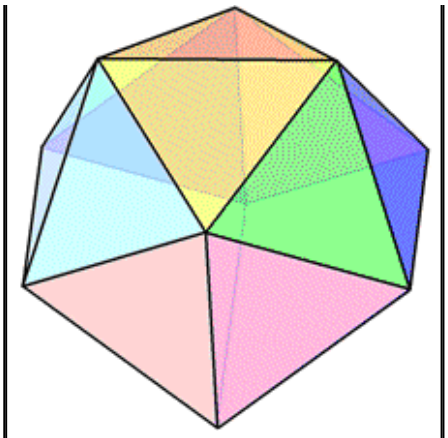
degrees of freedom NOUN /də'griəz ʌv 'fri.dʌm/ the number of independent parameters required to specify an instance of an object.

deka- PREFIX /'dɛk.ə/ 10. *Abbreviation: da.* *Example:* 7 dekagrams = 70 grams; 7dag = 70g. *Synonym: ten. See also deca-.*

delta NOUN /'dɛl.tə/ the Greek letter Δ, used to represent incremental change. *Example:* 'Δx' means 'change in x'.

delta- PREFIX /'dɛl.tə/ having to do with equilateral triangles.

deltahedron NOUN /'dɛl.təˌhi.drən/ any polyhedron whose faces are congruent equilateral triangles.

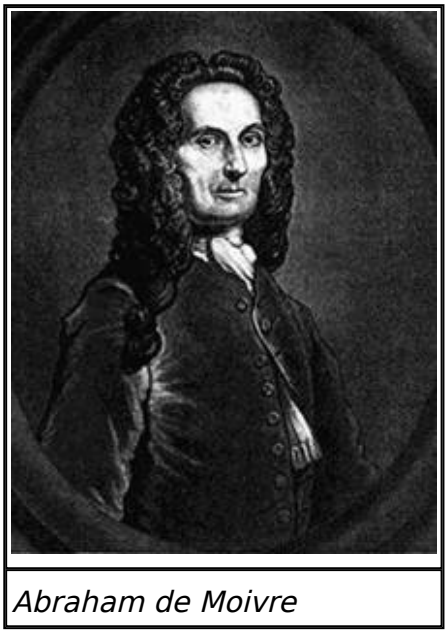


Deltahedron

deltoid NOUN /'dɛl.tɔɪd/ *See kite.*

deltoidal ADJECTIVE /dɛl'tɔɪ.dl/ containing or constructed from deltoids.

de Moivre, Abraham PERSON /də mwɑvr 'eɪ.brəˌhæm/ (1667-1754) a French mathematician known for his contributions to probability and for de Moivre's formula.



Abraham de Moivre

de Moivre's formula NOUN /də mwɑvrz 'fɔr.myə.lə/ a formula for the exponentiation of complex numbers in trigonometric form.

Formula: $(\cos\theta + i\sin\theta)^n = \cos(n\theta) + i\sin(n\theta)$

.

de Morgan, Augustus PERSON /də ˈmɔr.gən ɔˈgʌs.təs/ (1806-1871) an India born British mathematician who advanced, among other things, Boolean algebra.

Augustus DeMorgan

de Morgan's Theorem NOUN /də ˈmɔr.gənz ˈθɪər.əm/ a set of identities relating the complements of unions and intersections of sets. *Formulas:*

- $(A \cap B)' = A' \cup B'$
- $(A \cup B)' = A' \cap B'$
- $\neg(P \vee Q) \leftrightarrow (\neg P) \wedge (\neg Q)$
- $\neg(P \wedge Q) \leftrightarrow (\neg P) \vee (\neg Q)$

denominator NOUN /dɪˈnɒm.əˌneɪ.tər/ the bottom part of a fraction; the divisor. *Notation:* $\frac{\text{numerator}}{\text{denominator}}$ = *numerator ÷ denominator. Example:* In $\frac{3}{7}$, the denominator is 7.

density NOUN /ˈdɛn.sɪ.ti/ how closely a set of objects are crowded together.

density property NOUN /ˈdɛn.sɪ.ti ˈprɒ.pər.ti/ a property of many ordered sets where, between any two members of a set, there exists at least one other member of the set.

denumerable ADJECTIVE /dɪˈnu.mər.ə.bəl/ *See countable.*

depend VERB /dɪ'pɛnd/ needs to calculate the value or state. *Example:* In $y = 5x$ the value of y depends on the value of x.

dependent ADJECTIVE /dɪ'pɛn.dənt/ depending on one or more other math objects. *Antonym: independent.*

dependent axiom NOUN /dɪ'pɛn.dənt 'æk.si.əm/ an axiom that can be proven from other axioms in an axiomatic system. *Antonym: independent axiom.*

dependent events NOUN /dɪ'pɛn.dənt ɪ'vɛntz/ events where the outcome of one event affects the outcome of another event. *Antonym: independent events.*

dependent linear equation NOUN /dɪ'pɛn.dənt 'lɪn.i.ər ɪ'kweɪ.ʒən/

1. a linear equation having solutions identical to another linear equation in the same linear system.
2. a linear equation that is a linear combination of one or more other linear equations in the same linear system.

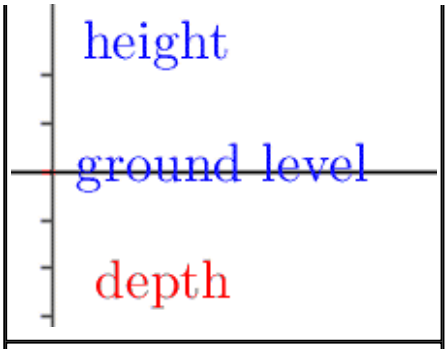
dependent system of linear equations NOUN /dɪ'pɛn.dənt 'sɪs.təm ʌv 'lɪn.i.ər ɪ'kweɪ.ʃənz/ a system of linear equations having infinite solutions. *Example:* $x + y = 3$, $2x + 2y = 6$.

dependent variable NOUN /dɪ'pɛn.dənt 'vɛər.i.ə.bəl/ having values that depend on one or more independent variable(s). *Example:* in $y = \sin(x)$, y is the dependent variable. *Synonym: output. Antonyms: independent variable, input.*

deposit NOUN /dip'ɑz.ɪt/

1. money paid to reserve goods or services.
2. money placed in an interest bearing account.

depth NOUN /dɛpθ/ a distance below a surface. *Example:* a depth of 10 feet.



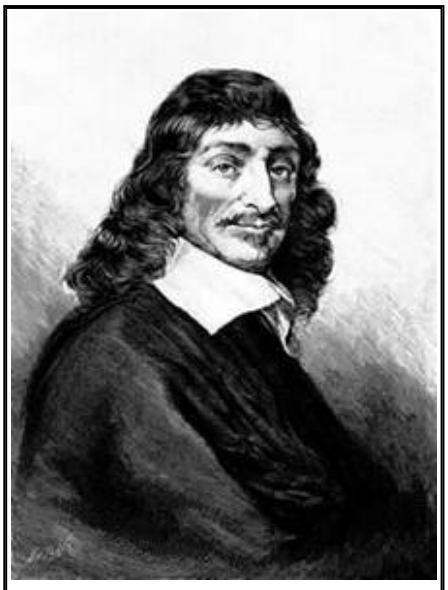
Depth

derivation NOUN /ˌdær.ə'veɪ.ʃən/
1. how a formula is found.
2. how a conclusion is reached.

derive VERB /də'raɪv/
1. to trace how a formula is found. *Example:* the quadratic formula is derived using the complete the squares algorithm.
2. to obtain from a more fundamental measurement.

derived unit NOUN /də'raɪvd 'yu.nɪt/ a unit of measure that is obtained from one of the fundamental units of measure. *Example:* velocity in meters per second.

Descartes, René PERSON /deɪ'kɑrt rɜ'neɪ/ (1596-1650) a French philosopher and mathematician who formalized the basic concepts of analytic geometry, including the rectangular coordinate system.


René Descartes

Descartes Rule of Signs NOUN /deɪ'kɑrt rul ʌv saɪnz/ a rule for determining the maximum number of zeros of a polynomial.

descend VERB /di'sɪnd/ to go down; to reduce in quantity.

descending ADJECTIVE /di'sɪn.dɪŋ/ going down; reducing in quantity. *Example:* sort into descending numerical order: 9, 8, 6, 4, 1, -1.

descriptive statistics NOUN /dɪ'skrɪp.tɪv stə'tɪs.tɪks/ the organization and summarization of data.

designed experiment NOUN /di'saɪnd ɛɪk'spɛr.ə.mənt/ a statistical study that studies the effect of applying a change to a group. *Synonym: experimental study.*

determinant /dɪ'tɜr.mə.nənt/

1. NOUN a scalar generated from the elements of a square matrix. *Notations:* $|A|$, $det(A)$. *Example:*

$$\begin{vmatrix} 3 & -1 & 0 \\ 2 & 4 & -2 \\ -2 & 3 & -1 \end{vmatrix} = 3\cdot4\cdot(-1) + (-1)(-2)(-2) + 0\cdot2\cdot3 - 0\cdot4\cdot(-2) - (-2)3\cdot3 - (-1)(-1)2 = -12-4+6+8+18-2 = 14.$$

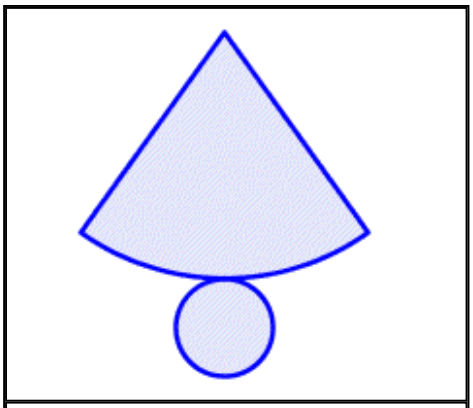
2. ADJECTIVE having a finite number of solutions.

determinate equation NOUN /dɪ'tɜr.mə.nət ɪ'kweɪ.ʒən/ an equation that has a finite number of solutions. *Example:* $0 = x^2 - 4$ is a determinate equation. Its solution set is $\{2,-2\}$. *Antonym: indeterminate equation.*

determine VERB /dɪ'tɜr.mɪn/ to define an object is such a way that no other unique object can be defined this way. *Example:* Two points determine a line.

determined ADJECTIVE /dɪ'tɜr.mɪnd/ no other object of the same type can fulfill the given condition. *Example:* a line is determined by two points.

developable surface NOUN /dɪ'vɛl.əp.ə.bl 'sɜr.fɪs/ a surface of a three dimensional object that can be 'rolled flat' without changing the surface area.



Developable Surface of a Cone

deviation NOUN /ˌdi.vi'eɪ.ʃən/ the difference of a mean of a data set and a data value in the data set. *Math definition:* $D(n) = M_x - d_n$ where $D(n)$ is the deviation for item n, M_x is the mean, and d_n is the data value for item n.

di- PREFIX /daɪ/

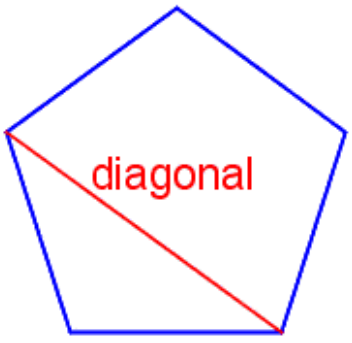
1. divided into two pieces that may be equal. *Example:* diagonal.
2. two. *Example:* dihedral.

diagonal NOUN /daɪ'æg.ə.nl/

1. (of a matrix) the diagonals of a square matrix A are the elements $A_{1,1}, A_{2,2}, A_{3,3}, \ldots, A_{n,n}$ (main diagonal) or the elements $A_{n,1}, A_{n-1,2}, \ldots, A_{1,n}$.
2. (of a polygon) a line segment between any two nonadjacent vertices of a polygon.
3. (of a polyhedron) a line segment between two vertices that are *not* on the same face.

$$\begin{bmatrix} 2 & -2 & -1 \\ 1 & 3 & 2 \\ -2 & 6 & -1 \end{bmatrix}$$

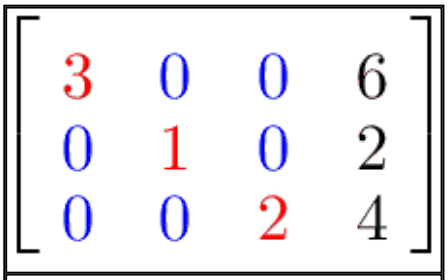
Diagonal of a Matrix



Diagonal of a Polygon

diagonalize VERB /daɪˈæg.ə.nlˌaɪz/ to convert a square matrix into a diagonal matrix using row operations.

diagonal matrix NOUN /daɪˈæg.ə.nl ˈmeɪ.trɪks/ a matrix with zeros in all elements except the main diagonal and the optional augmented column. *Plural: diagonal matrices* /daɪˈæg.ə.nl ˈmeɪ.trɪˌsiz/.



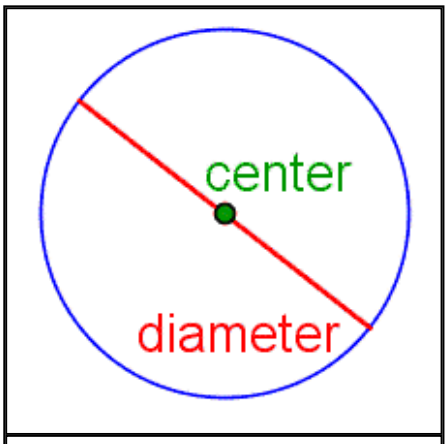
Diagonal Matrix

diagram NOUN /ˈdaɪ.ə.græm/ a figure, especially a line drawing, that outlines and explains a principle.

diameter NOUN /daɪˈæm.ɪ.tər/

1. a line segment extended from one edge of a circle or a sphere to the other edge that passes through the center of the circle.
2. the length of such a line segment.

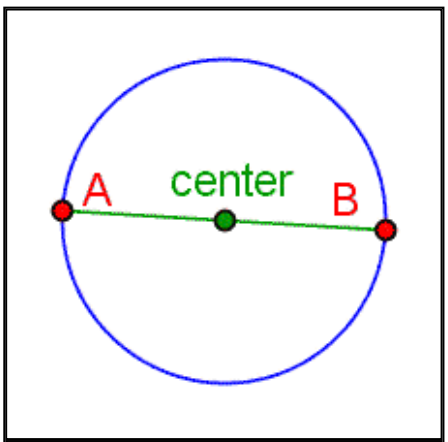
See also Parts of a Circle!.



Diameter

diametrically ADVERB /ˌdaɪ.əˈmɛ.trɪ.kli/ having to do with a diameter.

diametrically opposed VERB /ˌdaɪ.əˈmɛ.trɪ.kli ɒˈpoʊzd/ two points on a circle or a sphere that are on opposite sides of a diameter of that circle or sphere. *Synonym: antipodal.*



Diametrically opposed

diamond NOUN /ˌdaɪ.əˈmənd/ *See rhombus.*

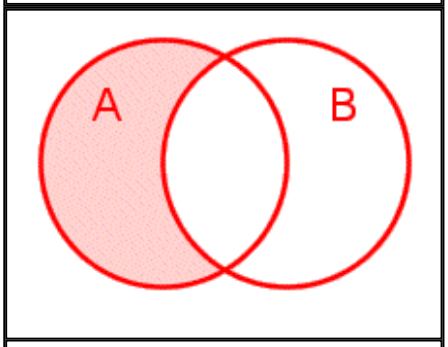
dice NOUN /daɪs/ more than one die.

die NOUN /daɪ/ a small cube with 1 to 6 dots on each side. *Plural: dice* /daɪs/. *Synonym: number cube. See also Net!.*

Die

difference NOUN /'dɪfr.əns/

1. (numbers) the result of subtracting one number from another. *Formula:* minuend – subtrahend = difference *Antonym: sum.*
2. (sets) all of the elements of one set that do *not* belong to another set. *Notation:* $A - B$.

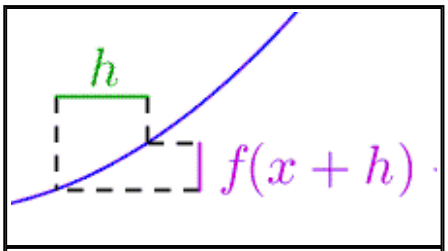


Difference of Sets

difference of cubes NOUN /'dɪfr.əns ʌv kyubz/ a polynomial identity useful in solving certain cubic equations. *Formula:* $a^3 - b^3 = (a - b)(a^2 + ab + b^2)$.

difference of squares NOUN /'dɪfr.əns ʌv skwɛərz/ a polynomial identity useful in solving certain quadratic equations. *Formula:* $a^2 - b^2 = (a + b)(a - b)$.

difference quotient NOUN /'dɪfr.əns 'kwoʊ.ʃənt/ the difference between two values of the dependent variable of a function divided by the difference in two close values of the independent variable. *Formula:* $\frac{f(x+h) - f(x)}{h}$ where h is a very small number.



Finite Difference

different ADJECTIVE /'dɪfr.ənt/

1. not like each other.
2. not identical.

digit NOUN /'dɪdʒ.ɪt/ a single symbol used to represent a part of a number. *Example:* the decimal digits are 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

> **Historical Note:** The word digit comes from the middle English word *digitus*, meaning finger. This comes from the practice of counting on one's fingers.

digital ADJECTIVE /'dɪdʒ.ɪ.tl/

1. having to do with the digits of a numeral.
2. having to do with or containing discrete numeric values.

Antonym: analog.

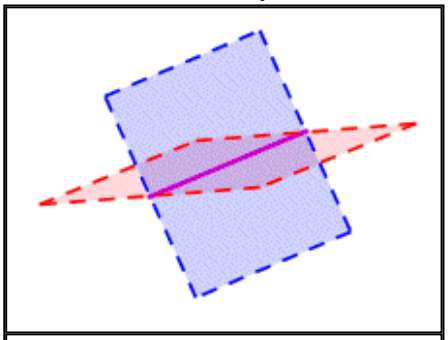
digital clock NOUN /'dɪdʒ.ɪ.tl klɒk/ a clock that uses numbers to show the time instead of hands. *Antonym: analog clock.*

digital root NOUN /'dɪdʒ.ɪ.tl rut/

1. an algorithm for adding the digits of a decimal number to get a single digit. Each of the digits is added together. If the result has more than one digit, each of those digits is added together until a single digit is found.
   Example: given $329 \rightarrow 3+2+9=14 \rightarrow 1+4=5$..
2. the result of such an algorithm. *Example:* The digital root of 329 is 5.

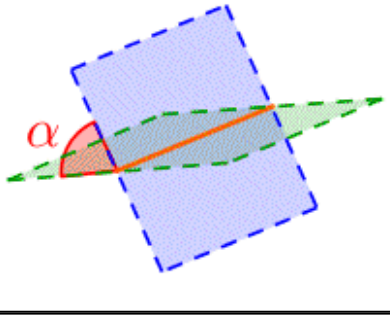
digit position NOUN /'dɪdʒ.ɪt ˌpoʊ'sɪ.ʃən/ *See decimal place.*

dihedral ADJECTIVE /daɪ'hi.drəl/ having to do with two intersecting planes.



Dihedral

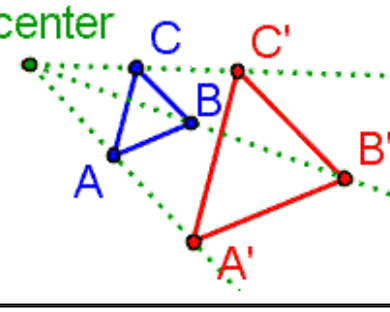
dihedral angle NOUN /daɪ'hi.drəl 'æŋ.gəl/ the angle made by two intersecting planes. Dihedral angles are measured between lines in each plane that are perpendicular to the line formed by the intersection of the planes.



Dihedral Angle

dihedron NOUN /daɪ'hi.drən/ a figure formed by two intersecting planes.

dilation NOUN /daɪ'leɪ.ʃən/ a geometric transformation where each point of a figure is moved a certain ratio of its distance from a center point. *Synonym: dilatation* /ˌdɪl.ə'teɪ.ʃən/*. See also GeoApp!.*

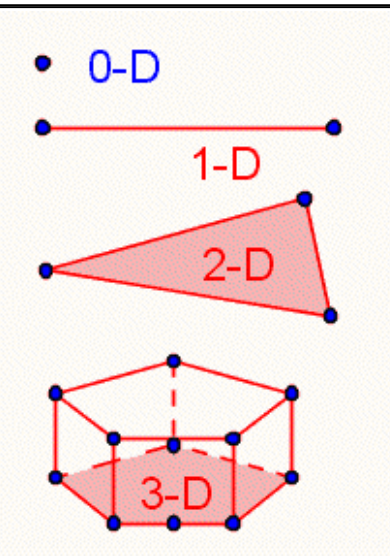


Dilation

dime NOUN /daɪm/ a coin valued at ten cents or 1/10 of a dollar.

dimension NOUN /dɪ'mɛn.ʃən/

1. an extension in a direction. *Example:* a plane has 2 dimensions.
2. one component of a measurement. *Example:* meters in meters per second.
3. (of a matrix) the number of rows and columns in a matrix. *Example:*



Dimensions

$Dim\left(\begin{bmatrix} 1 & 0 & 2 \\ 2 & 1 & 3 \end{bmatrix}\right) = 2 \times 3$ (2 rows, 3 columns).

4. (of a space) the number of coordinates needed to define a location in that space.

dimensional ADJECTIVE /dɪ'mɛn.ʃə.nl/

1. contained within a certain number of dimensions. *Example:* one dimensional.
2. having to do with dimensions.

dimensional analysis NOUN /dɪ'mɛn.ʃə.nl ˌæ'næl.ɪ.sɪs/ a process for verifying an equation using dimensions. *Example:* $5\,\frac{m}{s^2} = \frac{a\ m^2}{b\ s^2}$ is invalid because $\frac{m}{s^2} \neq \frac{m^2}{s^2}$.

dimensionless ADJECTIVE /dɪ'mɛn.ʃən.lɛs/

1. having no dimensions. *Example:* a point is dimensionless.
2. a ratio that has no dimensions. *Example:* a ratio of length to width.

Diophantine equation NOUN /'di.oʊ.fæn.tin ɪ'kweɪ.ʒən/ a polynomial equation with integer coefficients and integer values for variables. *Example:* $0 = 3x^2 - 2x + 1,\ x \in \mathbb{Z}$.

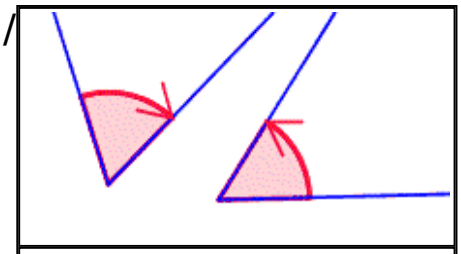
Diophantus of Alexandria PERSON /'di.oʊ.fæn.tʌs ʌv ˌæl.ɪg'zæn.dri.ə/ (about 200-about 284) the first person known to have tried to develop algebraic notation and who is considered the father of algebra.

direct /dɪ'rɛkt/

1. ADJECTIVE proceeding in a straight line, without deviation. *Antonym: indirect.*
2. ADJECTIVE being proportional one to another.
3. VERB to guide.

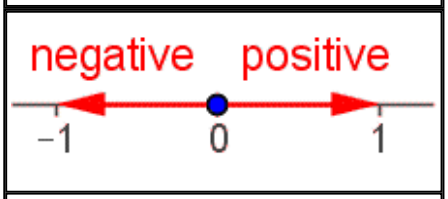
directed ADJECTIVE /dɪ'rɛk.tɪd/ having a direction. *Examples:* positive or negative, clockwise or counterclockwise.

directed angle NOUN /dɪˈrɛk.tɪd ˈæŋ.gəl/ an angle for which the direction of rotation is important (clockwise or counterclockwise).



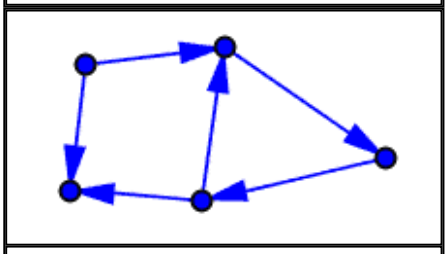
Directed Angle

directed distance NOUN /dɪˈrɛk.tɪd ˈdɪs.təns/ a distance that includes a direction. *Examples:* negative or positive, east or west.



Directed Distance

directed graph NOUN /dɪˈrɛk.tɪd græf/ a network graph in which the edges are arrows.

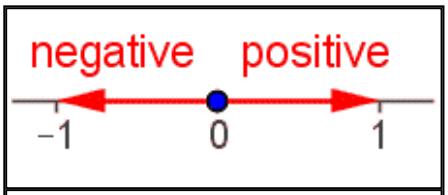


Directed Graph

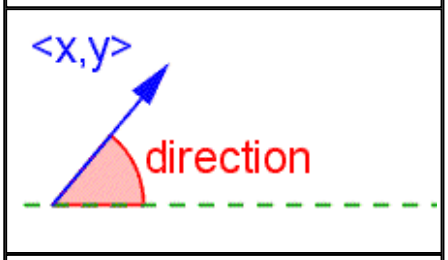
directed number NOUN /dɪˈrɛk.tɪd ˈnʌm.bər/ *See signed number.*

direction NOUN /dɪˈrɛk.ʃən/

1. a way something goes.
2. (number line) positive or negative.
3. (2-dimensional) left or right, up or down.
4. (angle of rotation) clockwise or counterclockwise.
5. (2-dimensional) angle of rotation from the positive x-axis.
6. (3-dimensional) two angles of rotation, one from the positive x-axis, and one from the positive y-axis.
7. (of a vector) the rotation from the positive x-axis. *Formula:* Given



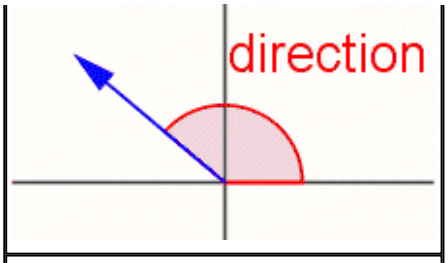
Direction (number line)



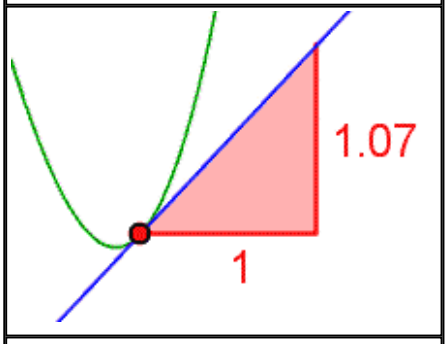
Direction (vector)

vector $<x,y>$, $\alpha = tan^{-1}\frac{y}{x}$

8. (of a curve) the slope of a non-vertical line tangent to the curve at a point.
9. north, south, east or west.



Direction (angle)



Direction (curve)

direct isometry NOUN /dɪ'rɛkt aɪ'sɒm.ɪ.tri/ an isometry that preserves orientation and order. *Examples:* dilation, translation. *Antonym: indirect isometry. See also isometry.*

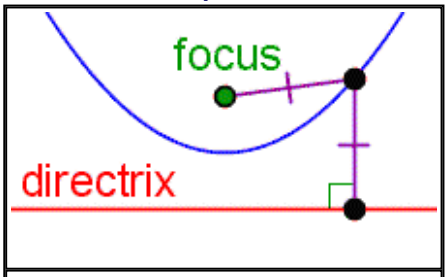
directly proportional ADJECTIVE /dɪ'rɛkt.li prə'poʊr.ʃən.l/ having a relationship of direct variation. *Formula:* $y = ax$ where a is the constant of variation.

direct proof NOUN /dɪ'rɛkt pruf/ a proof that builds on axioms, definitions and previously proved theorems. *Antonym: proof by contradiction.*

direct proportion NOUN /dɪ'rɛkt prə'poʊr.ʃən/ *See direct variation.*

direct reasoning NOUN /dɪ'rɛkt 'riz.nɪŋ/ *See direct proof.*

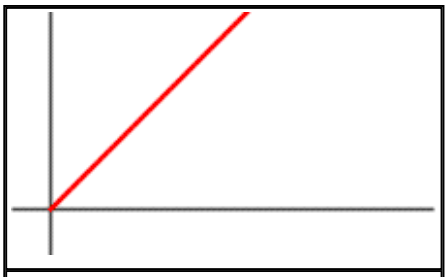
directrix NOUN /dɪ'rɛk.trɪks/ a fixed line used to determine a curve, particularly a conic section. *Example:* a parabola is the locus of all points equidistant from a directrix and a focus.



Directrix

direct variation NOUN /dɪ'rɛkt ˌvɛər.i'eɪ.ʃən/ one variable is equal to a constant times another variable.

Formula: $y = ax$ where a is the constant of variation. *Synonym:* *direct proportion*. *See also* *GeoApp!*.



Direct Variation

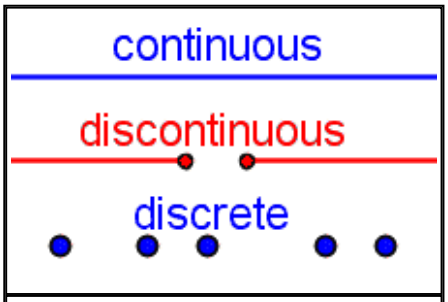
dis- PREFIX /dɪs/

1. not.
2. undo.
3. opposite of.

disc NOUN /dɪsk/ *See* *disk*.

disconnected ADJECTIVE /'dɪs.kəˌnɛk.tɪd/ does *not* share any points. *Antonym:* *connected*.

discontinuous ADJECTIVE /'dɪs.kənˌtɪn.yu.əs/ not continuous; not all in one piece. *Antonym:* *continuous*.



Discontinuous

discount NOUN /'dɪs.koʊnt/

1. an amount subtracted from a total.

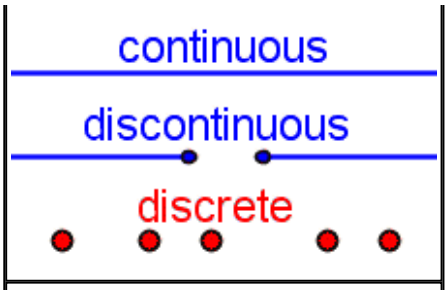
   Formula: $\text{total} - \text{discount} = \text{net}$.
2. a percentage of the total amount which is subtracted from the total.

   Formula: $\text{gross}(1 - \text{discount \%}) = \text{net}$.

discover VERB /dɪ'skʌ.vər/

1. to notice or realize.
2. to find out.

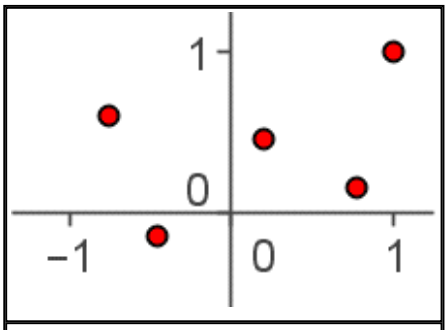
discrete ADJECTIVE /dɪ'skrit/ isolated. *Example:* The set of integers is a discrete set. *Antonym:* *continuous*.



Discrete

discrete data NOUN /dɪ'skrit 'deɪ.tə/ data that takes only isolated values. *Example:* age as opposed to height. *Antonym:* *continuous data*.

discrete graph NOUN /dɪ'skrit græf/ a graph of individual, non-connected points.



Discrete Graph

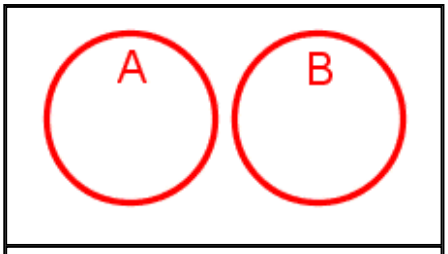
discrete mathematics NOUN /dɪ'skrit ˌmæθ.ə'mæ.tɪks/ a branch of mathematics dealing with discrete (*not* continuous) objects such as integers.

discrete variable NOUN /dɪ'skrit 'vɛər.i.ə.bəl/ a variable that can take on values of discrete data, as opposed to continuous data. *Example:* age of participant. *Antonym:* *continuous variable*.

discriminant NOUN /dɪ'skrɪ.mə.nənt/ an expression that gives information about the properties of a mathematical object. *Example:* discriminant of a quadratic equation.

discriminant of a quadratic equation NOUN /dɪ'skrɪ.mə.nənt ʌv eɪ kwɒ'dræ.tɪk ɪ'kweɪ.ʒən/ the expression $b^2 - 4ac$ where $ax^2 + bx + c = 0$. If the discriminant $D = b^2 - 4ac > 0$, the quadratic equation has two real roots. If $D = 0$, the quadratic equation has one real root with a multiplicity of 2. If $D < 0$ the quadratic equation has two complex roots.

disjoint ADJECTIVE /dɪs'dʒɔɪnt/ having no members in common.

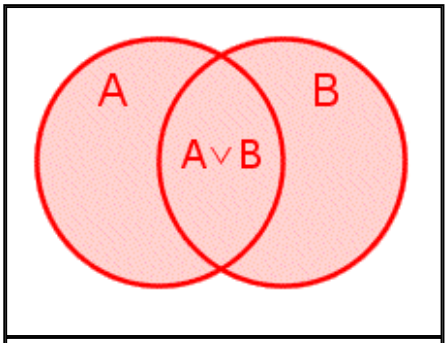


Disjoint Sets

disjoint events NOUN /dɪs'dʒɔɪnt ɪ'vɛntz/ *See exclusive events.*

disjunction NOUN /dɪs'dʒʌŋk.ʃən/ two logical statements connected with an 'or'. A disjunction is true of either or both of its arguments are true.

Notation: $\vee$. *Synonyms: or, inclusive disjunction.*



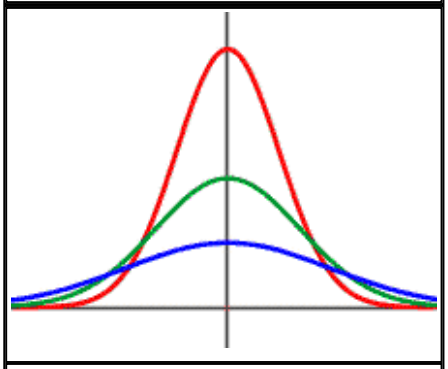
Disjunction

Disjunction		
A	B	$A \vee B$
false	false	false
false	true	true
true	false	true
true	true	true

disk NOUN /dɪsk/ a circle that is completely filled in. *Synonym: disc.*

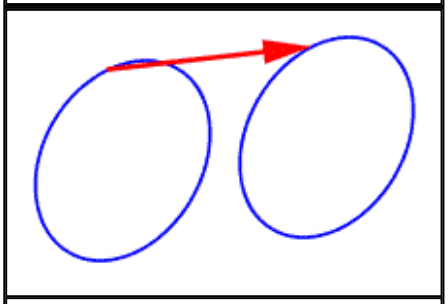
Disk

dispersion NOUN /dɪs'pɜr.ʒən/
(statistics) the degree of scattering of data values around a central point. *See also spread.*



Dispersion

displace VERB /dɪs'pleɪs/ to move a certain direction and distance.

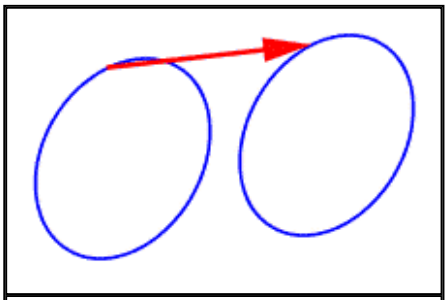


Displace

displacement NOUN /dɪs'pleɪs.mənt/

1. the direction and distance of a movement. *See also translation, definition 1.*
2. the amount of liquid replaced by a solid.

displacement vector NOUN /dɪs'pleɪs.mənt 'vɛk.tər/ a vector that shows the direction and distance of movement.



Displacement Vector

disproof NOUN /dɪs'pruf/ a set of statements that show a proposition is false.

disprove VERB /dɪs'pruv/ show by logical argument that a statement is false. Most disproofs show that at least one case exists that contradicts the proposition.

dissimilar ADJECTIVE /dɪs'sɪm.ə.lər/

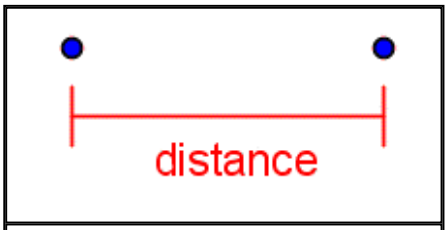
1. not similar.
2. unlike.

Antonym: similar.

dissimilar terms NOUN /dɪs'sɪm.ə.lər tɜrmz/ *See unlike terms.*

distance NOUN /'dɪs.təns/

1. how far apart two object are.
2. a measurement of space in one dimension.



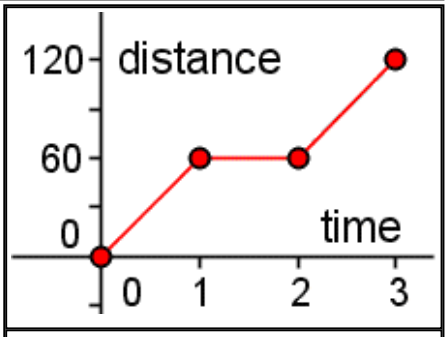
Distance

Distance Formulas

Distance …	Formula
between real numbers a and b.	$D = \|a - b\|$
between a point (x,y) and the origin.	$D = \sqrt{x^2 + y^2}$
between a complex number $a+bi$ and the origin.	$D = \sqrt{a^2 + b^2}$
between two points (x_1,y_1) and (x_2,y_2).	$D = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}$
between a point (x_1,y_1) and a	$D = \frac{\|y_1 - m \cdot x_1 - b\|}{}$

(x_1, y_1) and a nonvertical line $y = mx + b$.	$\sqrt{m^2 + 1}$
between two parallel, nonvertical lines $y = mx + b_1$ and $y = mx + b_2$.	$D = \frac{\lvert b_2 - b_1 \rvert}{\sqrt{m^2 + 1}}$

distance-time graph NOUN /'dɪs.təns taɪm græf/ a graph with distance on the vertical axis and time on the horizontal axis.



Distance-Time graph

distinct ADJECTIVE /dɪ'stɪŋkt/ not the same; not identical.

distort VERB /dɪ'stɔrt/ to change such that something no longer accurately represents the original.

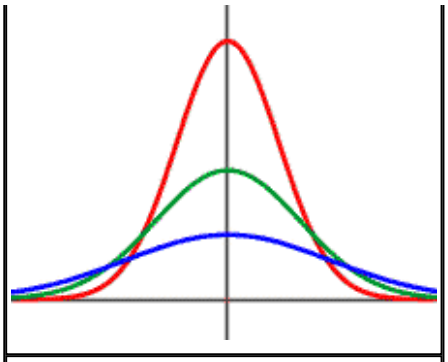
distortion NOUN /dɪ'stɔr.ʃən/ a change such that something no longer accurately represents the original.

distribute VERB /dɪ'strɪ.byut/ to expand an expression by multiplying through parentheses. *Example:* $x(x^2 + y) = x \cdot x^2 + x \cdot y = x^3 + xy$.

distribution NOUN /dɪ'strɪ.byu.ʃən/

1. (dataset) the frequency of data in a dataset over the range of the dataset. *Synonym: spread.*

2. (operations) the performance of operations through parentheses. *Example:* $3(5+2) = 3\cdot5+3\cdot2$.



Dispersion

distributive ADJECTIVE /dɪ'strɪ.byu.tɪv/ having the property of performing operations through parentheses.

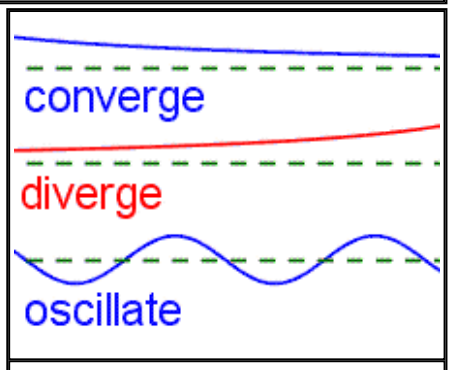
distributive property NOUN /dɪ'strɪ.byu.tɪv 'prɒ.pər.ti/ a property of operations that can be performed through parentheses. *Example:* distributive property of multiplication over addition and subtraction.

Distributive Properties	
Name	**Formula(s)**
Multiplication over addition and subtraction	$a(b + c) = ab + ac$ $a(b - c) = ab - ac$
Exponents over multiplication and division	$(ab)^n = a^n b^n$ $\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$

diverge VERB /dɪ'vɜrdʒ/

1. to *not* get closer and closer to a fixed value.
2. to *not* approach each other.

Antonym: converge.



Diverge

divergent ADJECTIVE /dɪ'vɜr.dʒənt/ having no finite limit.
Example: the geometric sequence $1, 2, 4, 8, 16, \ldots$.
Antonym: convergent.

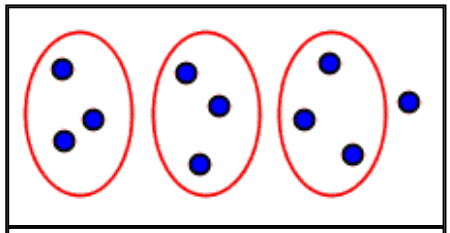
divergent function NOUN /dɪ'vɜr.dʒənt 'fʌŋk.ʃən/ a function that increases or decreases without bounds.
Antonyms: convergent function, oscillating function.

divergent sequence NOUN /dɪ'vɜr.dʒənt 'si.kwəns/ an infinite sequence that does *not* have a limit. *Example:* the geometric sequence $1, 2, 4, 8, 16, \ldots$. *Antonym: convergent sequence.*

divergent series NOUN /dɪ'vɜr.dʒənt 'sɪər.iz/ an infinite series whose partial sums do not approach a particular value.
Plural: divergent series /dɪ'vɜr.dʒənt 'sɪər.iz/. *Antonym: convergent series.*

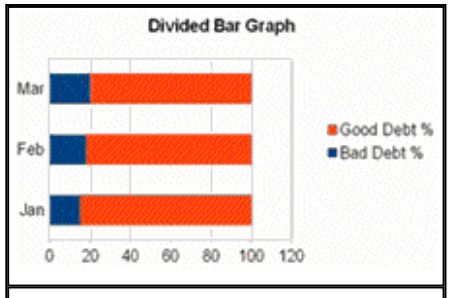
divide VERB /dɪ'vaɪd/

1. to calculate how many times a value is contained in another value; repeated subtraction. *Notations:* $\div$, $/$, $\overline{)}$. *Math definitions:* (integers) $a \div b = c\mathrm{R}d$ if and only if $b \cdot c + d = a, b \neq 0$, (real numbers) $a \div b = c$ if and only if $b \cdot c = a, b \neq 0$.
   Example: $10 \div 3 = 3\mathrm{R}1$. *Inverse: multiply.*
2. to separate into multiple parts.



Divide

divided bar graph NOUN /dɪ'vaɪd.əd bɑr græf/ a bar graph where each bar is divided into sections showing a proportion to the whole.



Divided Bar Graph

divide evenly VERB /dɪ'vaɪd 'i.vən.li/ (integer division) to divide into with no remainder. *Example:* 4 divides evenly into 16.

dividend NOUN /'dɪv.ɪˌdɛnd/ a number or expression that is divided in a division problem. *Notations:* $dividend \div divisor = quotient$, $\begin{array}{r} quotient \\ divisor\overline{)dividend} \end{array}$, $\frac{dividend}{divisor} = quotient$.

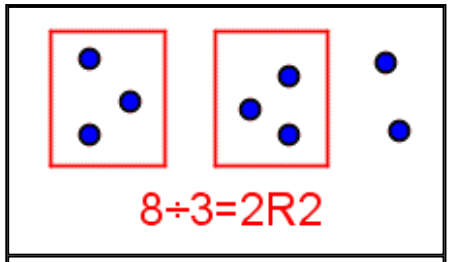
divine proportion NOUN /dɪ'vaɪn prə'poʊr.ʃən/ *See golden ratio.*

divisibility NOUN /dɪˌvɪz.ə'bɪl.ɪ.ti/ the capacity to be evenly divided.

divisibility rules NOUN /dɪˌvɪz.ə'bɪl.ɪ.ti rulz/ a set of rules for determining if an integer is divisible by a small integer. *See also Divisibility Rules.*

divisible ADJECTIVE /dɪ'vɪz.ə.bəl/ capable of being evenly divided. *Notations:* $b \mid a$ (b divides a, a is divisible by b), $b \nmid a$ (b does not divide a, a is not divisible by b). *Math definition:* given integers a and b, a is divisible by b if $a \div b$ has a remainder of 0. *Examples:* 12 is divisible by 4 ($4 \mid 12$); 14 is not divisible by 5 ($5 \nmid 14$).

division NOUN /dɪ'vɪ.ʒən/ the act of dividing; the opposite of multiplication; repeated subtraction. *Math definition:* $a \div b = c$ if and only if $a = b \cdot c$, $b \neq 0$. *Inverse: multiplication.*



Division

division algorithm NOUN /dɪ'vɪ.ʒən 'æl.gəˌrɪ.ðəm/ *See Division With Remainder Theorem.*

division by zero NOUN /dɪ'vɪ.ʒən baɪ 'zɪər.oʊ/ division by zero is undefined.

division modulo NOUN /dɪ'vɪ.ʒən 'mɒdʒ.əˌloʊ/ finding the remainder when dividing one integer by another. *Abbreviation:* *mod.*.

Formula: $\text{number mod. modulo} = \text{residue}$.

Example: $13 \text{ mod. } 5 = 3$ since $13 \div 5 = 2\text{R}3$.

Division Property of Equality NOUN /dɪ'vɪ.ʒən 'prɒ.pər.ti ʌv ɪ'kwɒl.ɪ.ti/ both sides of an equation can be divided by the same nonzero value without changing the truth value of the equation. *Math definition:* For any real or complex numbers a, b and $c \neq 0$; if $a = b$ then $a \div c = b \div c$ and if $a \div c = b \div c$ then $a = b$; if $a \neq b$ then $a \div c \neq b \div c$ and if $a \div c \neq b \div c$ then $a \neq b$.

Division Property of Inequality NOUN /dɪ'vɪ.ʒən 'prɒ.pər.ti ʌv ˌɪn.ɪ'kwɒl.ɪ.ti/ if both sides of an inequality are divided by a positive value, the truth value of the inequality does not change. If both sides of an inequality are divided by a negative value, '>' flips to '<' and '<' flips to '>'. *Example:* if $a < b$ then $a \div 3 < b \div 3$ and $a \div (-3) > b \div (-3)$.

division sign NOUN /dɪ'vɪ.ʒən saɪn/ the symbol '÷', used to indicate division. *Notation:* $x \div y$ is read 'x divided by y'.

Division With Remainder Theorem NOUN /dɪ'vɪ.ʒən wɪθ rɪ'meɪn.dər 'θɪər.əm/ division of any two integers equals an integer quotient with an integer remainder. *Math definition:* given two integers a and d, with $d \neq 0$, there exist unique integers q and r such that $a = qd + r$ and $0 \leq r < |d|$. *Synonym:* *division algorithm*.

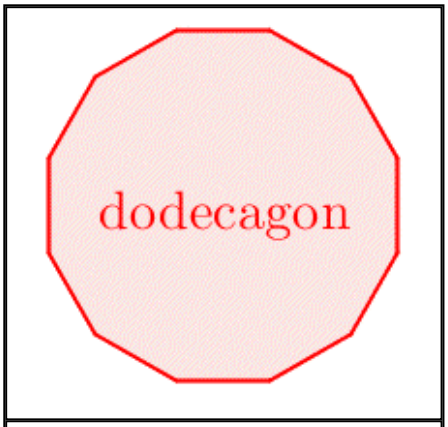
divisor NOUN /dɪ'vaɪ.zər/ an expression that is used to divide in a division problem.

Examples: $\text{dividend} \div \text{divisor} = \text{quotient}$;

$$\begin{array}{r} \text{quotient} \\ \text{divisor}\overline{)\text{dividend}} \end{array}$$; $\frac{\text{dividend}}{\text{divisor}} = \text{quotient}$.

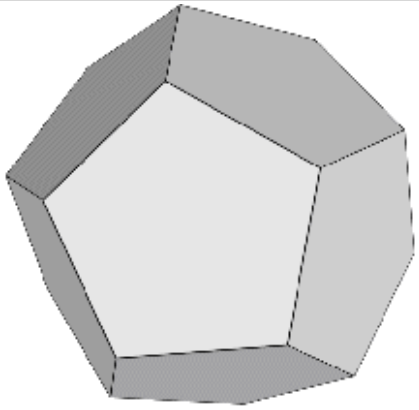
dodeca- PREFIX /doʊ'dɛk.ə/ twelve.

dodecagon NOUN /doʊ'dɛk.əˌgɒn/ any twelve sided polygon. *See also GeoApp!.*



Dodecagon

dodecahedron NOUN /doʊˌdɛk.ə'hi.drən/ any twelve faced polyhedron. *See also Net!.*

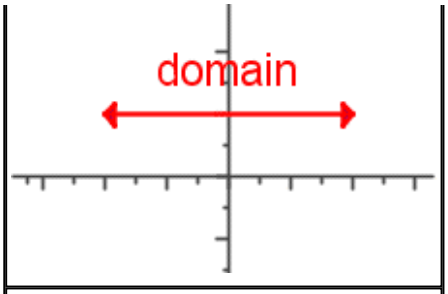


Regular Dodecahedron

dollar NOUN /'dɒl.ər/ a unit of currency used in many countries around the world. *Notations: $* (U.S. dollar)*, USD* (U.S. dollar)*. Examples:* US dollar, Canadian dollar.

Dollar

domain NOUN /doʊ'meɪn/ all values that an independent variable can take; the values for which a function is defined. *See also range, definition 1.*

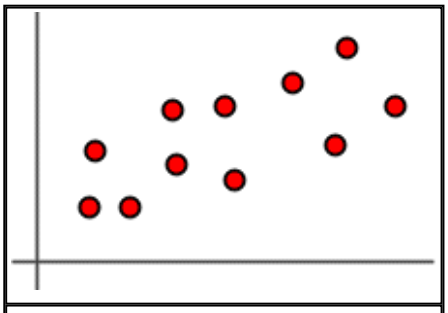


Domain

domain of definition NOUN /doʊ'meɪn ʌv ˌdɛf.ə'nɪ.ʃən/ all values for which a function is defined without additional restrictions. *Example:* the domain of definition of the real-valued function $f(x) = \sqrt{x}$ is $x = 0$.

dot NOUN /dɒt/ a point drawn on a paper.

dot plot NOUN /dɒt plɒt/ a graph where each data point is plotted as a single dot. *Synonym: scatter plot.*



Dot Plot

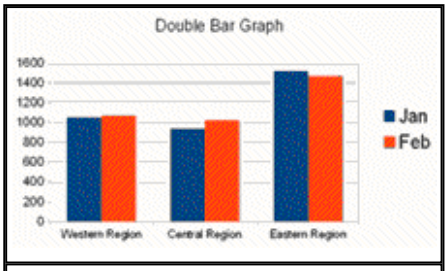
dot product NOUN /dɒt 'prɒ.dəkt/ given two vectors $\overrightarrow{X} = \langle x_1, x_2 \rangle$" /> and $\overrightarrow{Y} = \langle y_1,\ y_2 \rangle$" />, the dot product is $\overrightarrow{X} \cdot \overrightarrow{Y} = x_1 y_1 + x_2 y_2$. *Notation:* ⋅. *Example:* $\langle 3, -2 \rangle \cdot \langle -1, 1 \rangle =$ dot -1,1> =" />
$3 \cdot (-1) + (-2) \cdot 1 = -3 - 2 = -5$.
Synonyms: inner product, scalar product.

double /'dʌb.əl/

1. ADJECTIVE twice as much. *Example:* double of 3 is 6. *Inverse: half.*
2. ADJECTIVE two. *Inverse: half.*
3. VERB increase by a factor of two. *Inverse: halve.*

double angle identities NOUN /ˈdʌb.əl ˈæŋ.gəl aɪˈdɛnˌtɪ.tiz/ trigonometric identities involving double angles. *See also* *Trigonometric Identities*.

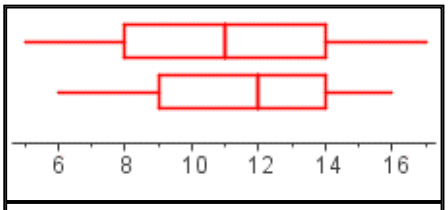
double bar graph NOUN /ˈdʌb.əl bɑr græf/ a bar graph with two sets of bars placed next to each other to compare related data.



Double Bar Graph

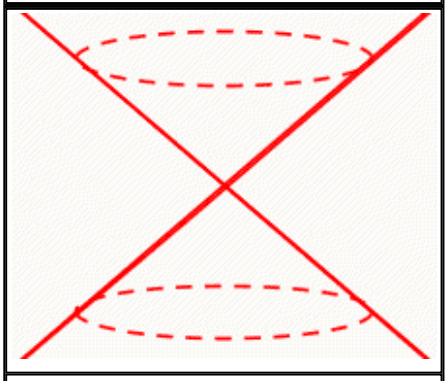
double blind NOUN /ˈdʌb.əl blaɪnd/ a study where neither the administrators nor the subjects know which group each subject belongs to.

double box and whisker plot NOUN /ˈdʌb.əl bɒks ænd ˈʰwɪs.kər plɒt/ two box and whisker plots drawn using the same scale.



Double Box and Whisker Plot

double cone NOUN /ˈdʌb.əl koʊn/ two cones placed apex to apex whose altitudes lie in the same line.


Double Cone

double minus one VERB /ˈdʌb.əl ˈmaɪ.nəs wʌn/ to multiply a number by 2, then subtract 1. *Math definition:* $2a - 1$.

Example: double 3 minus 1 $= 2 \cdot 3 - 1 = 6 - 1 = 5$.

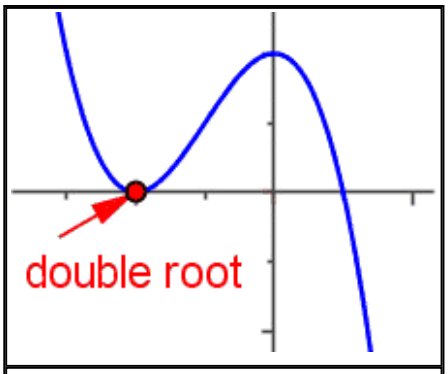
double negative NOUN /ˈdʌb.əl ˈnɛg.ə.tɪv/

1. the negative of a negative number. *Formula:* $-(-a) = a$.
2. the negative of a negative of a proposition.

   Notation: $\neg\neg P$ In most systems of logic, $\neg\neg P \equiv P$.

double plus one VERB /ˈdʌb.əl plʌs wʌn/ to multiply a number by 2, then add 1. *Math definition:* $2a + 1$. *Example:* double 3 plus 1 $= 2 \cdot 3 + 1 = 6 + 1 = 7$.

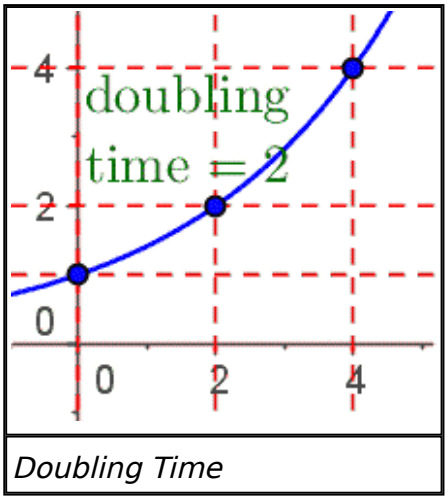
double root NOUN /ˈdʌb.əl rut/ a root of a polynomial that is repeated exactly twice. Given the polynomial $(x + 2)(x + 2)(x - 1)$, the root -2 is a double root. *Synonym:* *double zero*.



Double Root

double zero NOUN /ˈdʌb.əl ˈzɪər.oʊ/ *See* *double root*.

doubling time NOUN /ˈdʌ.blɪŋ taɪm/ the time it takes for the output of an exponential function to double. Doubling time remains constant for all intervals of the same length of an exponential function. *Formula:* $y = a\,(2)^{\frac{t}{d}}$ where a is the initial value at $t = 0$, t is the elapsed time, and d is the doubling time. *See also* *GeoApp!*.



Doubling Time

down ADVERB /daʊn/
1. a vertical direction moving towards the center of the earth.
2. decreasing in size or quantity.

dozen NOUN /ˈdʌ.zən/ 12.

draw VERB /drɔ/
1. to create a figure freehand without using tools such as a compass or a ruler.
2. to infer from a sample. *Example:* draw a conclusion.

drawing NOUN /ˈdrɔ.ɪŋ/ a sketch or design that uses lines to represent an object or idea.

duodecimal system NOUN /ˌduːoʊˈdɛsəməl ˈsɪstəm/ a base 12 numeration system. *Example:* $3B7_{12} = 3 \cdot 12^2 + 11 \cdot 12 + 7 = 432 + 132 + 7 = 571_{10}$.

dynamic geometry software NOUN /daɪˈnæmɪk dʒiˈɒmɪtri ˈsɔftˌwɛər/ computer software that allows a user to explore geometric concepts by creating and manipulating geometric drawings. See http://www.geogebra.org for free dynamic geometry software.

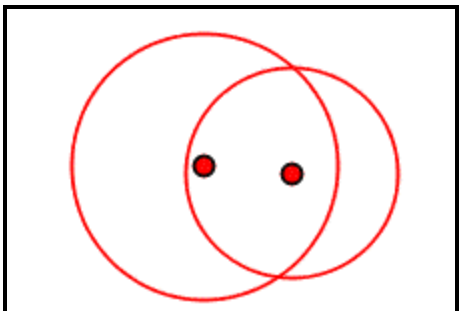
E

e NOUN /i/ a constant that is the base of the natural logarithm; $e \approx 2.71828$. *Synonym: Euler's number.*

E ABBREVIATION See exa-.

eccentric ADJECTIVE /ˌɛkˈsɛn.trɪk/

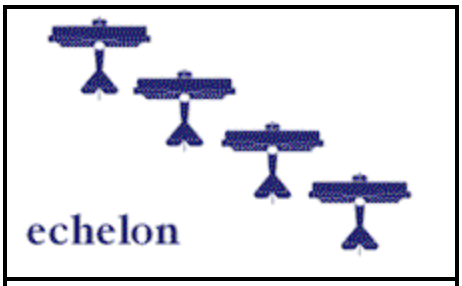
1. not having the same center. *Antonym: concentric.*
2. deviating from a circle.



Eccentric Circles

eccentricity NOUN /ˌɛk.sənˈtrɪ.sɪ.ti/ a number that tells how much a conic section is different from from a circle; the ratio of the distance of any point on a conic section from a focus and the corresponding directrix. *Notation:* $\mathcal{E}$ (epsilon).

echelon ADJECTIVE /ˈɛʃ.əˌlɒn/ arranged in parallel rows and columns at a diagonal to the direction of travel.



Echelon

echelon form NOUN /ˈɛʃ.əˌlɒn fɔrm/ *See row-echelon form.*

echelon matrix NOUN /ˈɛʃ.əˌlɒn ˈmeɪ.trɪks/ a matrix in row-echelon form.

edge NOUN /ɛdʒ/

1. (of a polygon) *See side, definition 1.*
2. (of a polyhedron) a line segment where two faces of the polyhedron meet.
3. (of a figure) *See boundary.*

4. (graph theory) *See path, definition 2.*

effective APR NOUN /əˈfɛk.tɪv eɪ pi ɑr/ the annual percentage rate with all fees counted as interest.

eight ADJECTIVE, NOUN /eɪt/ the number 8.

eighteen ADJECTIVE, NOUN /eɪˈtin/ the number 18.

eighth ADJECTIVE /eɪtθ/

1. coming in position 8 in an ordered list. *Notation:* 8^{th}.
2. one of eight equal parts; 1/8.

eighty ADJECTIVE, NOUN /ˈeɪ.ti/ the number 80.

elapsed time NOUN /əˈlæpsd taɪm/

1. the amount of time that has passed since a reference time.
2. the amount of time between two events.

element NOUN /ˈɛl.ə.mənt/

1. a uniquely identifiable component of a mathematical object.
2. (of a set) an object belonging to a set. *Notation:* $x \in A$. *Synonym: member.*
3. (of a matrix) one item at a particular row and column. *Synonym: member.*
4. (geometry) a fundamental object such as a point, line or plane.

eleven ADJECTIVE, NOUN /ɪˈlɛ.vən/ the number 11.

eleventh ADJECTIVE /ɪˈlɛ.vənθ/

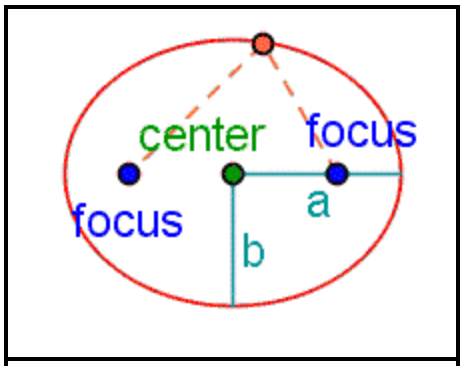
1. coming in position 11 in an ordered list. *Notation:* 11^{th}.
2. one of eleven equal parts; 1/11;

eliminate VERB /ɪˌlɪm.əˈneɪt/

1. to remove.
2. to cause to disappear.

elimination NOUN /ɪˌlɪm.əˈneɪ.ʃən/ simplification by removing variables. *Example:* elimination of a variable in a system of equations.

ellipse NOUN /ɪ'lɪps/ all points equidistant from two focal points; a closed curve with an equation in the form $\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1$ where (h,k) is the coordinate of the center of the ellipse, a is half the length of the horizontal axis and b is half the length of the vertical axis. *See GeoApp!.*



Ellipse

ellipsis SYMBOL /ɪ'lɪp.sɪs/ three dots (**...**) placed in a sequence of objects to indicate that there are more objects in the same pattern. An ellipsis at the beginning or the end of a sequence indicates that the sequence is infinite. *Example:* 1, 2, 3, ...

ellipsoid NOUN /ɪ'lɪp.sɔɪd/ a 3-dimensional solid whose cross sections are ellipses. An ellipsoid can be formed by rotating an ellipse about one of its axes.

elliptic ADJECTIVE /ɪ'lɪp.tɪ.k/
1. having to do with an ellipse.
2. in the shape of an ellipse.

elliptical ADJECTIVE /ɪ'lɪp.tɪ.kəl/ *See elliptic.*

elliptic geometry NOUN /ɪ'lɪp.tɪ.k dʒi'ɒ.mɪ.tri/ a non-Euclidean geometry that can be visualized as taking place on the surface of a sphere or an ellipsoid. *Synonym: spherical geometry.*

empirical ADJECTIVE /'ɛm.pɪr.ɪ.kl/ (statistics) based on scientific observation and experiment, *not* theory. *Antonyms: theoretical, anecdotal.*

empirical data NOUN /'ɛm.pɪr.ɪ.kl 'deɪ.tə/ data obtained through observation and experiment and *not* generated from theory.

empty ADJECTIVE /'ɛmp.ti/

1. having no members.
2. containing nothing.

empty set NOUN /'ɛmp.ti sɛt/ the unique set containing no members. *Notations:* ∅, { }. *Synonym:* *null set*.

en- PREFIX /ɛn/
1. to make. *Example:* enlarge.
2. to transform. *Example:* encrypt.

encipher VERB /ɛn'saɪ.fər/ to convert plain text to enciphered text using a method such as transposition of letters. *Example:* 'encipher this text' becomes 'neich preht siett x'. *Antonym:* *decipher*.

enciphered text NOUN /ɛn'saɪ.fərd tɛkst/ text that has been enciphered. *Antonym:* *plain text*.

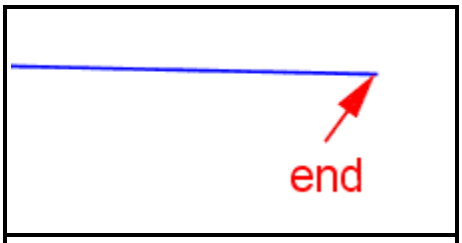
encipherment NOUN /ɛn'saɪ.fər.mənt/ the process of rendering text unreadable using a cipher. *Antonym:* *decipherment*.

encrypt VERB /ɛn'krɪpt/ to convert plain text to encrypted text using a key. *Example:* 'George' becomes '10-6-18-18-12-14'. *Antonym:* *decrypt*.

encrypted text NOUN /ɛn'krɪp.təd tɛkst/ text that has been encrypted. *Antonym:* *plain text*.

encryption NOUN /ɛn'krɪp.ʃən/ the act of encrypting. *Antonym:* *decryption*.

end NOUN /ɛnd/ the final part; the last of something.

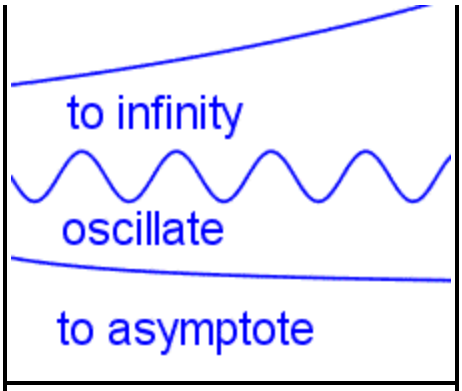


End

end behavior of a function NOUN /ɛnd bɪ'heɪv.yər ʌv eɪ 'fʌŋk.ʃən/ the behavior of a function as the arguments tends to infinity or negative infinity. The function can:

- go to positive infinity or negative infinity,
- approach a horizontal asymptote, or
- oscillate.

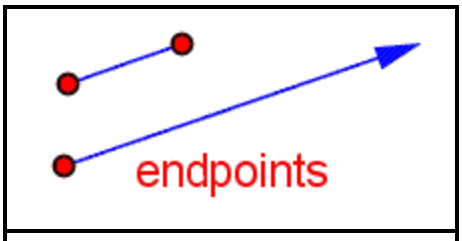
See also GeoApp!.



End Behavior of a Function

end of proof NOUN /ɛnd ʌv pruf/ a statement that the proof has been concluded. *Notations: QED, ■.*

endpoint NOUN /ˈɛndˌpɔɪnt/
1. (geometry) the last point where a ray, line segment, or other curve stops.
2. (statistics) a boundary between categories.



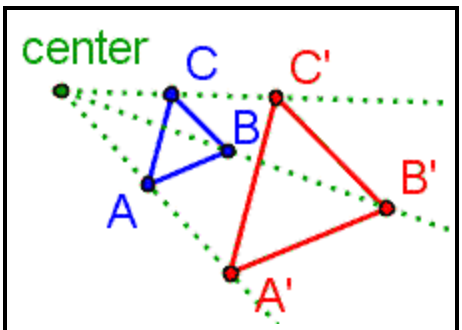
Endpoint

endpoint convention NOUN /ˈɛndˌpɔɪnt kənˈvɛn.ʃən/ (histogram) the category to which the data value on the boundary between two categories is assigned.

engineering notation NOUN /ˌɪn.dʒəˈnɪr.ɪŋg noʊˈteɪ.ʃən/ a way to write real numbers that are very large or very small. *Notation:* $mantissa \times 10^{exponent}$ where $1 \leq \text{mantissa} < 1000$ and exponent is a multiple of 3. *Example:* 25.5×10^6.

enlarge VERB /ɛnˈlɑrdʒ/ to make bigger.

enlargement NOUN /ɛnˈlɑrdʒ.mənt/
1. any transformation that increases the size of objects.
2. an object that is larger than the original.



Enlargement

e notation NOUN /i noʊˈteɪ.ʃən/ a way to represent real numbers that are very large or very small that is used by many calculators and computer programs.

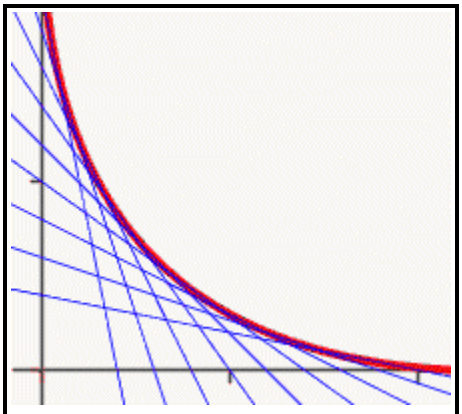
Notation: $mantissaE\pm nn$ where $1 \leq \text{mantissa} < 10$, $\pm$ is either $+$ or $-$, and nn is an unsigned integer.

Example: $2.749\text{E-}08 = 2.749 \times 10^{-8}$. *See also scientific notation, engineering notation.*

enumerate VERB /ɪˈnu.məˌreɪt/ to count instances; to associate objects in a set with the set of natural numbers starting at 1. *Synonym: count.*

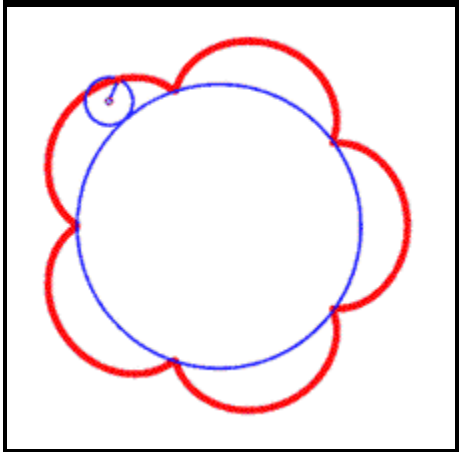
enumeration NOUN /ɪˈnu.məˌreɪ.ʃən/ the act of counting instances.

envelope NOUN /ˈɛn.vəˌloʊp/ a curve that is tangent to a family of lines or other geometric shapes.



Envelope

epicycloid NOUN /ˈɛˌpɪ.saɪ.klɔɪd/ a plane curve made by tracing a point on a circle that is rolling around the outside of another circle. *See also GeoApp!.*



epsilon SYMBOL /ˈɛp.sɪˌlɒn/ the Greek letter Ɛ, used to represent eccentricity in geometry; and to represent a very small, nonzero quantity.

equal ADJECTIVE /ˈi.kwəl/

1. has the same value as. *Example:* $\mathrm{a} = \mathrm{b}$.
2. satisfies an equivalence relation.
   Example: $5 \bmod 2 = 7 \bmod 2$.
3. means the same thing mathematically.

Synonym: congruent. See also equal sign.

equality NOUN /ɪˈkwɒl.ɪ.ti/

1. (of numbers) $a = b$ if and only if a has the same numeric value as b.
2. (of ordered pairs) $(a_1,b_1) = (a_2,b_2)$ if and only if $a_1 = a_2$ and $b_1 = b_2$.
3. (of sets) two sets are equal if they contain exactly the same members. *Math definition:* $A = B$ if and only if $A \subset B$ and $B \subset A$.
4. (of vectors) has the same components: $<a_1,b_1> = <a_2,b_2>$ if and only if $a_1 = a_2$ and $b_1 = b_2$.
5. (of matrices) two matrices are equal if they have the same dimensions and if their corresponding elements are equal.

equally ADJECTIVE /ˈi.kwəl.i/ having the property of sameness or of equality.

equally likely ADJECTIVE /'i.kwəl.i 'laɪk.li/ having the same chances of happening. *Math definition:* e_1 and e_2 are equally likely events if and only if $P(e_1) = P(e_2)$. *Example:* heads and tails are equally likely events.

equal parts NOUN /'i.kwəl pahrtz/ congruent parts.

equal sign NOUN /'i.kwəl saɪn/ the symbol '=' which represents equality. *Example:* $2 + 3 = 5$.

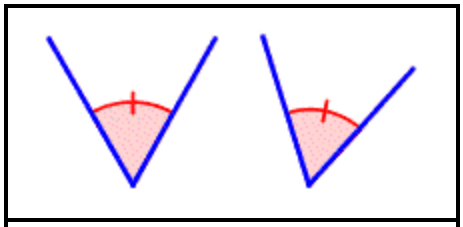
equate VERB /ɪ'kweɪt/ to state algebraically that two expressions are, perhaps conditionally, equal to each other. *Example:* equate $y+2$ and $x-3$.

equation NOUN /ɪ'kweɪ.ʒən/ a mathematical statement that two expressions have, perhaps conditionally, the same value. *Notation:* $expression = expression$. *Example:* $x + 3 = 2x - 4$.

Equation to Inequality Property NOUN /ɪ'kweɪ.ʒən tu ˌɪn.ɪ'kwɒl.ɪ.ti 'prɒ.pər.ti/ if $a, b > 0$, and $a + b = c$, then $c > a$ and $c > b$. If $a, b < 0$, and $a + b = c$, then $c < a$ and $c < b$.

equi- PREFIX /'i.kwə/ equal; the same.

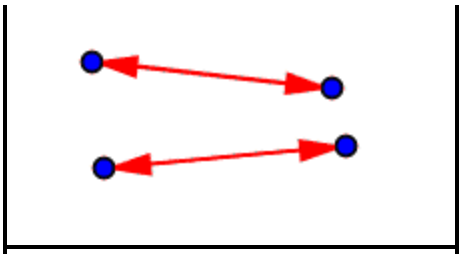
equiangular ADJECTIVE /ˌi.kwə'æŋ.gyə.lər/ having angles that are the same measure. *Synonym: congruent angles.*



Equiangular

equiangular triangle ADJECTIVE /ˌi.kwə'æŋ.gyə.lər 'traɪˌæŋ.gəl/ a triangle whose angles are all congruent. *Synonym: equilateral triangle.*

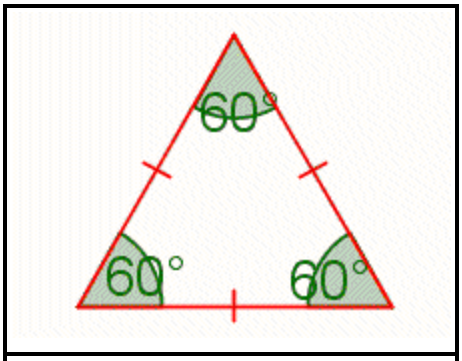
equidistant ADJECTIVE /ˌi.kwə'dɪs.tənt/ the same distance. *See also GeoApp!.*



Equidistant

equilateral ADJECTIVE /ˌi.kwə'læ.tər.əl/
1. (polygon) having sides that are the same length.
2. (polyhedron) having faces that are congruent.

equilateral triangle NOUN /ˌi.kwə'læ.tər.əl 'traɪˌæŋ.gəl/ a triangle whose sides are all congruent. *Synonym: equiangular triangle.*



Equilateral Triangle

equinox NOUN /'ɛ.kwəˌnɒks/ one of two days each year when the length of night and day are the closest to equal.

equivalence NOUN /ɪ'kwɪv.ə.ləns/ the state of being equivalent or not equivalent.

Equivalence of Congruence of Angles Theorem NOUN /ɪ'kwɪv.ə.ləns ʌv kən'gru.əns ʌv 'æŋ.gəlz 'θɪər.əm/ congruence of angles is reflexive, symmetric and transitive. *See also equivalence relation.*

Equivalence of Congruence of Segments Theorem NOUN /ɪ'kwɪv.ə.ləns ʌv kən'gru.əns ʌv 'sɛg.məntz 'θɪər.əm/ congruence of line segments is reflexive, symmetric and transitive. *See also equivalence relation.*

equivalence relation NOUN /ɪ'kwɪv.ə.ləns rɪ'leɪ.ʃən/ a relation that shows if two elements are equal and is reflexive, symmetric and transitive. *Example:* equality of real numbers is an equivalence relation. *See also equal.*

equivalent ADJECTIVE /ɪ'kwɪv.ə.lənt/

1. has the same amount.
2. possessing the properties of an equivalence relation: reflexive, symmetric and transitive.
3. identical to; the same as.
4. has the same meaning as.
5. (logic) either all of the statements are true or all are false.
6. (sets) having the same number of members or having a one to one correspondence.

equivalent decimals NOUN /ɪ'kwɪv.ə.lənt 'dɛs.məlz/ two or more decimal that have the same value.

Example: $2 = 2.0 = 2.00$.

equivalent equations NOUN /ɪ'kwɪv.ə.lənt ɪ'kweɪ.ʃənz/ two or more equations that have exactly the same solution.

Example: $y = x + 2$ is equivalent to $2y = 2x + 4$.

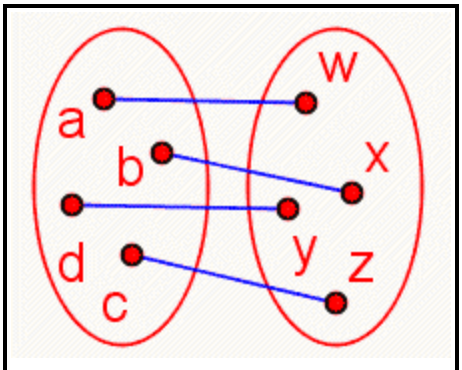
equivalent fractions NOUN /ɪ'kwɪv.ə.lənt 'fræk.ʃənz/ two or more fractions that have the same value. *Example:*

$$\frac{1}{2} = \frac{2}{4} = \frac{3\pi}{6\pi}.$$

equivalent ratios NOUN /ɪ'kwɪv.ə.lənt 'reɪ.ʃoʊz/ two or more ratios that are equal. *Example:* $1{:}2 = 2{:}4 = 3{:}6$.

equivalent sets NOUN /ɪ'kwɪv.ə.lənt sɛtz/

1. finite sets that have the same number of members. *See also cardinality.*
2. infinite sets that can be put into one to one correspondence with each other; sets that have the same cardinality. *Important:* This is *not* the same as equality of sets.



Equivalent Sets

Eratosthenes of Cyrene PERSON /ˌɛr.əˈtɒs.θəˌniz ʌv saɪˈri.ni/ (276 BCE - 194 BCE) a Libyan mathematician who measured the circumference of the Earth with astonishing accuracy and for whom the Sieve of Eratosthenes is named.

Eratosthenes of Cyrene

Eratosthenes sieve NOUN /ˌɛr.əˈtɒs.θəˌniz sɪv/ *See Sieve of Eratosthenes.*

error NOUN /ˈɛr.ər/

1. the difference between a measured or computed value and the actual or theoretical value.
2. something which causes an inaccurate result.

error analysis NOUN /ˈɛr.ər ˌæˈnæl.ɪ.sɪs/ the process of discovering what caused an error.

escapee NOUN /ɛsˈkeɪˌpi/ a value in a Julia set or a Mandelbrot set that grows larger with each iteration. *Antonym: prisoner.*

estimate

1. VERB /ˈɛs.təˌmeɪt/ to approximate a value by making an educated guess. *Example:* estimate the number of jelly beans in a jar.
2. VERB /ˈɛs.təˌmeɪt/ to approximate a value using an inexact algorithm. *Example:* estimate the circumference of the Earth.
3. NOUN /ˈɛs.təˌmɪt/ a value arrived at by estimating. *Example:* Jeff's estimate of the number of marbles in the jar was closest.

estimation NOUN /ˈɛs.təˌmeɪ.ʃən/
1. the process of estimating.
2. a value arrived at by estimating.

Euclidean ADJECTIVE /yuˈklɪ.di.ən/
1. having to do with Euclidean geometry.
2. being attributed to or named after Euclid of Alexandria.

Euclidean algorithm NOUN /yuˈklɪ.di.ən ˈæl.gəˌrɪ.ðəm/ a method for calculating a greatest common divisor. Take the two numbers, and subtract the smaller from the larger. If difference is not zero, repeat with the smallest of the three numbers. When the difference is zero, the subtrahend is the greatest common divisor. *Example:* Take 186 and 124. $186 - 124 = 62$; $124 - 62 = 62$; $62 - 62 = 0$; So, $\gcd(186,124) = 62$.

Euclidean geometry NOUN /yuˈklɪ.di.ən dʒiˈɒ.mɪ.tri/ the geometry based on Euclid's landmark work '*Elements*'. Euclidean geometry is distinguished from other geometries by the Parallel Postulate. *Antonym: non-Euclidean geometry.*

Euclidean n-space NOUN /yuˈklɪ.di.ən ɛn speɪs/ an n-dimensional geometric space where objects follow the rules of Euclidean geometry. *Example:* Euclidean 3-space.

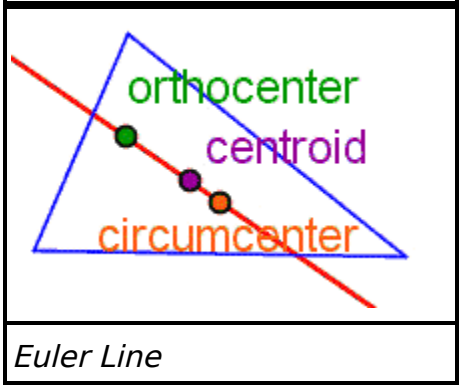
Euclid of Alexandria PERSON /ˈyu.klɪd ʌv ˌæl.ɪgˈzæn.dri.ə/ (325 BCE-265 BCE) a mathematician famous for collecting and formalizing the knowledge of mathematics, particularly geometry. Euclid is the earliest know writer to publish an axiomatic system.

Euler-Descartes polyhedron formula NOUN /ˈɔɪ.lər deɪˈkɑrt ˌpɒ.liˈhi.drən ˈfɔr.myə.lə/ a formula relating the number of vertices, edges and faces of convex polyhedra. *Formula:* $V - E + F = 2$.

Euler, Leonhard PERSON /ˈɔɪ.lər ˈlɪn.ɑrd/ (1707-1783) a Swiss mathematician considered by some to be the greatest mathematician ever. Leonhard Euler is credited with, among other things, Euler's formula and discovering the constant e.

Leonhard Euler

Euler line NOUN /ˈɔɪ.lər laɪn/ a line that passes through a triangle's orthocenter, centroid and circumcenter. *See also GeoApp!.*



Euler Line

Euler's formula NOUN /ˈɔɪ.lərz ˈfɔr.myə.lə/ $e^{i\theta} = \cos\theta + i\sin\theta$. Euler's formula relates exponents, complex numbers, and trigonometric functions.

Euler's number NOUN /ˈɔɪ.lərz ˈnʌm.bər/ *See e.*

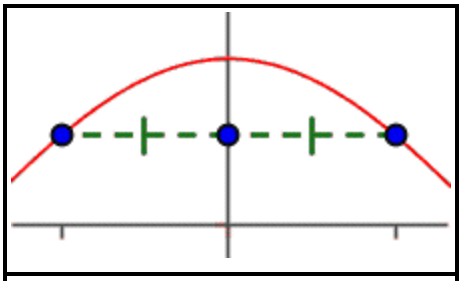
evaluate VERB /ɪˈvæl.yuˌeɪt/ to find the value of an expression given specific values for the variables. *Example:* evaluate $3x - 4$ when $x = -2$: $3(-2) - 4 = -6 - 4 = -10$.

even ADJECTIVE /ˈi.vən/

1. having a property associated with multiples of 2. *Example:* even number. *Antonym: odd.*
2. balanced. *Example:* even function.

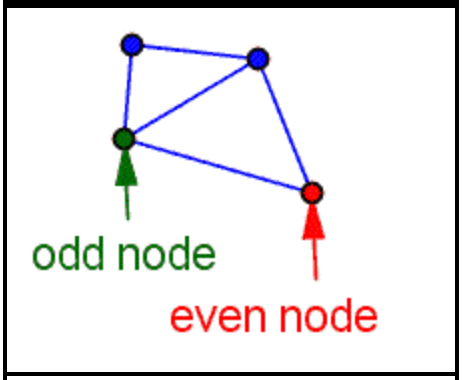
3. equal in quantity.

even function NOUN /'i.vən 'fʌŋk.ʃən/ a function for which $f(x) = f(-x)$; a function that is symmetric about the y-axis. *Examples:* $f(x)=x^2$, $f(x) = \cos x$. *See also GeoApp!.*



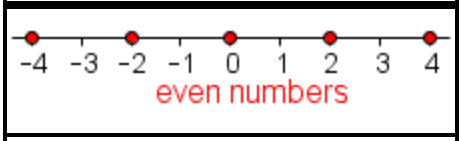
Even Function

even node NOUN /'i.vən noʊd/ a node of a network graph that has an even number of paths connecting it to other nodes. *Antonym: odd node.*



Even Node

even number NOUN /'i.vən 'nʌm.bər/ an integer that is divisible by 2. *Math definition:* {..., -4, -2, 0, 2, 4, ...}, or $\{x \mid x = 2k, k \in \mathbb{Z}\}$.



Even Numbers

even-odd trigonometric identities NOUN /'i.vən ɒd ˌtrɪg.ə.nə'mɛ.trɪk aɪ'dɛnˌtɪ.tiz/ trigonometric identities resulting from the evenness or oddness of trigonometric functions. *See also Trigonometric Identities.*

even polynomial NOUN /'i.vən ˌpɒl.ə'noʊ.mi.əl/ a polynomial that is an even function. The degree of every even polynomial is even. *Example:* $3x^8 + 4x^4$.

event NOUN /ɪ'vɛnt/ any outcome or related group of outcomes of a probability experiment. *Notations:* e, e_n. *Example:* flip of a coin; roll of a die.

ex- PREFIX /ɪks/

1. out of; from. *Example:* expand.

2. utterly. The ex- prefix is sometimes used to emphasize a concept, particularly uniqueness. *Example:* exact.

exa- PREFIX /ˈɪg.zə/ 10^{18}. *Abbreviation: E.*

Example: 5 exameters $= 5 \times 10^{18}$ meters.

Synonym: quintillion.

exact ADJECTIVE /ɪgˈzækt/

1. precise.
2. accurate or correct.

Antonyms: approximate , inexact.

exactly ADJECTIVE /ɪgˈzækt.li/ precisely; no more no less. *Example:* A line segment has exactly two end points. *Antonym: approximately.*

exact number NOUN /ɪgˈzækt ˈnʌm.bər/ a number arrived at by counting or by theory and *not* by measurement or inexact calculation. *Antonym: measurement.*

exact values of trigonometric functions NOUN /ɪgˈzækt ˈvæl.yuz ʌv ˌtrɪg.ə.nəˈmɛ.trɪk ˈfʌŋk.ʃənz/ values of trigonometric functions of certain angles that can be written exactly using expressions containing integers, radicals and pi. *Synonym: analytic values of trigonometric functions. See also Exact Values of Trigonometric Functions.*

example NOUN /ɪgˈzæm.pl/ an instance that illustrates a whole.

exceed VERB /ɪkˈsid/

1. to increase beyond a limit. *Example:* Their expenses exceed their income.
2. to go beyond a boundary.

except PREPOSITION /ɛkˈsɛpt/ not including. *Example:* All prime numbers are odd except 2. *Antonym: including.*

exception NOUN /ɛkˈsɛp.ʃən/ something that is *not* included. *Example:* All prime numbers are odd with the exception of 2.

exchange /ɛkˈtʃeɪŋdʒ/

1. VERB to trade one thing for another.

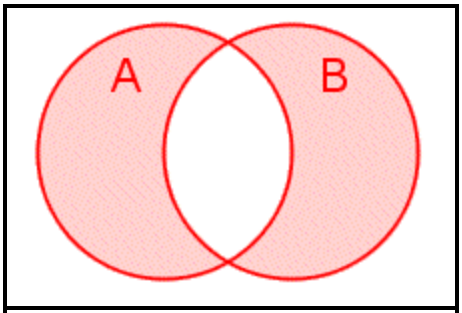
2. NOUN a market where stocks, bonds or commodities are traded.

exclusive ADJECTIVE /ɛk'sklu.sɪv/

1. one does *not* include the others. *Example:* exclusive events.
2. *not* including the endpoints, only the middle. *Example:* the interval from 1 to 3, exclusive.

Antonym: inclusive.

exclusive disjunction NOUN /ɛk'sklu.sɪv dɪs'dʒʌŋk.ʃən/ $P \oplus Q$ is true if and only if P is true or Q is true, but *not* both. *Notation:* $\oplus$. *Synonyms: xor, exclusive or.*



Exclusive Disjunction

Exclusive Disjunction

P	Q	$P \oplus Q$
False	False	False
False	True	True
True	False	True
True	True	False

exclusive events NOUN /ɛk'sklu.sɪv ɪ'vɛntz/ two or more events where only one of the events can happen in any single trial. *Example:* Heads and tails are exclusive events. *Synonym: mutually exclusive events.*

exclusive or NOUN /ɛk'sklu.sɪv ɔr/ *See exclusive disjunction.*

exist VERB /ɛg'zɪst/ to have actual or theoretical being. *Example:* There exists exactly one line through two points.

existence NOUN /ɛg'zɪs.təns/ having the property of being. *Example:* The existence of extraterrestrials has not been proven.

existence theorem NOUN /ɛgˈzɪs.təns ˈθɪər.əm/ a theorem that proves the existence of an object without necessarily telling how to find the object.

expand VERB /ɛkˈspænd/ to multiply through parentheses or raise an expression in parentheses to an exponent.

Example: $(x + 2)^2 = x^2 + 4x + 4$. *See also FOIL method.*

expanded form NOUN /ɛkˈspænd.ɪd fɔrm/ a form where multiplication is expanded through parentheses.

Example: The expanded form of $(a+b)^2$ is $a^2 + 2ab + b^2$.

expanded notation NOUN /ɛkˈspænd.ɪd noʊˈteɪ.ʃən/ writing out the digits of a number showing the digits multiplied by the place value.

Example: $324 = 3\times100 + 2\times10 + 4$.

expansion NOUN /ɛkˈspæn.ʃən/

1. the act of expanding.
2. something that has been expanded. *Example:* The expansion of $(a+b)^2$ is $a^2 + 2ab + b^2$.

expect VERB /ɛkˈspɛkt/ to think that something will happen. *Example:* expect night to follow day.

expected value NOUN /ɛkˈspɛkt.ɛd ˈvæl.yu/ the sum of the value of each possible outcome multiplied by the probability of the outcome. *Formula:* $P(e_1,e_2,\ldots,e_n) = e_1 \cdot P(e_1) + e_2 \cdot P(e_2) + \ldots + e_n \cdot P(e_n)$.

Example: The expected value of the roll of a single die is:

$$1 \cdot \frac{1}{6} + 2 \cdot \frac{1}{6} + 3 \cdot \frac{1}{6} + 4 \cdot \frac{1}{6} + 5 \cdot \frac{1}{6} + 6 \cdot \frac{1}{6} = \frac{21}{6} = 3.5.$$

experiment NOUN /ɛɪkˈspɛr.ə.mənt/ making an event happen and recording the outcome. *Example:* One flip of a coin is an experiment.

experimental ADJECTIVE /ɛkˌspɛr.əˈmɛn.tl/ having to do with making events happen. *Example:* experimental data. *Antonyms: observational, theoretical.*

experimental data NOUN /ɛkˌspɛr.əˈmɛn.tl ˈdeɪ.tə/ data obtained through a controlled experiment. *Example:* flip a coin 100 times and record the result. *Antonym: observational data.*

experimental group NOUN /ɛkˌspɛr.əˈmɛn.tl grup/ a group that is effected by an experiment. *Antonym: control group.*

experimental probability NOUN /ɛkˌspɛr.əˈmɛn.tl ˌprɒb.əˈbɪl.ɪ.ti/ a probability arrived at by experimentation. *Formula:* f/n where f is the count of the outcome being measured and n is the total number of trials. *Example:* If event a happened 10 times out of 50 trials, the experimental probability of a is $P(a) = 10/50 = 0.2$. *Antonym: theoretical probability.*

experimental study NOUN /ɛkˌspɛr.əˈmɛn.tl ˈstʌ.di/ *See designed experiment.*

explain VERB /ɛkˈspleɪn/ tell how something is known or what is known. *Example:* Explain AAS triangle congruence.

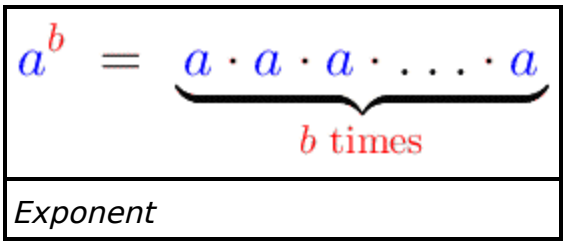
explanation NOUN /ˌɛk.splə̇ˈneɪ.ʃən/ a statement of how something is known or what is known. *Example:* The big bang theory is an explanation of the origin of the universe.

explementary angles NOUN /ˈɛk.splə.mən.tɑ.ri ˈæŋ.gəlz/ *See conjugate angles.*

exploration NOUN /ˌɛk.splə̇ˈreɪ.ʃən/ the act of exploring.

explore VERB /ɪkˈsploʊr/ to investigate systematically for the purpose of discovery. *Example:* explore the properties of triangles.

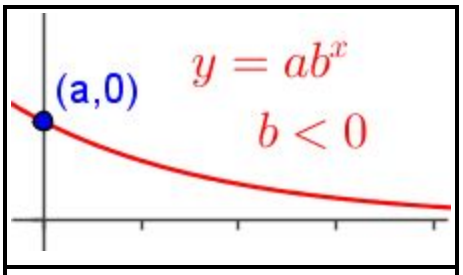
exponent NOUN /ˈɛks.poʊ.nənt/ notation for repeated multiplication.
Notations: $base^{exponent}$, *base^exponent* (computers), *base**exponent* (computers).
Example: $x^3 = x \cdot x \cdot x$. *Synonyms:* power, index (British English). *Inverse:* logarithm. *See also* Properties of Exponents.



Exponent

exponential ADJECTIVE /ˌɛk.spoʊˈnɛn.ʃəl/
1. having to do with exponents. *Example:* exponential graph.
2. having a variable in an exponent. *Example:* exponential equation.

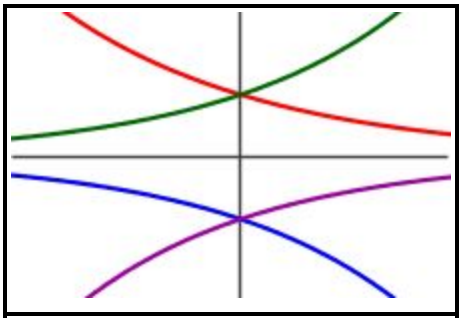
exponential decay NOUN /ˌɛk.spoʊˈnɛn.ʃəl dɪˈkeɪ/ a decreasing exponential function in the form $y = ab^x,\ a > 0,\ 0 < b < 1$ where a is the initial value and b is the decay factor.



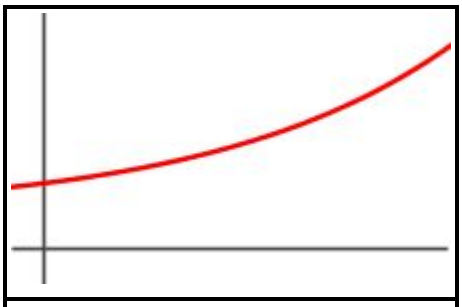
Exponential Decay

exponential equation NOUN /ˌɛk.spoʊˈnɛn.ʃəl ɪˈkweɪ.ʒən/ an equation containing a variable in an exponent.
Example: $y = e^x$.

exponential function NOUN /ˌɛk.spoʊˈnɛn.ʃəl ˈfʌŋk.ʃən/ a function with a variable in an exponent.
Formula: $f(x) = a \cdot b^{x - x_0} + y_0$.


Exponential Functions

exponential growth NOUN /ˌɛk.spoʊ'nɛn.ʃəl groʊθ/ an increasing function in the form $y = ab^x$, $a > 0, b > 1$ where a is the initial value and b is the growth factor. *Synonym: geometric growth.*



Exponential Growth

exponential notation NOUN /ˌɛk.spoʊ'nɛn.ʃəl noʊ'teɪ.ʃən/ *See e notation.*

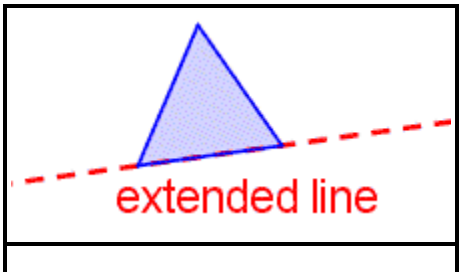
exponential series NOUN /ˌɛk.spoʊ'nɛn.ʃəl 'sɪər.iz/ the infinite series that equals e^x. *Formula:* $e^x = \frac{1}{0!} + \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \cdots = \sum_{k=0}^{\infty} \frac{x^k}{k!}$.

exponentiation NOUN /ˌɛk.spoʊˌnɛn.ʃi'eɪ.ʃən/ multiplying a number by itself a certain number of times: $a^b = a \cdot a \cdot \ldots \cdot a$ (b times). Raising a number or expression to an exponent. *Notations:* a^b, *a^b* (computers). *Example:* x^4. *Inverse: take a logarithm.*

expression NOUN /ɪk'sprɛ.ʃən/ any mathematical formula without equals or inequalities. *Examples:* $x^3 + 3xy - y^3$, $\sin(2x)$.

extend VERB /ɪk'stɛnd/ to make longer in one or more dimensions. *Example:* extend a line segment.

extended line NOUN /ɪk'stɛn.dɪd laɪn/ a line that contains a given line segment or ray. *Synonym: extended side.*

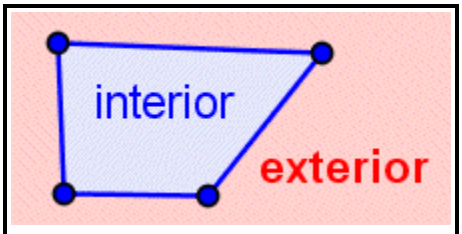


Extended Line

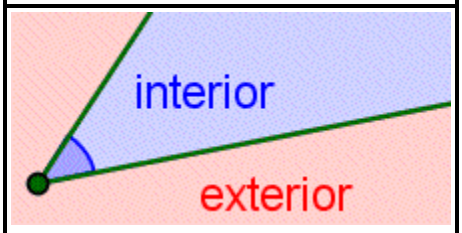
extended side NOUN /ɪkˈstɛn.dɪd saɪd/ *See extended line.*

exterior ADJECTIVE /ɪkˈstɪər.i.ər/

1. (figure) lying outside a boundary.
2. (angle) *not* lying on the interior of the angle.



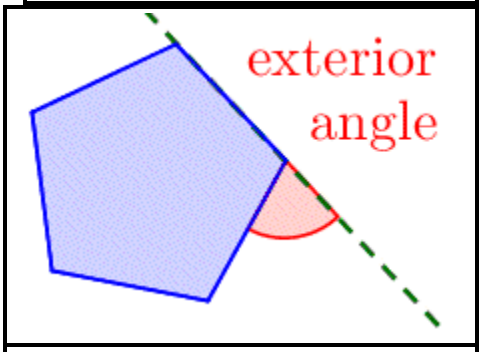
Exterior of a Polygon



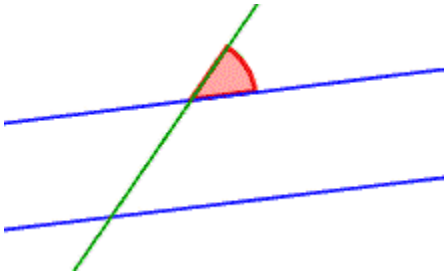
Exterior Angle

exterior angle NOUN /ɪkˈstɪər.i.ər ˈæŋ.gəl/

1. (of polygons) an angle between an extended side and an adjacent side of the polygon.
2. (of transversals) the angle between a transversal and one of a pair of transversed lines that is *not* between the transversed lines.

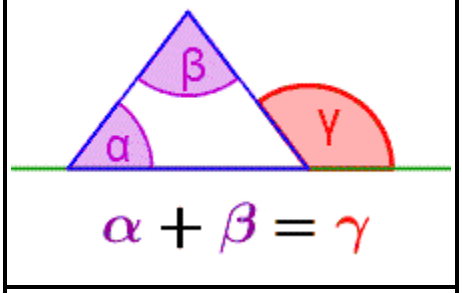


Exterior Angle of a Polygon



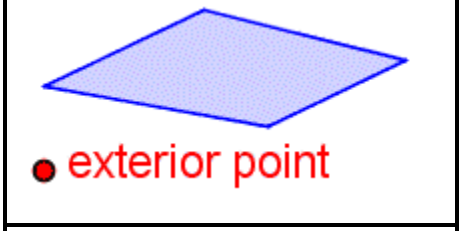
Exterior Angle of a Transversal

Exterior Angle Theorem NOUN /ɪkˈstɪər.i.ər ˈæŋ.gəl ˈθɪər.əm/ the measure of an exterior angle of a triangle is equal to the sum of the measures of the two remote interior angles. In the illustration, $\alpha + \beta = \gamma$.



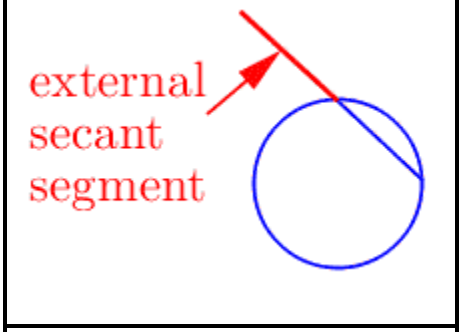
Exterior Angle Theorem

exterior point NOUN /ɪkˈstɪər.i.ər pɔɪnt/ a point in the exterior of a figure; *not* a boundary point or an interior point.



Exterior Point

external secant segment NOUN /ɪkˈstɜr.nl ˈsi.kænt ˈsɛg.mənt/ the part of a secant segment that is on the exterior of a circle. *See also* *secant segment*.



External Secant Segment

extract VERB /ˈɛk.strækt/
1. to calculate. *Example:* extract a root.
2. to approximate from a known value.

extract a root VERB /ˈɛk.strækt eɪ rut/ to approximate a value of a root. *Example:* $\sqrt{2} \approx 1.414$.

extraneous ADJECTIVE /ɪkˈstreɪ.ni.əs/
1. extra; not needed. *Example:* extraneous solution.
2. impracticable.

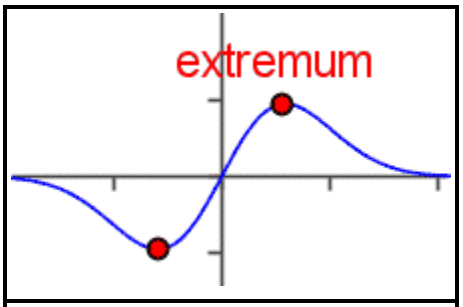
extraneous solution NOUN /ɪkˈstreɪ.ni.əs soʊˈlu.ʃən/ a solution that is *not* useful or is invalid. An extraneous solution can be a false solution introduced while solving a problem or a solution that does *not* make sense in the practical context of the problem.

extrapolate VERB /ɪkˈstræ.pəˌleɪt/ to estimate by extending data to values not in the dataset or to values outside the known range. *Example:* extrapolate life expectancy.

extrapolation NOUN /ɪkˈstræ.pəˌleɪ.ʃən/ estimation by extending data to values not in the dataset or to values outside the known range.

extreme ADJECTIVE /ɪkˈstrim/ a maximum or a minimum. *Example:* extreme value.

extremum NOUN /ɪkˈstri.məm/ a maximum or minimum value of a function. *Plural: extrema* /ɪkˈstri.mə/. *See also GeoApp!.*



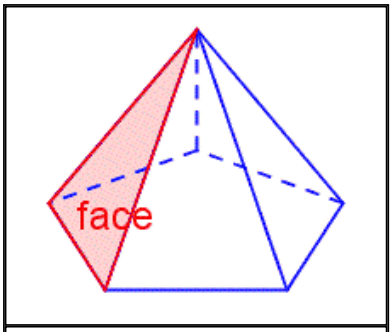
Extremum

F

f ABBREVIATION See femto-.

F ABBREVIATION degrees Fahrenheit.

face NOUN /feɪs/ a flat, 2-dimensional polygon on the surface of a polyhedron. *See also GeoApp!.*



Face

fact NOUN /fækt/

1. a true statement.
2. a widely accepted truth.

fact family NOUN /fækt 'fæm.li/ three integers and the addition and subtraction problems that connect them. *Example:* The fact family for 1, 4 and 5 is: $1 + 4 = 5$; $4 + 1 = 5$; $5 - 1 = 4$; $5 - 4 = 1$.

factor /'fæk.tər/

1. NOUN each of two or more integers or expressions that, when multiplied together, gives a particular product. *Math definition:* given integers a and b; a is a factor of b if and only if an integer c can be found such that $a \cdot c = b$. *Example:* $3 \cdot 2 = 6$. 3 and 2 are factors of 6.
2. NOUN a number that is multiplied by an expression in a function or equation, usually determining the form of the equation. *Example:* decay factor.
3. VERB to divide an integer or an expression into parts that, when multiplied together, equal the original expression.

factor completely VERB /'fæk.tər kəm'p.lit.li/ find irreducible factors whose product is the original expression. *See also irreducible.*

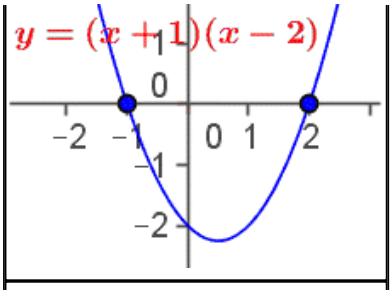
factored form NOUN /'fæk.tərd fɔrm/

1. a quadratic equation in the form $y = a(x - x_1)(x - x_2)$ where $(x_1, 0)$ and

$(x_2,0)$ are the x-intercepts. *See also* [GeoApp!](#).

2. any polynomial written as the product of irreducible polynomials.

   Example: $(x - 2)(x^2 + x + 7)$.



Factored Form

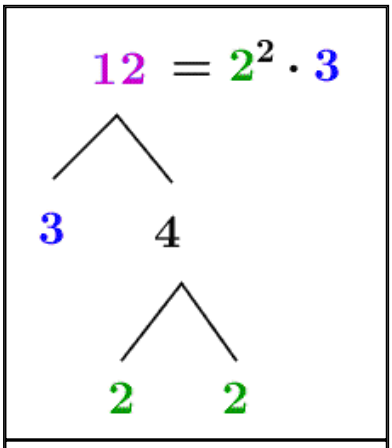
factorial NOUN /fæk'toʊr.i.əl/ the product of all integers between 1 and n, inclusive. *Math definition:* $n! \equiv 1 \cdot 2 \cdot 3 \cdot \ldots \cdot n$, $n>0$; $0! \equiv 1$. *Example:* $3! = 1 \cdot 2 \cdot 3 = 6$.

factorization NOUN /fæk,toʊr.i'zeɪ.ʃən/

1. the result of finding factors. *Example:* a factorization of 12 is $2 \cdot 2 \cdot 3$.
2. the act of factoring.

Factor Theorem NOUN /'fæk.tər 'θɪər.əm/ $x - a$ is a factor of polynomial $p(x)$ if and only if $p(a) = 0$. *Example:* $(x+3)$ is a factor of $p(x) = x^2 + 5x + 6$ since $p(-3) = (-3)^2 + 5(-3) + 6 = 9 - 15 + 6 = 0$.

factor tree NOUN /'fæk.tər tri/ an algorithm for finding the prime factors of an integer.



Factor Tree

Fahrenheit NOUN /'fær.ən,haɪt/ *See* [degree Fahrenheit](#).

Fahrenheit, Gabriel Daniel PERSON /'fær.ən,haɪt 'gɑ.bri,ɛl 'dɑ.ni,ɛl/ (1686–1736) a German physicist whose invented the Fahrenheit temperature scale.

fair ADJECTIVE /fɛər/ a probability experiment is called fair if all outcomes are equally likely. *Example:* when flipping a coin, if heads is just as likely as tails, then the flip of a coin is a fair experiment.

fallacy NOUN /'fæl.ə.si/ an argument that does *not* meet the standards of a logical argument. *Example:*

Premise 1: Most birds can fly.
Premise 2: A penguin is a bird.
Conclusion: Therefore most penguins can fly.

false ADJECTIVE /fals/

1. not true.
2. one of two truth values. False is often written 0, especially in computer programs.

Antonym: true. See also truth value.

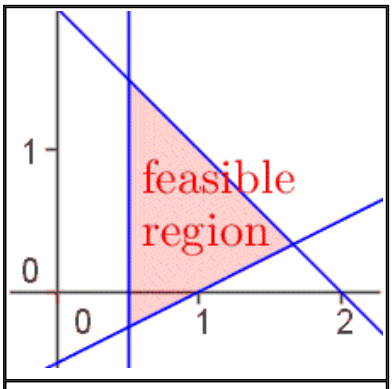
family NOUN /'fæm.li/ a set of related objects. *Examples:* fact family, family of curves.

favorable outcome NOUN /'feɪ.vɔr.ə.bl 'aʊtˌkʌm/ the outcome being considered.

feasible ADJECTIVE /'fi.zə.bəl/

1. can be done; can be accomplished.
2. satisfies the criteria. *Example:* feasible region.

feasible region NOUN /'fi.zə.bəl 'ri.dʒən/ (linear programming) the region of values that satisfy a system of linear inequalities.



Feasible Region

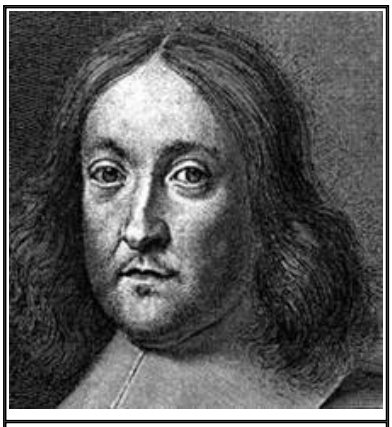
feasible solution NOUN /'fi.zə.bəl soʊ'lu.ʃən/ in linear programming, a solution that satisfies a system of linear inequalities.

feet per second NOUN /fit pər 'sɛ.kənd/ a unit of measure of speed. *Abbreviation: ft/s. Formulas:* $1\ \text{ft/s} \approx 0.68\ \text{mph}$, $1\ \text{ft/s} \approx 1.10\ \text{kph}$, $1\ \text{ft/s} \approx 1.30\ \text{m/s}$. *Example:* a average person walks at about 4.4 ft/s.

femto- PREFIX 10^{-15}. *Abbreviation: f.*

Example: $5\ \text{femtometers} = 5 \times 10^{-15}\ \text{meters}$.
Synonym: quadrillionth.

Fermat, Pierre de PERSON /fɛr'ma pyɛr də/ (1601–1665) a French mathematician famous for writing proofs in the margins of books, and claiming to have proved things, but had not written down the proof.



Pierre de Fermat

Fermat's last theorem NOUN /fɛr'maz læst 'θɪər.əm/ of the theorems Fermat claimed to have proved, the last to be proved. *Math definition:* given integers x, y, z and an integer $n>2$, no solutions exist for the equation $x^n + y^n = z^n$.

few ADJECTIVE /fyu/

1. more than one but not many. *Example:* a few friends came over.
2. more than zero.

fewer PRONOUN /'fyu.ər/ less in quantity; a key word for subtraction. *Example:* there are three fewer red bricks than tan bricks.

fewer than PREPOSITION /'fyu.ər ðæn/ has less than. Keyword for subtraction.

Fibonacci (Leonardo Pisano) PERSON /fi.bə'nɑ.tʃi 'li.oʊˌnɒr.doʊ ˌpi'zɑ.noʊ/ *See Pisano, Leonardo.*

Fibonacci numbers NOUN /fi.bə'nɑ.tʃi 'nʌm.bərz/ a sequence starting with $1, 1$ where each additional term is the sum of the previous two terms. *Math definition:* $F(1)=1$, $F(2)=1$, $F(n) = F(n–2)+F(n–1)$, $n>2$. *Example:* first few Fibonacci numbers are $1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, \ldots$.

Fibonacci sequence NOUN /fi.bə'nɑ.tʃi 'si.kwəns/ *See Fibonacci numbers.*

fifteen ADJECTIVE, NOUN /fɪf'tin/ the number 15. *Synonym: pentadeca-.*

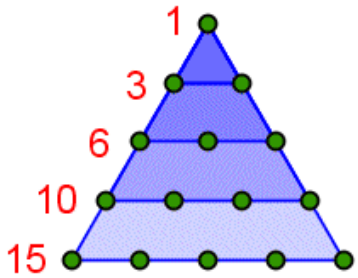
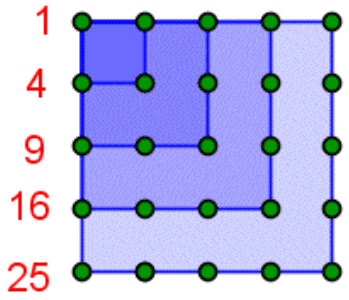
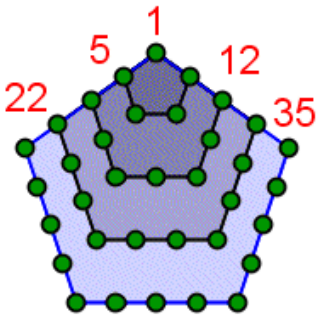
fifth ADJECTIVE /fɪfθ/

1. coming in position 5 in an ordered list. *Notation:* 5^{th}.
2. one of five equal parts; 1/5.

fifty ADJECTIVE, NOUN /'fɪf.ti/ the number 50.

figurate number NOUN /ˈfɪg.yər.ət ˈnʌm.bər/ a number generated from the edges of a regular polygon. *Examples:* triangular number, pentagonal number.

Figurate Numbers

Name	Sequence Formula	Illustration
Triangular	1, 3, 6, 10, 15, ... $T(n) = ½n(n - 1)$	
Square	1, 4, 9, 16, 25, ... $S(n) = n^2$	
Pentagonal	1, 5, 12, 22, 35, ... $P(n) = ½n(3n - 1)$	
Others	$F(n,i) = ½n((i - 2)n - 1)$ where i is the number of sides in the figure and n is the index of the number.	

finance NOUN /'faɪ.nɑns/ practices associated with money management and lending. *Example:* personal finance.

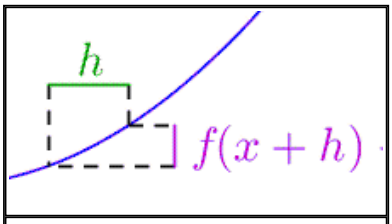
finance charge NOUN /'faɪ.nɑns tʃɑrdʒ/ a fee paid to a lender for the use of money. *Formula:* amount borrowed + finance charge = amount owed.

find VERB /faɪnd/ to discover using arithmetic or algebra.

finite ADJECTIVE /'faɪ.naɪt/ ends; does *not* go on forever. *Antonym:* *infinite*.

finite difference NOUN

1. an expression in the form $f(x+h) - f(x)$. The finite difference divided by h is the difference quotient.
2. the difference between two consecutive numbers in a table.



Finite Difference

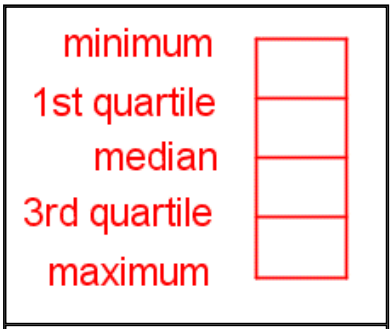
finite sequence NOUN /'faɪ.naɪt 'si.kwəns/ a sequence that has a last term. *Example:* $\{1, 3, 9, 27\}$. *Antonym:* *infinite sequence*.

first ADJECTIVE /fɜrst/

1. coming before all others. *Antonym:* *last*.
2. coming in position 1 in an ordered list. *Notation:* 1^{st}.

five ADJECTIVE, NOUN /faɪv/ the number 5. *Synonym:* *penta-*.

five number summary NOUN /faɪv 'nʌm.bər 'sʌm.ər.i/ a summary of a dataset containing the minimum, the first quartile, the median, the third quartile, and the maximum of the dataset.

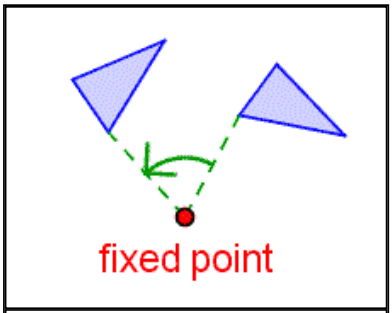


Five Number Summary

fixed ADJECTIVE /fɪkst/

1. does *not* change. *Example:* a fixed value.
2. does *not* move. *Example:* a fixed point.

fixed point NOUN /fɪkst pɔɪnt/ a point that does *not* move. *Example:* rotate a segment around a fixed point.



Fixed Point

flat ADJECTIVE /flæt/
1. level and even; *not* curved.
2. existing in a single plane.

flip VERB /flɪp/
1. to reflect across a line or around a point.
2. to make turn over in the air. *Example:* flip a coin.

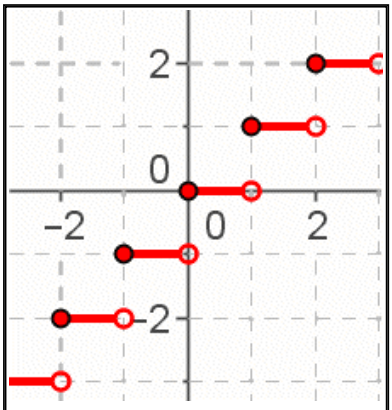
flip a coin VERB /flɪp eɪ kɔɪn/ to toss a coin in the air and see which side lands up. *Synonym: toss a coin.*

Flip a Coin

floor /flɔr/
1. ADJECTIVE having a lower limit.
2. NOUN a lower limit.

`floor()` COMPUTERS the representation of the floor function in many computer languages.

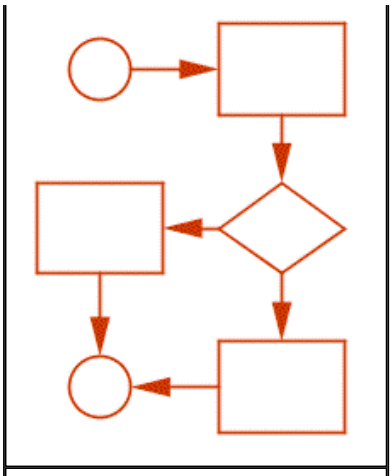
floor function NOUN /flɔr 'fʌŋk.ʃən/ the function that returns the largest integer less than or equal to the argument. *Notation:* $\lfloor x \rfloor$.



Floor Function

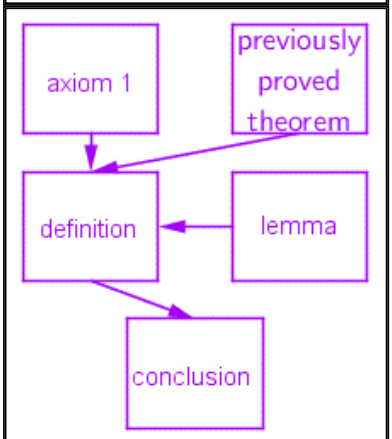
flow VERB /floʊ/ to move from one place to another in a smooth and predictable fashion.

flowchart NOUN /'floʊ.tʃɑrt/ a diagram showing the steps in solving a problem.



Flow Chart

flow proof NOUN /floʊ pruf/ a proof where each statement and its justification are placed in a box, and whose arrows show the logical flow from one box to another.



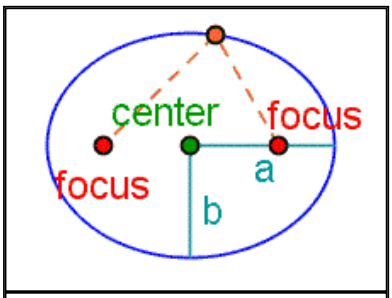
Flow Proof

fluid ADJECTIVE liquid.

fluid ounce NOUN a unit of measure of volume. *Abbreviation: fl oz.*

Formulas: $1 \text{ fl oz} \approx 1.8047 \text{ cubic in.}$, $8 \text{ fl oz} = 1 \text{ cup}$, $128 \text{ fl oz} = 1 \text{ gal.}$, $1 \text{ fl oz} \approx 29.6 \text{ milliliters}$.

focus NOUN /ˈfoʊ.kəs/ one or more points related to the construction and properties of conic sections. *Plural: foci* /ˈfoʊ.saɪ/.



Focus

FOIL method NOUN /fɔɪl ˈmɛθ.əd/ an algorithm for expanding the product of two binomials: First, Outer, Inner, Last.

first	$(x+3)(x-2)$	$x \cdot x = x^2$
outside	$(x+3)(x-2)$	$x \cdot -2 = -2x$
inside	$(x+3)(x-2)$	$3 \cdot x = 3x$
last	$(x+3)(x-2)$	$3 \cdot -2 = -6$

$$x^2 - 2x + 3x - 6 = x^2 + x - 6$$

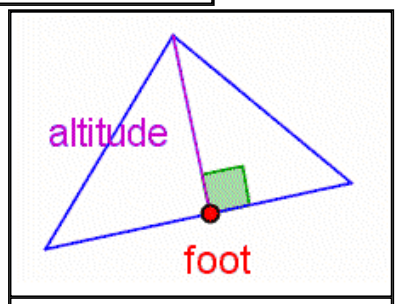
Foil Method

foot NOUN /fʊt/

1. a unit of measure of distance.

   $$12 \text{ in} = 1 \text{ ft}; \; 3 \text{ ft} = 1 \text{ yd};$$
   $$5280 \text{ ft} = 1 \text{ mile};$$
   $$1 \text{ foot} \approx 0.3048 \text{ meters}.$$

   Abbreviation: ft. Notation: ′. *Example:* In North America, the average man is about 6 feet tall.
2. (of an altitude) the point where an altitude of a triangle intersects the extended line of the opposite side.



Foot of an Altitude

Plural: feet /fit/.

force NOUN /fɔrs/ a force causes an object to move, or keeps it from moving. A force can be expressed as a vector since it has magnitude and direction. *Example:* the force of gravity.

form /fɔrm/

1. NOUN how something is written. *Example:* vertex form of a quadratic equation.
2. NOUN how something is expressed. *Example:* degree Fahrenheit is a form of temperature.
3. VERB to bring into being. *Example:* a line formed by two intersecting planes.

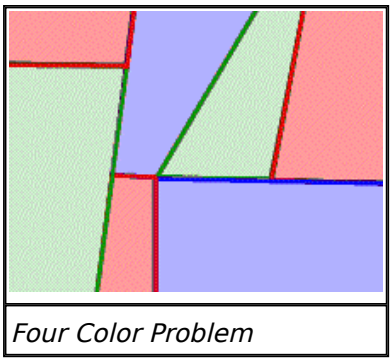
formula NOUN /'fɔr.myə.lə/ a rule, usually an equation, used to calculate a value. *Example:* the formula for the area of a circle is $A = \pi r^2$.

fortnight NOUN /'fɔrt.naɪt/ 14 days = 2 weeks.

forty ADJECTIVE, NOUN /'fɔr.ti/ the number 40.

four ADJECTIVE, NOUN /fɔr/ the number 4.

four-color problem NOUN /fɔr cʌlər 'prɒ.bləm/ a problem proposed that countries on a map could be colored using exactly four colors without adjacent countries having the same color.



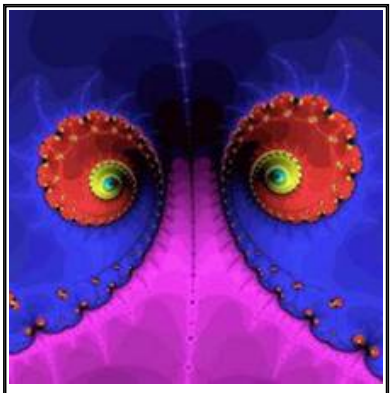
Four Color Problem

fourteen ADJECTIVE, NOUN /'fɔr.tin/ the number 14.

fourth ADJECTIVE /fɔrθ/

1. coming in position 4 in an ordered list. *Notation:* 4^{th}.
2. one of four equal parts; 1/4.

fractal NOUN /'fræk.tl/ a geometric object that has an irregular boundary and is self-similar at all scales. *Example:* the Sierpinski triangle.



Fractal. See Fractals

fractal geometry NOUN /'fræk.tl dʒi'ɒ.mɪ.tri/ a branch of geometry based on fractals.

fraction NOUN /'fræk.ʃən/

1. an expression divided by another expression. *Math definition:* $\frac{\text{numerator}}{\text{denominator}} = \text{numerator} \div \text{denominator}$. *Examples:* $\frac{5}{16}, \frac{x+3}{x-2}$.
2. part of a whole. *Example:* a fraction of a second.

fractional ADJECTIVE /'fræk.ʃə.nl/

1. having to do with fractions. *Example:* fractional exponent.
2. less than a whole. *Example:* fractional part.

fractional exponent NOUN /'fræk.ʃə.nl 'ɛks.poʊ.nənt/ an exponent written as a fraction where the numerator is a power and the denominator is a root. *Formula:* $x^{\frac{a}{b}} = \sqrt[b]{x^a} = \left(\sqrt[b]{x}\right)$. *Example:* $9^{\frac{3}{2}} = \left(\sqrt{9}\right)^3 = 3^3 = 27$.

fractional part NOUN /'fræk.ʃə.nl pɑrt/

1. the part of a number that is less than one. *Examples:* the fractional part of 3.15 is 0.15. The fractional part of $1\frac{3}{4}$ is $\frac{3}{4}$.
2. any part that is less than a whole.

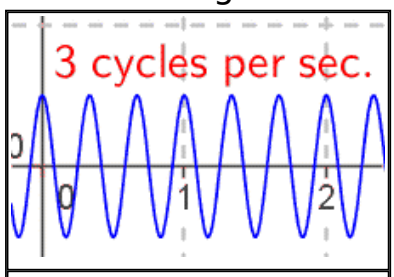
fraction bar NOUN /'fræk.ʃən bɑr/ the line segment between the numerator and denominator in a fraction. *Example:* $\frac{\text{numerator}}{\text{denominator}}$ ← fraction bar.

fraction rules NOUN /'fræk.ʃən rulz/ algebraic rules for working with fractions. *See Properties of Fractions.*

frame NOUN /freɪm/ a list of all individuals of a population being studied.

frequency NOUN /'fri.kwən.si/

1. (periodic functions) the number of cycles that happen each time period. *See also GeoApp!.*
2. (probability) the number of times an event happens compared to the total number of events.
3. (statistics) the number of occurrences in a category or an interval compared to the total sample.



Frequency

frequency distribution NOUN /'fri.kwən.si dɪ'strɪ.byu.ʃən/

1. a graph showing how many events happened in each category or interval.
2. the number of events happening in each category or interval.

frequency table NOUN /'fri.kwən.si 'teɪ.bəl/ a table that shows the frequency of occurrence of data values by category or interval.

frequent ADJECTIVE /'fri.kwənt/

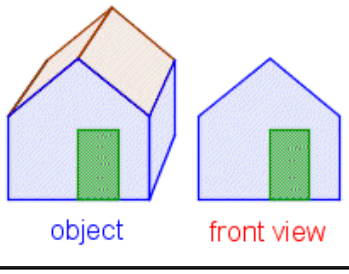
1. happening often.
2. happening at short intervals.

frequently ADVERB /'fri.kwənt.li/

1. often.
2. at short intervals. *Example:* disruption happens frequently.

front end digits NOUN /frʌnt ɛnd 'dɪdʒ.ɪtz/ the first one or more digits of a numeral. *Example:* In 1643.2, the three front end digits are 164.

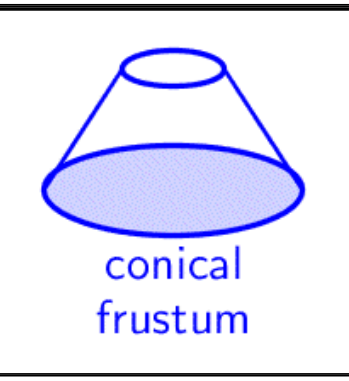
front view NOUN /frʌnt vyu/ the view from the front of an object.



Front View

frustum NOUN /'frʌs.təm/

1. a cone or pyramid with the top cut off parallel to the base. *See also Net!.*
2. the part of a solid between two parallel planes.

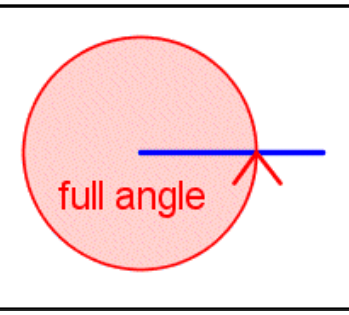


Conical Frustum

f/s ABBREVIATION *See feet per second.*

ft. ABBREVIATION *See foot.*

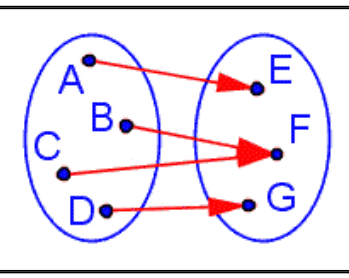
full angle NOUN /fʊl 'æŋ.gəl/ an angle that measures a full circle. A full angle measures $360°$ and 2π radians. *See also Angle Classes!.*



Full Angle

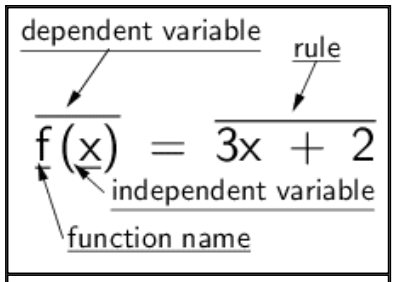
full circle NOUN /fʊl 'sɜr.kəl/ all the way around a circle. $360º$ or 2π rad.

function NOUN /'fʌŋk.ʃən/ a relation that has exactly one output for each input. *Examples:* $f(x) = \sin(x)$, $\{(1,3),(-2,1)\}$. *Synonym: injection.*



Function

function notation NOUN /'fʌŋk.ʃən noʊ'teɪ.ʃən/ a way to write functions that clarifies the name of the function, the independent variables, and the dependent variables.



Function Notation

function rule NOUN /'fʌŋk.ʃən rul/ an expression that transforms an independent variable into a dependent variable.

fundamental ADJECTIVE /ˌfʌn.də'mɛn.tl/ forming a base on which a large part depends. *Example:* Fundamental Theorem of Arithmetic.

Fundamental Counting Principle NOUN /ˌfʌn.də'mɛn.tl 'kaʊnt.iŋ 'prɪn.sə.pəl/ *See counting principle.*

Fundamental Theorem of Algebra NOUN /ˌfʌn.də'mɛn.tl 'θɪər.əm ʌv 'æl.dʒə.brə/ every non-constant single-variable polynomial with complex coefficients has at least one complex root.

Fundamental Theorem of Arithmetic NOUN /ˌfʌn.də'mɛn.tl 'θɪər.əm ʌv ə'rɪθ.mə.tɪk/ for all positive integers except 1, there exists a unique prime factorization. *Example:* the prime factorization of 12 is $2^2 \cdot 3$. There is no other prime factorization of 12.

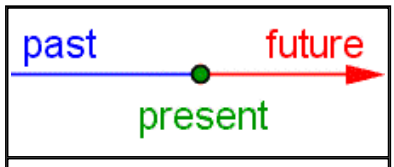
fundamental unit NOUN /ˌfʌn.də'mɛn.tl 'yu.nɪt/ one of the units of measure from which all other units of measure are derived: meter, kilogram, second, ampere, kelvin, candela, mole.

furlong NOUN /'fər.lɒŋ/ a unit of measure of distance.

Formulas: $1 \text{ furlong} = 220 \text{ yards} = 1/8 \text{ mile}$, $1 \text{ furlong} \approx 201\text{m}$.

future /'fyu.tʃər/

1. NOUN a period of time after now.
2. ADJECTIVE having to do with things that are to come.



Future

future value NOUN /'fyu.tʃər 'væl.yu/ the value of an investment at a particular time in the future.

G

g ABBREVIATION
1. *See gram.*
2. force of gravity on the earth's surface.

   $g \approx 9.81\ m/s^2$. *Example:* the force of gravity at the surface of the earth is $1g$.

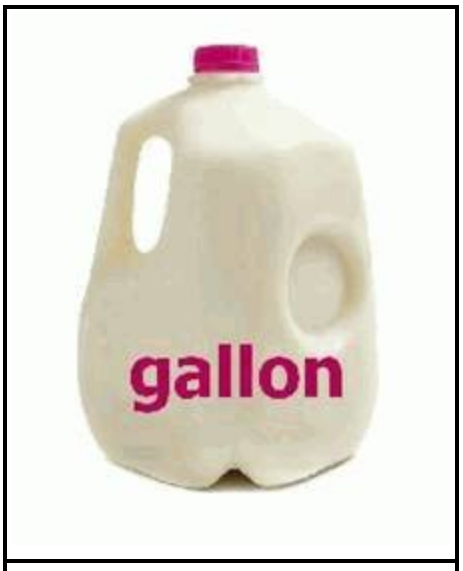
G ABBREVIATION
1. giga-. 10^9.
2. the universal gravitational constant.

   $G \approx 6.67384 \times 10^{-11}\ m^3/\ kg \cdot s^2$.

gain NOUN /geɪn/ an increase of value of an investment. Keyword for addition.
Formula: $investment + gain = new\ value$.
Example: post a gain of $100.

gal ABBREVIATION *See gallon.*

gallon NOUN /'gæl.ən/ a unit of measure of volume.
Abbreviation: gal.
Formulas: $1\ gal = 4\ quarts$, $1\ gal = 128\ fluid\ ounces$, $1\ gal \approx 3.78\ liters$.



Gallon

Gaussian ADJECTIVE /'gaʊz.i.n/ credited to or named after Johann Carl Friedrich Gauss.

Gaussian curve NOUN /ˈgaʊz.i.n kɜrv/ *See normal curve.*

Gaussian distribution NOUN /ˈgaʊz.i.n dɪˈstrɪ.byu.ʃən/ *See normal distribution.*

Gaussian elimination NOUN /ˈgaʊz.i.n ɪˌlɪm.əˈneɪ.ʃən/ a method for solving linear systems in matrices by 1) putting the matrix in row-echelon form, and 2) using back substitution.

Gaussian integer NOUN /ˈgaʊz.i.n ˈɪn.tɪ.dʒər/ a complex number $a+bi$ where a and b are both integers. *Example:* $3-2i$. *Synonym: complex integer.*

Gauss, Johann Carl Friedrich PERSON /gaʊs ˈyoʊ.hɑn kɑrl ˈfri.drɪk/ (1777-1855) a German mathematician and physicist. A unit of measure of magnetism (the gauss) and two similar methods for solving linear equations (Gaussian elimination and Gauss-Jordan elimination) are named after him.

Johann Carl Friedrich Gauss

Gauss-Jordan elimination NOUN /gaʊs ˈdʒɔr.dn ɪˌlɪm.əˈneɪ.ʃən/ a method for solving linear systems in matrices by putting the matrix in reduced row-echelon form.

gcd ABBREVIATION *See greatest common divisor.*

gcf ABBREVIATION *See greatest common factor.*

general ADJECTIVE /ˈdʒɛn.ər.əl/ applying to an entire class of objects. *Example:* general case.

general case NOUN /ˈdʒɛn.ər.əl keɪs/ a formula or principle that applies to an entire class of objects.

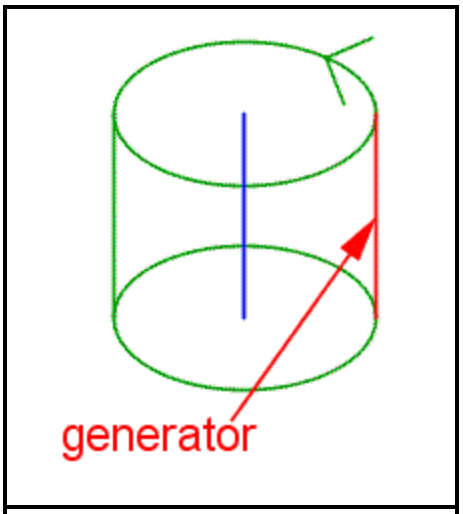
generalization NOUN /ˌdʒɛn.ər.ə.ləˈzeɪ.ʃən/ an application of a specific result to a larger case.

generalize VERB /ˈdʒɛn.ər.əˌlaɪz/ to take specific results and apply them to a larger class of objects.

generate VERB /ˈdʒɛn.ər.eɪt/ to create based on one or more rules. *Example:* generate the first 10 Fibonacci numbers.

generator NOUN /ˈdʒɛn.ər.eɪˌtər/

1. a line that, when given a specific movement, generates a figure.
2. (fractals) a figure that replaces an initiator in one iteration of a classical fractal.



Generator

geo- PREFIX /ˈdʒi.oʊ/

1. having to do with the Earth.
2. having to do with geometry.

geoboard NOUN /ˈdʒi.oʊ.bɔrd/ a board with pegs on it on which geostrips or rubber bands are strung to demonstrate geometric principles.

geodesic ADJECTIVE /ˌdʒi.əˈdɛs.ɪk/ having to do with the shortest distance between two points on a non-planar surface.

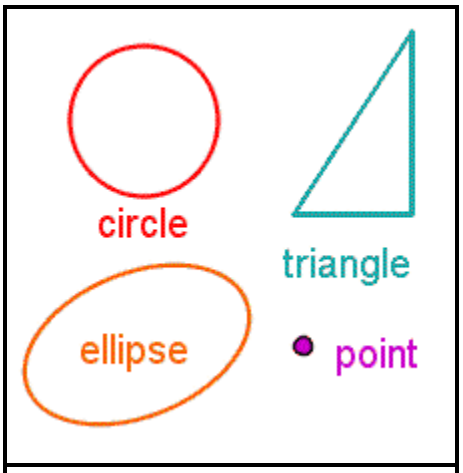
GeoGebra NOUN /ˌdʒiˈoʊ.dʒə.brə/ free interactive geometry software. See http://www.geogebra.org.

geometric ADJECTIVE /ˌdʒi.əˈmɛt.rɪk/

1. having to do with geometry. *Example:* geometric net.
2. having to do with multiplication. *Example:* geometric sequence.
3. having to do with exponentiation. *Example:* geometric growth.

geometric average NOUN /ˌdʒi.əˈmɛt.rɪk ˈæv.rɪdʒ/ *See* *geometric mean*.

geometric figure NOUN /ˌdʒi.əˈmɛt.rɪk ˈfɪg.yər/ a set of one or more points in n-space.

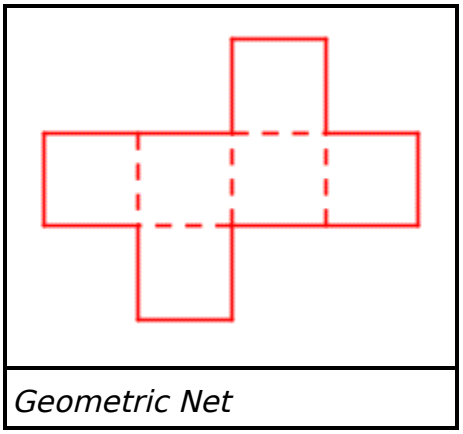


Geometric Figures

geometric growth NOUN /ˌdʒi.əˈmɛt.rɪk groʊθ/ *See* *exponential growth*.

geometric mean NOUN /ˌdʒi.əˈmɛt.rɪk min/ the n^{th} root of the product of all of the numbers in a set. *Formula:* $mean\left(\{a_1, a_2, \ldots, a_n\}\right) \sqrt[n]{a_1 \cdot a_2 \cdot \ldots \cdot a_n}$. *Example:* $mean\left(\{1, 4, 6, 7\}\right) = \sqrt[4]{1 \cdot 4 \cdot 6 \cdot 7} = \sqrt[4]{168} \approx 3.6002$. *Synonym:* *geometric average*.

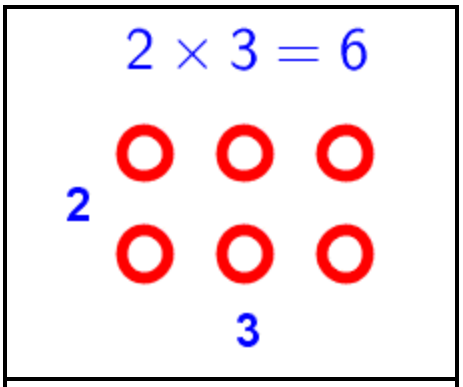
geometric net NOUN /ˌdʒi.əˈmɛt.rɪk nɛt/ a 2-dimensional shape that folds into a 3-dimensional shape. *See also* *Net!*.


Geometric Net

geometric probability NOUN /ˌdʒi.əˈmɛt.rɪk ˌprɒb.əˈbɪl.ɪ.ti/ uses the principles of area to find the probability of an event. *Example:* the probability of a 2×2 piece of paper being hit by a raindrop.

geometric progression NOUN /ˌdʒi.əˈmɛt.rɪk proʊˈgrɛ.ʃən/ *See geometric sequence.*

geometric representation NOUN /ˌdʒi.əˈmɛt.rɪk ˌrɛp.rɪ.zɛnˈteɪ.ʃən/ a drawing based on geometry that illustrates or clarifies a mathematical truth. *Example:* A geometric representation of multiplication of integers is rows and columns of dots.

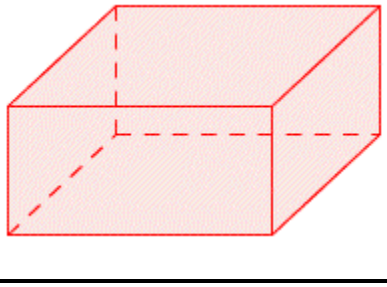


Geometric Representation

geometric sequence NOUN /ˌdʒi.əˈmɛt.rɪk ˈsi.kwəns/ a sequence of numbers that have a common ratio. *Formula:* $n_i = r \cdot n_{i-1}$ where n_i is the ith term, r is the common ratio, and n_{i-1} is the term before the ith term. *Example:* $\{1,3,9,27,81,\ldots\}$ has a common ratio of 3 $(1 \cdot 3 = 3, 3 \cdot 3 = 9, \ldots)$. *Synonym: geometric progression.*

geometric series NOUN /ˌdʒi.əˈmɛt.rɪk ˈsɪər.iz/ the sum of all the terms of a geometric sequence. *Formula:* A geometric sequence with a common ratio greater than 0 and less than 1 converges to the value $S = a \frac{1}{1 - r}$ where a is the value of the first term of the series and r is the common ratio. *Example:* the sum of the geometric sequence $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8} \ldots$ is $S = 1 \frac{1}{1 - \frac{1}{2}} = 1 \frac{1}{\frac{1}{2}} = 1 \frac{1 \cdot 2}{\frac{1}{2} \cdot 2} = \frac{1 \cdot 2}{1} = 2$. *Plural: geometric series.*

geometric solid NOUN /ˌdʒi.əˈmɛt.rɪk ˈsɒl.ɪd/ a 3-dimensional geometric figure. *Synonym: solid.*



Geometric Solid

geometric space NOUN /ˌdʒi.əˈmɛt.rɪk speɪs/ *See space.*

geometric transformation NOUN /ˌdʒi.əˈmɛt.rɪk ˈtræns.fərˌmeɪ.ʃən/ *See transformation.*

geometry NOUN /dʒiˈɒ.mɪ.tri/ the study of points, lines and other shapes in space.

geostrip NOUN /ˈdʒi.oʊ.strɪp/ a straight piece of plastic with holes in it that fits on a geoboard.

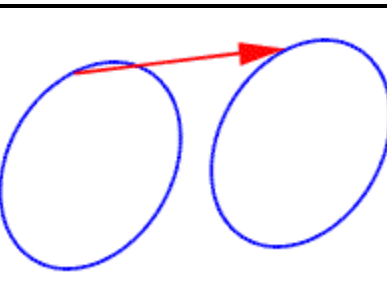
giga- PREFIX /ˈgɪg.ə/ $10^9 = 1{,}000{,}000{,}000$.
Abbreviation: G, definition 1.
Example: 3 gigahertz $= 3 \times 10^9$ hertz.
Synonym: billion.

given /ˈgɪv.ən/

1. PREPOSITION knowing that the criterion is true ....
   Example: given $a = b$ ....
2. NOUN a known value.
3. NOUN a criterion.

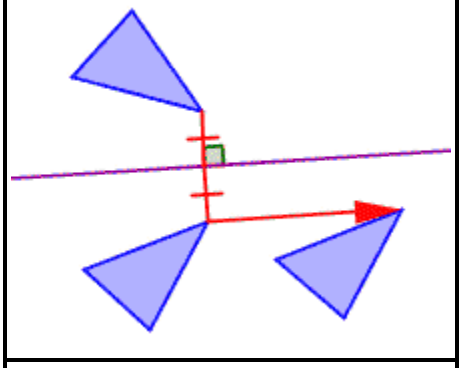
glide /glaɪd/

1. VERB to slide along a straight line for a certain distance.
2. NOUN *See translation, definition 1.*



Glide

glide reflection NOUN /glaɪd rɪ'flɛk.ʃən/ a transformation that "flips" an object over a line, then slides the object along the line. *See also reflection.*

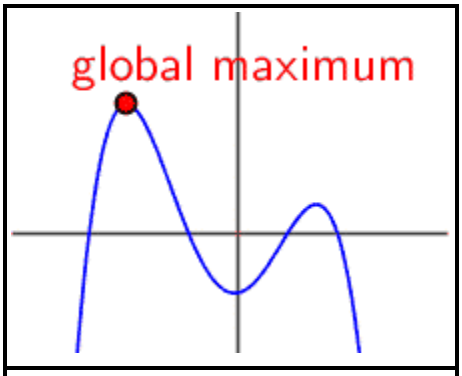


Glide Reflection

glide reflection symmetry NOUN /glaɪd rɪ'flɛk.ʃən 'sɪm.ɪ.tri/ two objects have glide reflection symmetry if a glide reflection will place one identically on top of the other.

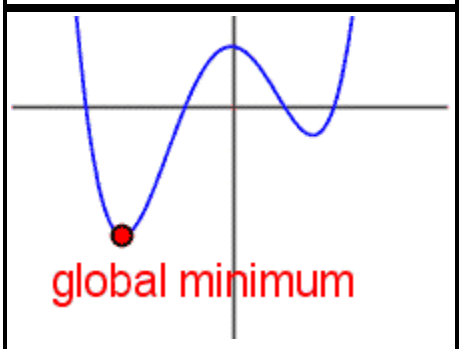
global ADJECTIVE /'gloʊ.bəl/ applying to a whole. *Example:* global maximum. *Antonym: local.*

global maximum NOUN /'gloʊ.bəl 'mæk.sə.məm/ the greatest value in the range of a function. *Synonym: absolute maximum. See also local maximum.*



Global Maximum

global minimum NOUN /'gloʊ.bəl 'mɪn.ə.məm/ the least value in the range of the function. *Synonym: absolute minimum. See also local minimum.*



Global Minimum

GMT ACRONYM *See Greenwich Mean Time.*

Goldbach's conjecture NOUN /ˈgold.bɑks kənˈdʒɛk.tʃər/ every even integer greater than 2 can be written as the sum of two prime numbers. This conjecture has not been proved or disproved.

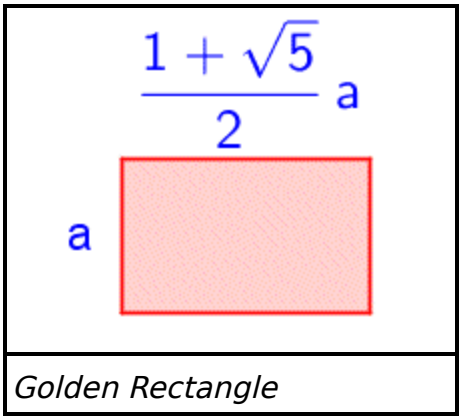
golden ratio NOUN /ˈgoʊl.dən ˈreɪ.ʃoʊ/ a ratio between two numbers such that the ratio between the sum of the numbers and the larger number is equal to the ratio between the larger number and the smaller. *Formula:*

$$\phi = \frac{a+b}{b} = \frac{a}{b}, \phi = \frac{1+\sqrt{5}}{2} \approx 1.618.$$

Synonyms: golden section, golden mean, golden proportion, golden number. See also GeoApp!.

golden rectangle NOUN /ˈgoʊl.dən ˈrɛkˌtæŋ.gəl/ a rectangle where the ratio of the length of adjacent sides is equal to the golden ratio:

$$\phi = \frac{1+\sqrt{5}}{2} \approx 1.618.$$

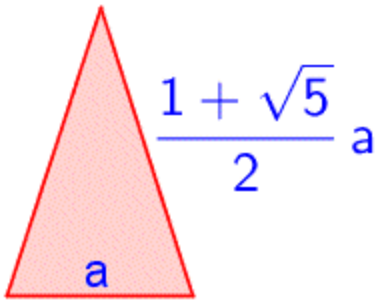


Golden Rectangle

golden section NOUN /ˈgoʊl.dən ˈsɛk.ʃən/ *See golden ratio.*

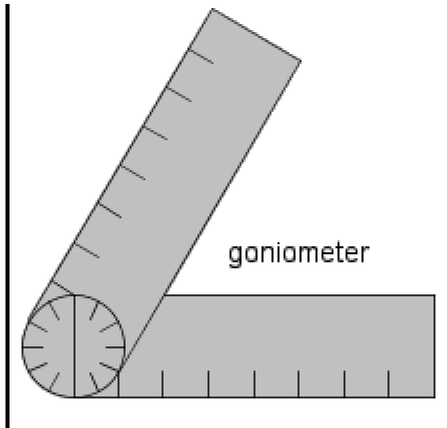
golden triangle NOUN /ˈgoʊl.dən ˈtraɪˌæŋ.gəl/ an isosceles triangle where the ratio of the length of the sides to the base is equal to the golden ratio:

$$\phi = \frac{1+\sqrt{5}}{2} \approx 1.618.$$



Golden Triangle

goniometer NOUN /ˌgoʊ.niˈɒm.ɪ.tər/ an instrument that measures angles.



Goniometer

googol NOUN /ˈgug.gɔl/ a very large number equaling $10^{100} = 10,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000,000$

googolplex NOUN /ˈgu.gɔlˌplɛks/ an extremely large number. *Formula:* $1 \text{ googolplex} = 10^{\text{googol}} = 10^{10^{100}}$.

gradian NOUN /ˈgreɪ.di.n/ a measure of an angle. *Formula:* $1 \text{ gradian} = 1/400$ of a full circle.

gradient NOUN /ˈgreɪ.di.ənt/

1. *See slope.*
2. the slope of a curve at a point.

graduated ADJECTIVE /ˈgræ.dyu.eɪ.təd/ having marks used for measurement.

gram NOUN /græm/ a unit of measure of mass. *Abbreviation: gr. Formulas:* $1000 \text{ grams} = 1 \text{ kilogram}$, $1 \text{ gram} \approx 0.0022 \text{ pounds}$.

graph /græf/

1. NOUN a drawing showing an algebraic relation.

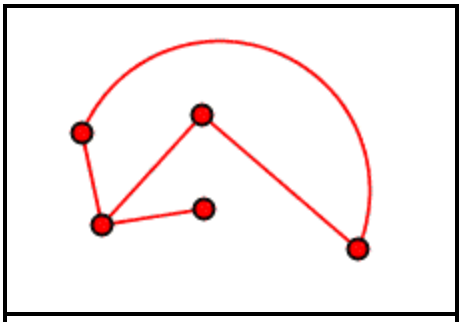
2. NOUN a set of lines and points that represent a geometric network. *See also geometric net.*
3. NOUN a visual representation of data. *See also chart.*
4. VERB to draw on a graph.

graphing ADJECTIVE /'græf.iŋ/ having to do with the construction of a graph.

graphing calculator NOUN /'græf.iŋ 'kæl.kyəˌleɪ.tər/ a calculator that plots graphs of functions on a screen.

graphing window NOUN /'græf.iŋ 'wɪn.doʊ/ the portion of a graph that can be seen, especially in graphing calculators and graphing software.

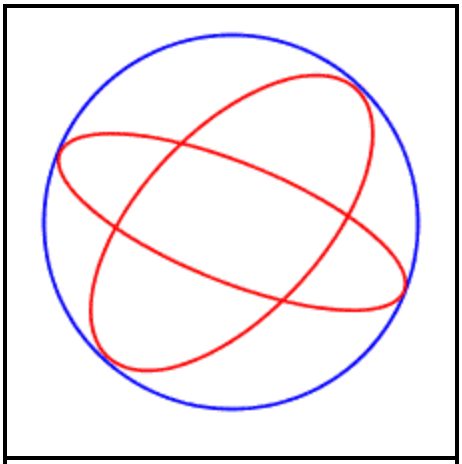
graph theory NOUN /græf 'θɪər.i/ the study of nodes and the paths that connect those nodes.



Network Graph

great ADJECTIVE /greɪt/ large or important.

great circle NOUN /greɪt 'sɜr.kəl/ a circle on the surface of a sphere that divides the sphere into two half-spheres. *Antonym: small circle.*



Great Circle

greater ADJECTIVE /'greɪ.tər/

1. more positive than. *Notation:* $>$. *Example:* $5 > 3$.
2. larger or more important than.

Greater

greatest ADJECTIVE /'greɪt.est/ (American English)
1. most positive.
2. largest or most important.

Synonym: highest (primarily British English).

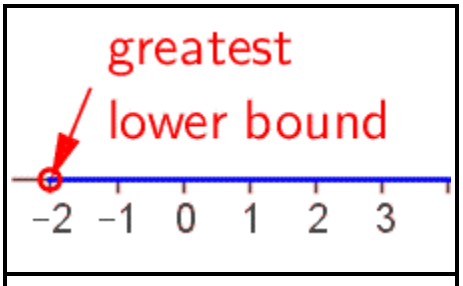
greatest common divisor NOUN /'greɪt.est 'kɒm.ən dɪ'vaɪ.zər/ (American English) the greatest common factor of two divisors. *Abbreviation: gcd. Synonym: highest common divisor* (British English). *See also greatest common factor.*

greatest common factor NOUN /'greɪt.est 'kɒm.ən 'fæk.tər/ (American English) the largest number or expression of highest degree that divides evenly into two or more numbers or expressions. *Abbreviation: gcf.*

Examples: $\gcf((x + 2)(x - 3)(x + 1)(x - 3))$ is $x - 3$, $\gcf((x + 2)(x - 3)(x + 1)(x - 3))$ is $x - 3$. *Synonym: highest common factor* (British English).

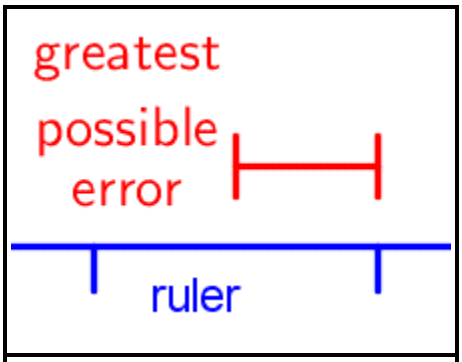
greatest integer function NOUN /'greɪt.est 'ɪn.tɪ.dʒər 'fʌŋk.ʃən/ *See ceiling function.*

greatest lower bound NOUN /'greɪt.est 'loʊ.ər baʊnd/ the greatest number that is less than or equal to all members of a set of numbers. *Synonym: infimum.*



Greatest Lower Bound

greatest possible error NOUN /'greɪt.est 'pɑs.ɪ.bəl 'ɛr.ər/ half of the smallest measurement division on an measuring instrument. *Example:* if a ruler is marked in centimeters, the greatest possible error is ½ centimeter.

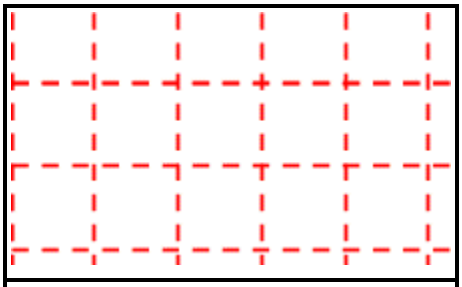


Greatest Possible Error

Greek letters NOUN /grik 'lɛt.ərz/ ancient Greek letters are used for special variables and constants. *See also Greek Letters.*

Greenwich Mean Time NOUN /'grɪn.ɪdʒ min taɪm/ the mean solar time at the Royal Observatory in Greenwich, England. This standard has been replaced by the Coordinated Universal Time (CUT). *Acronym: GMT.*

grid NOUN /grɪd/ regularly spaced lines at right angles used as guide lines for graphs and figures.


Grid

grid paper NOUN /grɪd 'peɪ.pər/ paper with grid lines printed on it used for drawing graphs and figures.

gross NOUN /groʊs/
1. an amount before deductions.
2. 12 dozen; 144.

gross profit NOUN /groʊs 'prɑf.ɪt/ profit on sales before any deductions *not* directly related to the sales. *Formula:* gross profit – expenses = net profit.

gross weight NOUN /groʊs weɪt/ the weight of a container including its packaging and contents. *Formula:* gross weight – tare = net weight.

group /grup/

1. NOUN (Set Theory) a set with an operation defined on members of the set. The operation must meet the requirements of closure, associativity, identity and invertibility. *Example:* the set of real numbers under addition is a group.
2. NOUN (Statistics) a sample of a population used in a study. *Example:* control group.
3. VERB (Statistics) to gather things into sets based on some criterion.
4. NOUN a collection of objects.

grouping /ˈgrup.ɪŋ/

1. ADJECTIVE how objects are grouped together.
2. NOUN a set of objects that have been grouped together.

grouping property of addition NOUN /ˈgrup.ɪŋ ˈprɒ.pər.ti ʌv əˈdɪ.ʃən/ *See Associative Property of Addition.*

grouping property of multiplication NOUN /ˈgrup.ɪŋ ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən/ *See Associative Property of Multiplication.*

grouping symbol NOUN /ˈgrup.ɪŋ ˈsɪm.bəl/ one of parenthesis (), bracket [] or brace {}.

growth NOUN /groʊθ/ an increase in quantity. Keyword for addition or multiplication. *Example:* arithmetic growth.

growth factor NOUN /groʊθ ˈfæk.tər/ a factor indicating the speed of growth in an exponential equation. *Example:* b in $y = ab^x$ where $a > 0$ and $b > 1$.

guess and check NOUN /gɛs ænd tʃɛk/ *See trial and error.*

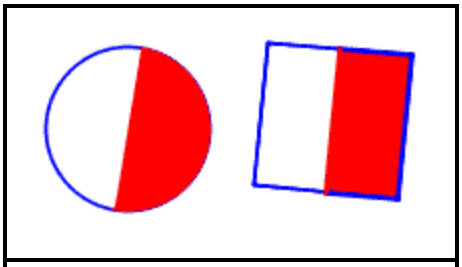
H

h ABBREVIATION
1. hecto-
2. hour

ha ABBREVIATION hectare.

half /hæf/
1. NOUN one of two equal portions. *Notation: ½.*
2. ADJECTIVE an amount divided by 2.

Plural: halves /hævz/*.*
Antonym: double.

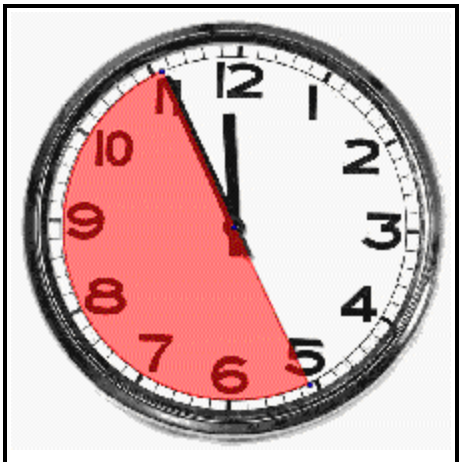


Half

half-angle identities NOUN /hæf 'æŋ.gəl aɪ'dɛnˌtɪ.tiz/ trigonometric identities for half-angles. *See also Trigonometric Identities.*

half-dollar NOUN /hæf 'dɒl.ər/ a coin worth ½ of a dollar or 50 cents.

half-hour NOUN /hæf 'aʊ.ər/ ½ of an hour or 30 minutes.

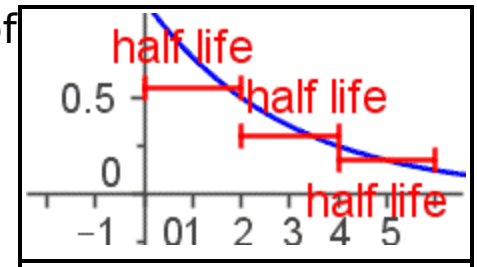


half-hour

half-life NOUN /hæf laɪf/ the amount of time in which ½ of a substance is decayed, metabolized, or used up.

Formula: $h(x) = I_0 \left(\frac{1}{2}\right)^{\frac{t}{h}}$

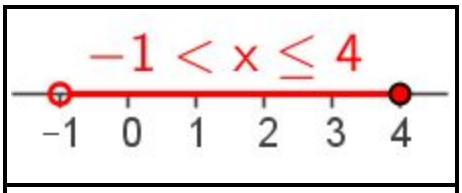
where I_0 is the initial quantity, t is the elapsed time and h is the half life. t and h must use the same units of time. *Plural: half-lifes* /'hæf,laɪfs/.



half-Life

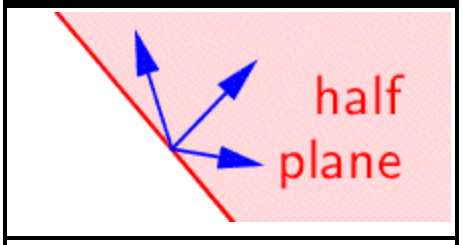
half-line NOUN /hæf laɪn/ *See ray.*

half open interval NOUN /hæf 'oʊ.pən 'ɪn.tər.vəl/ an interval is half open if it is open on one side and closed on the other. *Example:* $\{x \mid x > 3\}$.



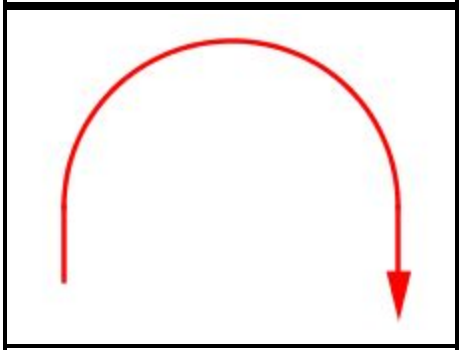
Half Open Interval

half-plane NOUN /hæf pleɪn/ half of a plane with a line for an edge.



Half-Plane

half-turn NOUN /hæf 'tɜrn/ a rotation through half of a circle. A 180° turn.


Half-Turn

halve VERB /'hæv/

1. *See bisect.*
2. to divide by two. *Antonym: double.*

harmonic mean NOUN /hɑr'mɒn.ɪk min/ *Formula:* for $\{x_1, x_2, \ldots, x_n\}$, the harmonic mean is $H = \frac{n}{\frac{1}{x_1} + \frac{1}{x_2} + \cdots + \frac{1}{x_n}}$.

harmonic sequence NOUN /hɑr'mɒn.ɪk 'si.kwəns/ the sequence $1, \frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \ldots$.

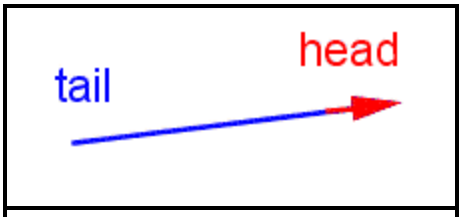
harmonic series NOUN /hɑr'mɒn.ɪk 'sɪər.iz/ the divergent series $1 + \frac{1}{2} + \frac{1}{3} + \frac{1}{4} + \cdots = \sum_{k=1}^{\infty} \frac{1}{k}$

Plural: harmonic series.

hash mark NOUN /hæʃ mɑrk/ *See tally mark.*

hcf ABBREVIATION highest common factor (British English). *See greatest common factor (American English).*

head NOUN /hɛd/ where the vector ends; the arrow point of the vector.



Head of a Vector

hectare NOUN /'hɛk.tɛər/ a unit of measure of area equaling 10,000 square meters.

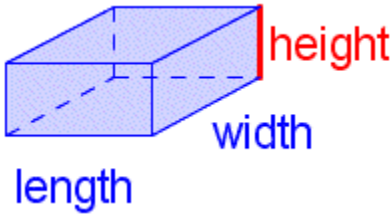
Formula: $1 \text{ hectare} \approx 2.47 \text{ acres}$.

hecto- PREFIX /'hɛk.tə/ $10^2 = 100$. *Abbreviation: h, definition 1. Example:* $3 \text{ hectograms} = 3 \times 10^2 \text{ grams} = 300 \text{ grams}$. *Synonym: hundred.*

heft /hɛft/

1. NOUN weight; heaviness.
2. VERB to estimate weight by lifting.

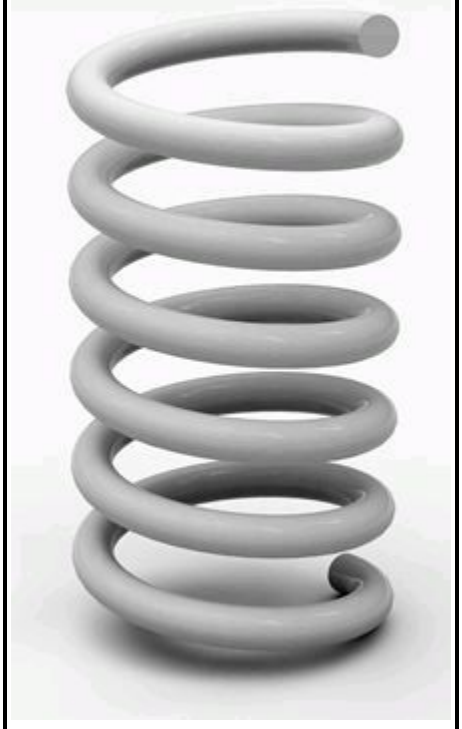
height NOUN /haɪt/
1. any vertical measure of distance.
2. the length of an altitude.
3. a measurement of distance at right angles to length and width.



Height

helix NOUN /ˈhi.lɪks/ a curve formed by wrapping a wire around a cylinder.

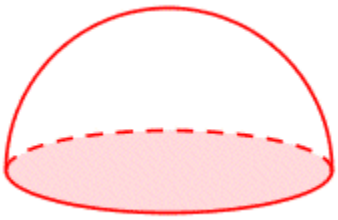
Equation: $x = a \sin \theta$, $y = a \cos \theta$, $z = b\theta$.



Helix

hemi- PREFIX /ˈhɛm.ɪ/ half. *Example:* hemisphere.

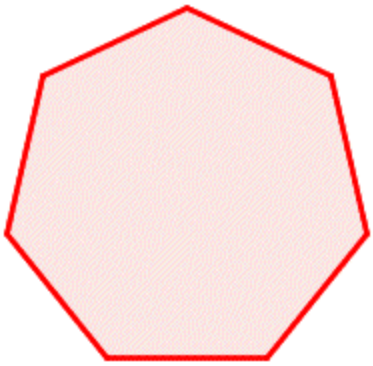
hemisphere NOUN /ˈhɛm.ɪˌsfɪər/ exactly one half of a sphere; a sphere cut in two by a plane passing through the center of the sphere.



Hemisphere

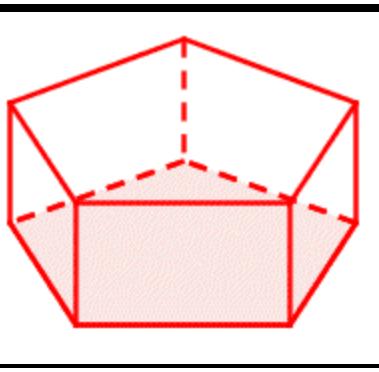
hepta- PREFIX /ˈhɛp.tə/ seven. *Example:* heptahedron.

heptagon NOUN /ˈhɛp.təˌgɒn/ any seven-sided polygon.



Heptagon

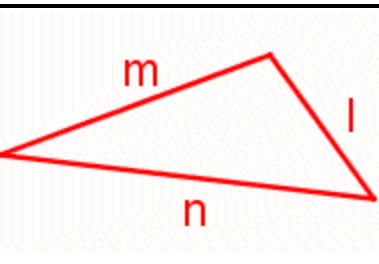
heptahedron NOUN /ˌhɛp.tə'hi.drən/ any polyhedron with seven faces. *Example:* pentagonal prism. *See also* *Net!*.



Heptahedron

Heron of Alexandria PERSON /'hɛr.ən ʌv ˌæl.ɪg'zæn.dri.ə/ (ca. 10-ca. 75) a mathematician from Alexandria, Egypt who discovered Heron's formula for the area of a triangle.

Heron's formula NOUN /'hɛr.ənz 'fɔr.myə.lə/ a formula for the area of a triangle given the lengths of the sides. *Formula:* $s = \frac{l+m+n}{2}$, $A = \sqrt{s(s-l)(s-m)(s-n)}$. *Synonym:* *Hero's formula*.



Heron's Formula

Hero's formula NOUN /'hɪər.oʊz 'fɔr.myə.lə/ *See* *Heron's formula*.

heuristic ADJECTIVE /hyʊ'r.ɪs.tɪk/ involving trial and error; involving guess and check. *Antonyms: empirical, theoretical, definition 3.*

heuristic method NOUN /hyʊ'r.ɪs.tɪk 'mɛθ.əd/ a method of solving a problem that involves trial and error. *Antonym: algorithm.*

hex ABBREVIATION *See hexadecimal.*

hexa- PREFIX /'hɛk.sə/ six. *Example:* hexagon.

hexadec- PREFIX /ˌhɛk.sə'dɛs/ sixteen. *Example:* hexadecimal.

hexadecimal /ˌhɛk.sə'dɛs.ə.məl/

1. ADJECTIVE having to do with a base 16 numeration system.

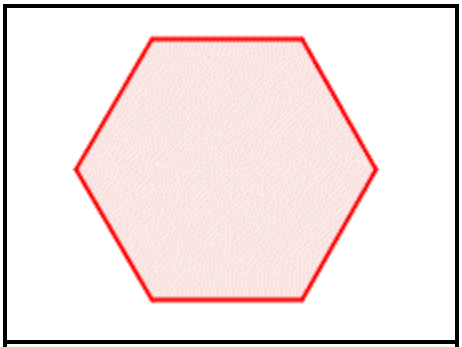
   Example: $2\mathrm{F0B}_{16} = 2\times16^3 + 15\times16^2 + 0\times16+11 = 12043_{10}$.

2. NOUN the hexadecimal numeration system.

Abbreviation: hex.

hexadecimal digit NOUN /ˌhɛk.sə'dɛs.ə.məl 'dɪdʒ.ɪt/ a digit used in hexadecimal numeration: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A=10, B=11 C=12, D=13, E=14, F=15.

hexagon NOUN /'hɛk.səˌgɒn/ any six sided polygon.

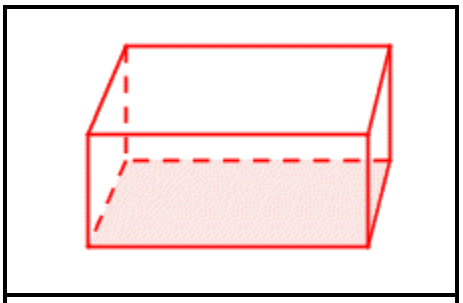


Hexagon

hexagonal ADJECTIVE /'hɛk.səˌgɒn.l/

1. having to do with a hexagon.
2. including a hexagon. *Example:* hexagonal pyramid.
3. shaped like a hexagon.

hexahedron NOUN /ˌhɛk.səˈhid.rən/ any polyhedron with six faces and six vertices. A regular hexahedron is a cube.



Hexahedron

higher ADJECTIVE /ˈhaɪ.ər/ *See greater.*

highest ADJECTIVE /ˈhaɪ.ɛst/ (British English) *See greatest (primarily American English).*

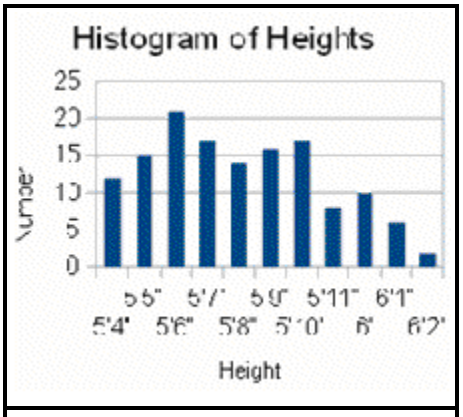
highest common factor NOUN /ˈhaɪ.ɛst ˈkɒm.ən ˈfæk.tər/ (British English) (British English) *See greatest common factor.*

Hilbert, David PERSON /ˈhɪl.bərt ˈdeɪ.vɪd/ (1862-1943) a Prussian mathematician who reorganized Euclidean Geometry into what is now called Modern Geometry.

Hindu NOUN /ˈhɪn.du/ having to do with the people of northern India.

Hindu-Arabic numerals NOUN /ˈhɪn.du ˈær.ə.bɪk ˈnum.rəlz/ *See Arabic numerals.*

histogram NOUN /ˈhɪs.təˌgræm/ a bar graph where the height of a rectangle shows frequency.



Histogram

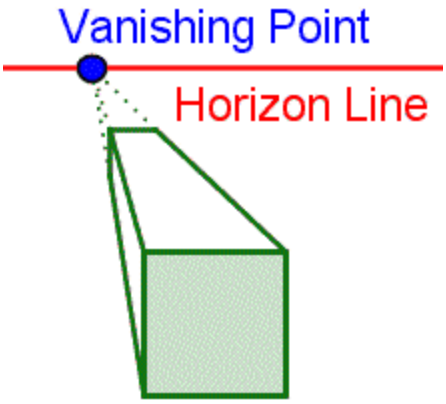
homo- PREFIX /ˈhoʊ.moʊ/ the same in some way.

homogeneous ADJECTIVE /ˌhoʊ.məˈdʒi.ni.əs/ having some property in common.

horizon NOUN /hə'raɪ.zən/ the apparent boundary between the Earth and the sky.

Horizon

horizon line NOUN /hə'raɪ.zən laɪn/ a line used in a perspective view where objects seem to disappear into the distance. *See also GeoApp!.*



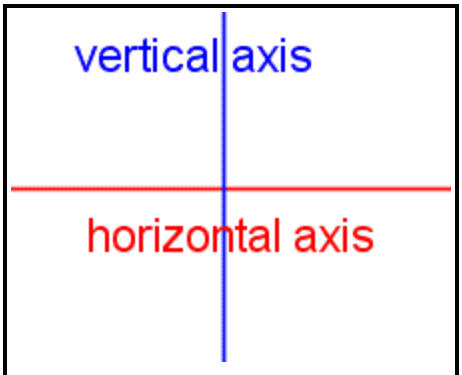
Horizon Line

horizontal /ˌhɔr.ə'zɒn.tl/

1. ADJECTIVE parallel with the x-axis.
2. ADJECTIVE parallel with the horizon.
3. ADJECTIVE goes from left to right or from right to left, *not* up and down.
4. NOUN a horizontal line or a horizontal line segment.

Antonym: vertical.

horizontal axis NOUN /ˌhɔr.ə'zɒn.tl 'æk.sɪs/ in a rectangular coordinate system, the axis that goes from side to side. *Synonyms: x-axis, real axis. Antonym: vertical axis.*

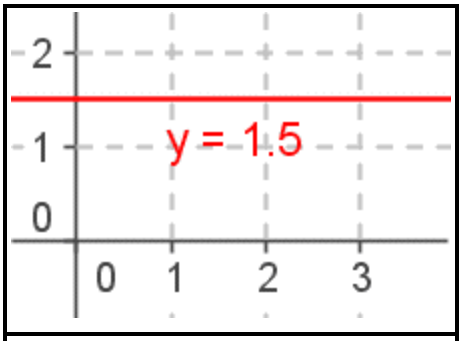


Horizontal Axis

horizontal intercept NOUN /ˌhɔr.əˈzɒn.tl ˈɪn.təˌsɛpt/ *See x-intercept.*

horizontal line NOUN /ˌhɔr.əˈzɒn.tl laɪn/

1. a line that is parallel with the x-axis. *Equation:* $y = a$. *Example:* $y = 5$.
2. a line that is parallel with the horizon.



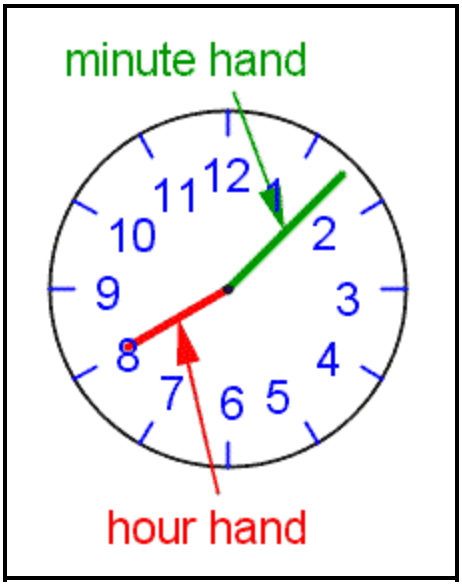
Horizontal Line

hour NOUN /ˈaʊ.ər/ a unit of measure of time. *Abbreviation: h.*

Hour

Formulas: $1 \text{ hour} = 60 \text{ minutes}$, $1 \text{ day} \approx 24 \text{ hours}$.

hour hand NOUN /ˈaʊ.ər hænd/ the smaller hand on an analog clock that points to the current hour.



Hour Hand

hundred ADJECTIVE, NOUN /ˈhʌn.drɛd/ 100. *Synonym: hecto-.*

hundredth ADJECTIVE, NOUN /ˈhʌn.drɛθ/

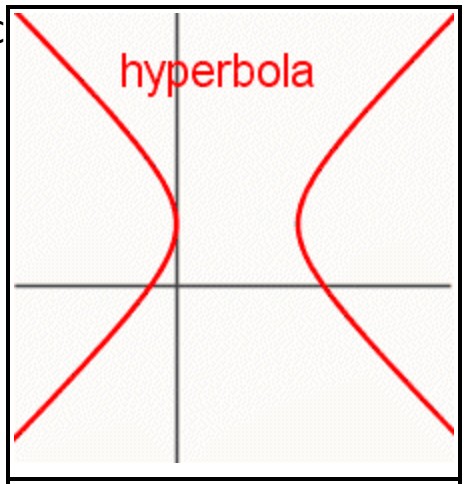
1. coming in position 100 in an ordered list. *Notation: 100^{th}.*
2. one of one hundred equal parts. 1/100. *Synonym: centi-.*

hyper- PREFIX /ˈhaɪ.pɜr/

1. over.
2. above.
3. beyond.
4. an extension of a 3-dimensional figure to 4 or more dimensions. *Example:* hypersphere.

hyperbola NOUN /haɪˈpɜr.bə.lə/ a conic section formed by intersecting a plane with both halves of a right double cone; all points in a plane where the difference of the distances between two points is constant. *Equation:* $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$.

See also GeoApp!.



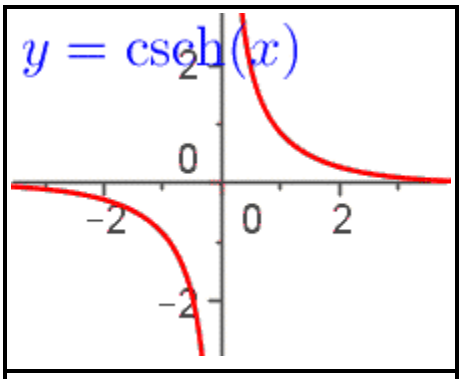
Hyperbola

hyperbolic ADJECTIVE /ˌhaɪ.pərˈbɒl.ɪk/ having to do with a hyperbola.

hyperbolic cosecant NOUN /ˌhaɪ.pər'bɒl.ɪk koʊ'si.kænt/ a function based on the ratios of line segments between the origin and a unit hyperbola; the multiplicative inverse of the hyperbolic sine. *Abbreviation: csch. Equation:*

$$\operatorname{csch}\, x = \frac{1}{\sinh\, x} = \frac{2}{e^x - e^{-x}}.$$

Inverse: arc hyperbolic cosecant.

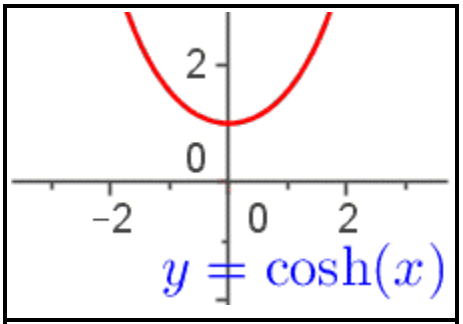


Hyperbolic Cosecant

hyperbolic cosine NOUN /ˌhaɪ.pər'bɒl.ɪk 'koʊ.saɪn/ a function based on the ratios of line segments between the origin and a unit hyperbola. *Abbreviation: cosh.*

Equation: $\cosh\, x = \frac{e^x - e^{-x}}{2}.$

Inverse: arc hyperbolic cosine.

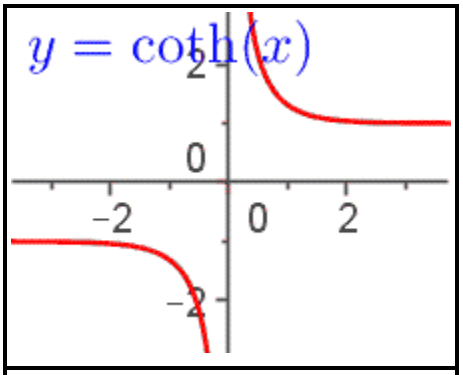


Hyperbolic Cosine

hyperbolic cotangent NOUN /ˌhaɪ.pər'bɒl.ɪk 'koʊ.tæn.dʒənt/ a function based on the ratios of line segments between the origin and a unit hyperbola; the multiplicative inverse of the hyperbolic tangent. *Abbreviation: coth. Equation:*

$$\coth\, x = \frac{\sinh\, x}{\cosh\, x} = \frac{e^{2x} + 1}{e^{2x} - 1}.$$

Inverse: arc hyperbolic cotangent.



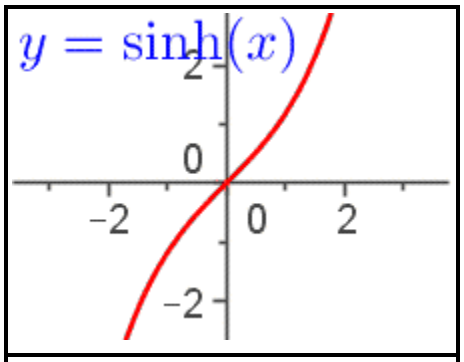
Hyperbolic Cotangent

hyperbolic function NOUN /ˌhaɪ.pər'bɒl.ɪk 'fʌŋk.ʃən/ a function based on the hyperbola similar to the trigonometric functions. *Examples:* hyperbolic sine, hyperbolic cosine.

hyperbolic secant NOUN /ˌhaɪ.pər'bɒl.ɪk 'si.kænt/ a function based on the ratios of line segments between the origin and a unit hyperbola; the multiplicative inverse of the hyperbolic cosine. *Abbreviation: sech. Equation:*

$$\operatorname{sech} x = \frac{1}{\cosh x} = \frac{2}{e^x + e^{-x}}.$$

Inverse: arc hyperbolic secant.

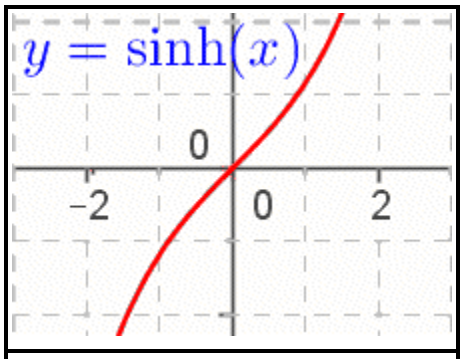


Hyperbolic Secant

hyperbolic sine NOUN /ˌhaɪ.pər'bɒl.ɪk saɪn/ a function based on the ratios of line segments between the origin and a unit hyperbola. *Abbreviation: sinh. Equation:*

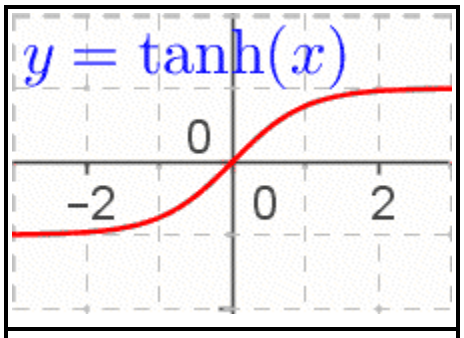
$$\sinh x = \frac{1}{2}\left(e^x + e^{-x}\right).$$

Inverse: arc hyperbolic sine.



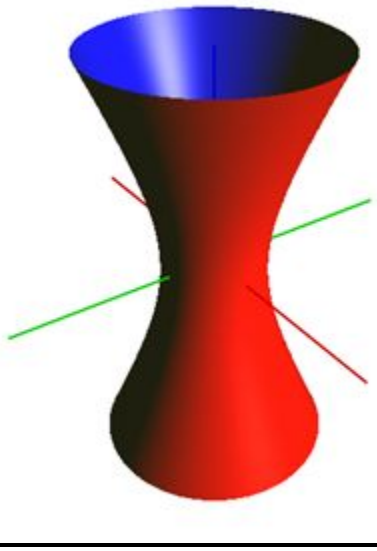
Hyperbolic Sine

hyperbolic tangent NOUN /ˌhaɪ.pər'bɒl.ɪk 'tæn.dʒənt/ a function based on the ratios of line segments between the origin and a unit hyperbola. *Abbreviation: tanh. Equation:* $\tanh x = \frac{\sinh x}{\cosh x} = \frac{e^{2x} - 1}{e^{2x} + 1}$. *Inverse: arc hyperbolic tangent.*



Hyperbolic Tangent

hyperboloid NOUN /haɪ'pɜr.bəˌlɔɪd/ a 3-dimensional figure created by rotating a hyperbola around an axis.



Hyperboloid

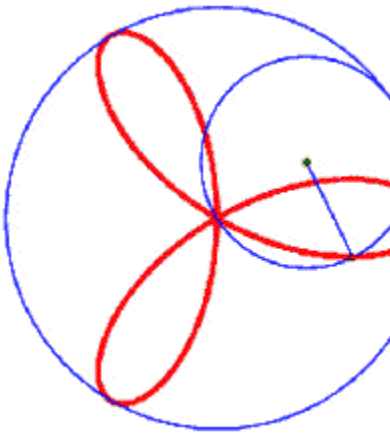
hypercube NOUN /haɪˈpɜr.kyub/ a cube extended to a fourth dimension; a four-dimensional figure bounded by 6 cubes. *Synonyms: tesseract, 4-cube. See also GeoApp!.*

hyperplane NOUN /ˈhaɪ.pɜr.pleɪn/ a plane extended to three or more dimensions. *Formula:* $\mathrm{a}x + \mathrm{b}y + \mathrm{c}z = \mathrm{d}$.

hypersphere NOUN /ˈhaɪ.pɜr.sfɪər/ a sphere extended to a four or more dimensions; the set of all points in four or more dimensions that are equidistant from a center point.

hypo- PREFIX /haɪˈpoʊ/ under.

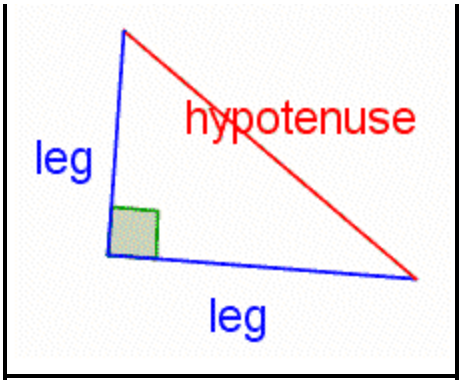
hypocycloid NOUN /haɪˈpoʊ.saɪk.lɔɪd/ a curve generated by tracing a fixed point on a circle as it rolls around the inside of another circle.



Hypocycloid

hypotenuse NOUN /haɪˈpɒ.tn̩.us/

1. the side of a right triangle opposite the right angle. *See also side, definition 1, GeoApp!.*
2. the length of an hypotenuse.



Hypotenuse

hypothesis NOUN /haɪˈpɒ.θə.sɪs/

1. a statement that is believed to be true, and is to be proved.
2. (statistics and science) a proposal or an educated guess to be investigated.

Plural: hypotheses /haɪˈpɒθ.ə.siz/*.*

I

i SYMBOL /aɪ/

1. *See imaginary unit.*
2. an identity element for an arbitrary operation on a set. *Math definition:* i is an identity for operation $*$ on set A if and only if for every element a of A, $a*i = i*a = a$. *Example:* 0 is the identity element for integers under addition since $a + 0 = 0 + a = a$.

I SYMBOL 1 in Roman numerals.

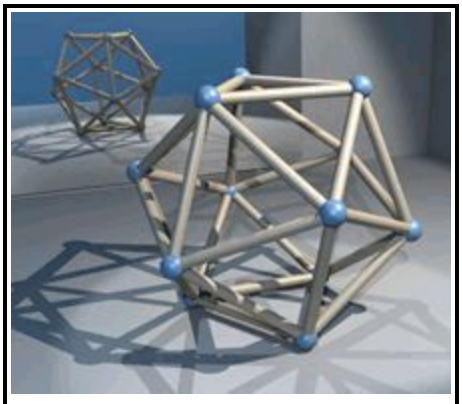
I_n SYMBOL an $n \times n$ identity matrix; an $n \times n$ matrix with all zeroes except in the main diagonal which contains ones. *Example:* a 3×3 identity matrix.

$$I_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Identity Matrix

icosa- PREFIX /aɪ'koʊ.sə/ twenty. *Example:* icosahedron.

icosahedron NOUN /aɪˌkoʊ.sə'hid.rən/ any polyhedron with 20 faces. A regular icosahedron has 20 congruent faces all of which are equilateral triangles. *See also Net!.*



Icosahedron

idempotency ADJECTIVE /ˌaɪ.dəm'poʊ.tən.si/ having to do with whether or not a set has an idempotent element.

idempotent /ˌaɪ.dəm'poʊt.nt/

1. ADJECTIVE an element and a binary operation such that if the operation is applied using the element for both operands, the result is the original element.
   Examples: $1 \cdot 1 = 1, 0 \cdot 0 = 0, 0 + 0 = 0$.
2. NOUN an element of a set that is idempotent with respect to that set.

identical ADJECTIVE /aɪ'dɛn.tɪ.kl/ exactly the same.

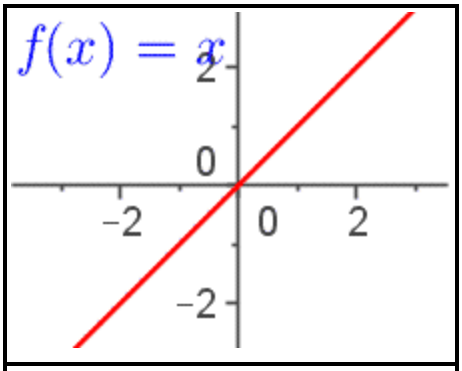
identity NOUN /aɪ'dɛn.tɪ.ti/

1. a value that returns the same value after an operation.
   Math definition: i is an identity for the operation $*$ on the set A if and only if for every element a of A, $a * i = a$ and $i * a = a$. *Examples:* $a + 0 = a$, $0 + a = a$. *See also additive identity, multiplicative identity.*
2. an equation that is true for all values of the variables.
   Notation: $\equiv$. *Example:* $\sin^2\theta + \cos^2\theta \equiv 1$.

Identity Elements		
Operation	**Identity Element**	**Equation(s)**
Addition of numbers	0	$a + 0 = a$ $0 + a = a$
Multiplication of numbers	1	$a \cdot 1 = a$ $1 \cdot a = a$
Matrix addition	Zero matrix	$A_{n \times m} + Z_{n \times m} = A_{n \times m}$
Matrix multiplication (square matrices only)	Identity matrix	$A_{n \times n} \cdot I_{n \times n} = A_{n \times n}$ $I_{n \times n} \cdot A_{n \times n} = A_{n \times n}$
Vector addition	Zero	

vector addition	zero vector	$u + z = u$ $z + u = u$

identity function NOUN /aɪ'dɛn.tɪ.ti 'fʌŋk.ʃən/ the function $f(x) = x$.



Identity Function

identity matrix NOUN /aɪ'dɛn.tɪ.ti 'meɪ.trɪks/ a square matrix containing all zeros except for the main diagonal which contains all ones. *Notation:* I_n is an $n \times n$ identity matrix. *Plural: identity matrices* /aɪ'dɛn.tɪ.ti 'meɪ.trɪˌsiz/.

$$I_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Identity Matrix

identity property of 0 NOUN /aɪ'dɛn.tɪ.ti 'prɒ.pər.ti ʌv 'zɪər.oʊ/ *See additive identity.*

identity property of 1 NOUN /aɪ'dɛn.tɪ.ti 'prɒ.pər.ti ʌv wʌn/ *See multiplicative identity.*

identity property of addition NOUN /aɪ'dɛn.tɪ.ti 'prɒ.pər.ti ʌv ə'dɪ.ʃən/ *See additive identity.*

identity property of multiplication NOUN /aɪ'dɛn.tɪ.ti 'prɒ.pər.ti ʌv ˌmʌl.tə.plɪ'keɪ.ʃən/ *See multiplicative identity.*

if PREPOSITION /ɪf/ based on a condition. *Example:* if a rectangle has congruent sides, then it is also a square.

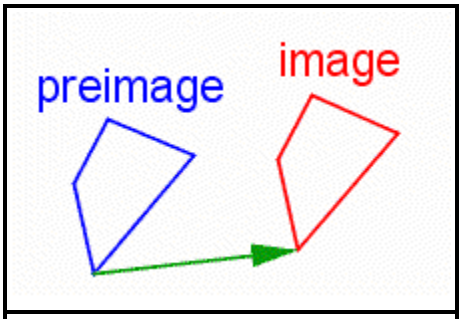
if and only if /ɪf ænd oʊnli ɪf/ *See biconditional.*

iff CONJUNCTION if and only if. *See also biconditional.*

if ... then ... /ɪf ðɛn/ if antecedent then consequent. A statement claiming that if the antecedent is true, then the consequent must be true. *See also implication.*

im- PREFIX /ɪm/ not. *Example:* impossible.

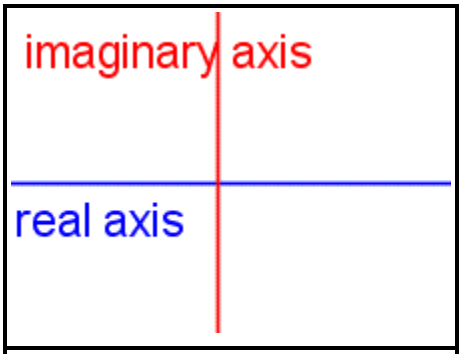
image NOUN /ˈɪm.ɪdʒ/
1. a copy of an object; the result of a geometric transformation.
2. the result of a mapping of a set.



Image

imaginary ADJECTIVE /ɪˈmædʒ.əˌnɛr.i/ having to do with the imaginary part of a complex number.

imaginary axis NOUN /ɪˈmædʒ.əˌnɛr.i ˈæk.sɪs/ the vertical axis in a complex plane which represents the imaginary part of a complex number.



Imaginary Axis

imaginary number NOUN /ɪˈmædʒ.əˌnɛr.i ˈnʌm.bər/ a complex number that has no real part.
Example: $3i = 0+3i$. *Synonym:* *pure imaginary number*.

imaginary part NOUN /ɪˈmædʒ.əˌnɛr.i pɑrt/ the part of a complex number that is multiplied by the imaginary unit $i \equiv \sqrt{-1}$. *Notations:* $\Im$, Im. *Formula:* $\Im(a+bi) = b$. *Example:* $\Im(2+3\mathrm{i}) = 3$.

imaginary unit NOUN /ɪˈmædʒ.əˌnɛr.i ˈyu.nɪt/ the square root of negative one. *Notation:* i. *Math definition:* $i \equiv \sqrt{-1}$.

imperial ADJECTIVE /ˌɪmˈpər.i.l/ having to do with an empire, especially the British Empire.

imperial system NOUN /ˌɪmˈpər.i.l ˈsɪs.təm/ a set of units of measures once used in the United Kingdom. *See also* *imperial unit*.

imperial unit NOUN /ˌɪmˈpər.i.l ˈyu.nɪt/ one of several units of measure once used in United Kingdom. *Examples:* foot, mile, gallon.

implication NOUN /ˌɪm.plɪˈkeɪ.ʃən/ if ... then .... *Notation:* $P \to Q$. *Math definition:* if P implies Q, then if P is true, Q must be true, and if P is false, Q must be false. *Example:* if

$$\underbrace{\text{the sides of a rhombus meet at a right angle}}_{P}$$

$$\underbrace{\text{then}}_{\to}\ \underbrace{\text{the rhombus is also a square}}_{Q}.$$

implied coefficient NOUN /ɪmˈplaɪd ˌkoʊ.əˈfɪ.ʃənt/ a term with one or more variables that does *not* have an explicit coefficient has an implied coefficient of 1. *Example:* x^2y has an implied coefficient of 1 since $x^2y = 1x^2y$. *See also 1, Property of Multiplication by.*

implied multiplication NOUN /ɪmˈplaɪd ˌmʌl.tə.plɪˈkeɪ.ʃən/ in the term $2x$, the multiplication of 2 by x is implied.

imply VERB /ɪmˈplaɪ/

1. if one is true the other is true. If one is false the other is false. *Example:* $a \mathrm{R} b$ implies $b \mathrm{R} a$.
2. to suggest without stating explicitly. *Example:* implied coefficient.

impossible ADJECTIVE /ɪmˈpɒs.ə.bəl/ can not happen; will not happen. *Antonyms: certain, possibility, definition 2.*

impossible event NOUN /ɪmˈpɒs.ə.bəl ɪˈvɛnt/ an event that will never happen. *Math definition:* e is an impossible event if and only if $P(e) = 0$. *Antonym: certain event.*

improper ADJECTIVE /ɪmˈprɒ.pər/ not in standard or reduced form. *Antonym: proper.*

improper fraction NOUN /ɪmˈprɒ.pər ˈfræk.ʃən/

1. a numeric fraction where the absolute value of the numerator is greater than the absolute value of the denominator. *Example:* $\frac{16}{7}$.
2. a rational polynomial where the degree of polynomial in the numerator is greater than or equal to the degree of the polynomial in the denominator. *Example:* $\frac{x^3 - 1}{x + 2}$.

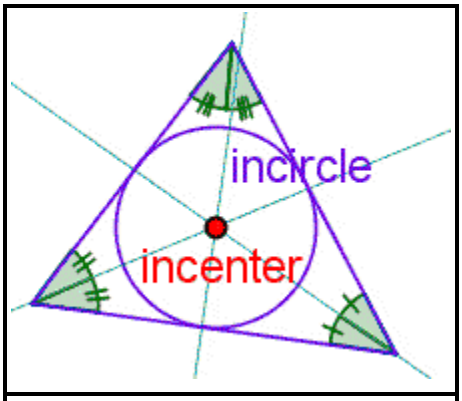
Antonym: proper fraction.

in ABBREVIATION *See inch.*

in- PREFIX /ɪn/

1. in, inside.
2. not.

incenter NOUN /ˈɪnˌsɛn.tər/ the center of the circle that intersects each side of a triangle or a regular polygon exactly once. The incenter of a triangle is located at the intersection of the angle bisectors of the triangle. *See also GeoApp!.*



Incenter

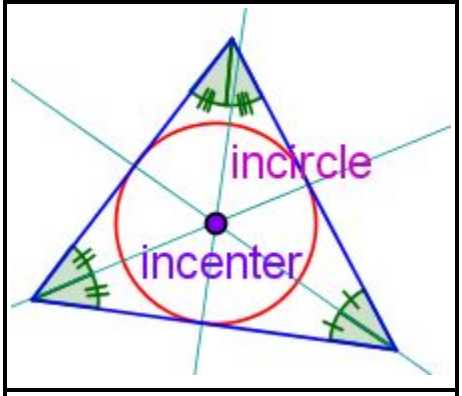
inch NOUN /ɪntʃ/ a unit of measure of distance.

Abbreviation: in. Notation: ″.

Formulas: 1 foot = 12 inches,

1 inch ≈ 2.54 centimeters.

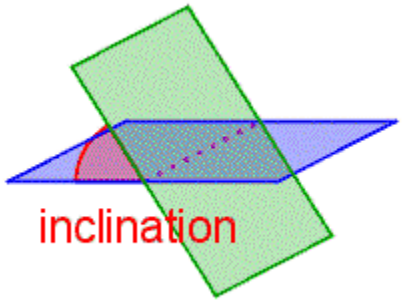
incircle NOUN /ˈɪnˌsɜr.kəl/ the circle that is tangent to all the sides of a triangle or of a regular polygon. The center of the incircle of is located at the intersection of the angle bisectors of the figure. *See also GeoApp!.*



Incircle

inclination NOUN /ˌɪn.klə'neɪ.ʃən/

1. a plane-like figure that is *not* parallel with a reference plane.
2. the dihedral angle between a reference plane and another plane.

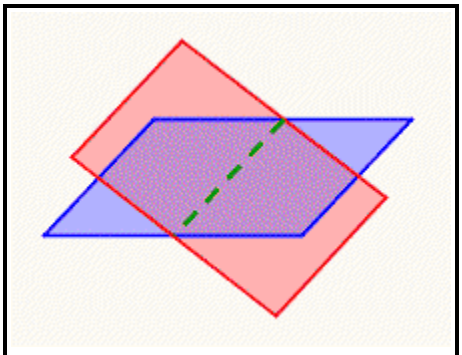


Inclination

incline /ɪn'klaɪn/

1. NOUN the slope of a plane-like figure measured from the horizontal.
2. NOUN an inclined plane.
3. VERB to place at an incline.

inclined plane NOUN /ɪn'klaɪnd pleɪn/ a plane that is sloped compared to the horizontal. *Synonym: incline.*



Inclined Plane

include VERB /ɪn'klud/

1. to contain.
2. to make part of a whole.

included angle NOUN /ɪn'klu.dɪd 'æŋ.gəl/ *See contained angle.*

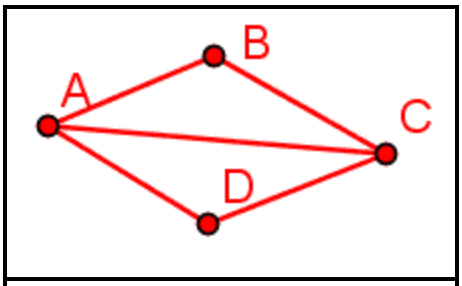
included side NOUN /ɪn'klu.dɪd saɪd/ *See contained side.*

inclusion relation NOUN /ɪn'klu.ʒən rɪ'leɪ.ʃən/ *See subset.*

inclusive ADJECTIVE /ɪn'klu.sɪv/ includes all endpoints as well as what is in the middle. *Example:* the interval from 1 to 3, inclusive. *Antonym: exclusive.*

incompatible ADJECTIVE /ˌɪn.kəm'pæt.ə.bəl/ can *not* be used together. *Antonym: compatible.*

incomplete ADJECTIVE /ˌɪn.kəm'plit/ of a network graph, at least one pair of nodes is *not* directly connected by a path. *Antonym: complete.*



Incomplete Network

in conclusion IDIOM /ɪn kən'klu.ʒən/ it can be concluded that; the preceding arguments lead to the following conclusion.

inconsistent ADJECTIVE /ˌɪn.kən'sɪs.tənt/

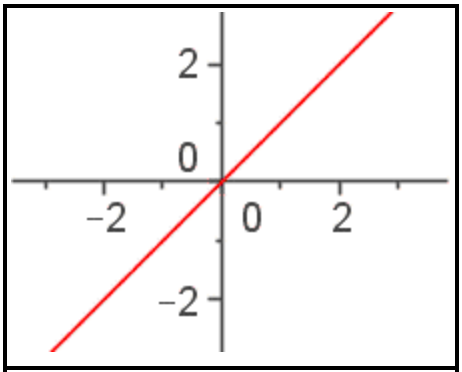
1. (system of equations) having no common solution.
2. (axiomatic system) generates at least one contradiction; both a proposition and its negation can be proved.

Antonym: consistent.

increase /'ɪn.kris/

1. VERB to go up; to become more or larger. Keyword for addition. *Synonym: add.*
2. NOUN the amount, proportion or percentage by which a value increases.

Antonym: decrease.

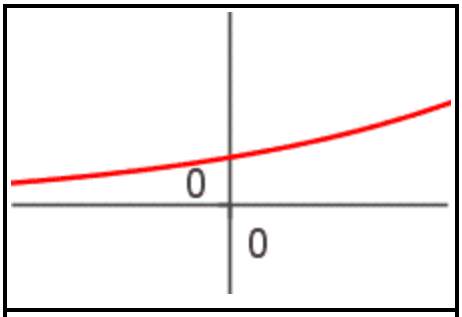


Increase

increase by PREPOSITION /'ɪn.kris baɪ/ add to. Keywords for addition. *Example:* 5 increased by 2 is $5 + 2 = 7$. *Antonym: decrease by.*

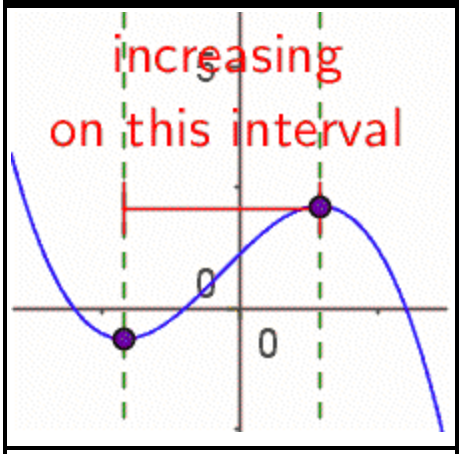
increasing ADJECTIVE /ɪn'kri.sɪŋ/ the property of having an increase. *Example:* increasing sequence. *Antonym: decreasing.*

increasing function NOUN /ɪn'kri.sɪŋ 'fʌŋk.ʃən/ a function whose output increases as the input increases. *Math definition:* if $a > b$, then $f(a) > f(b)$. *Antonym: decreasing function.*



Increasing Function

increasing on an interval ADJECTIVE /ɪn'kri.sɪŋ ɒn ən 'ɪn.tər.vəl/ a function whose output increases as the input increases on a continuous subdomain. *Antonym: decreasing on an interval.*



Increasing on an Interval

increasing sequence NOUN /ɪn'kri.sɪŋ 'si.kwəns/ a sequence of real numbers where each term is greater that its preceding term. *Example:* $\frac{2}{2}, \frac{3}{2}, \frac{4}{2}, \frac{5}{2}, \ldots$. *Antonym: decreasing sequence.*

increment /'ɪn.krəˌmənt/

1. VERB to increase by a small quantity.
2. NOUN a usually small quantity by which something is increased each iteration.

incremental ADJECTIVE /ˌɪn.krə'mən.tl/

1. added in small amounts each iteration.
   Example: incremental increase.
2. in small steps.

independent ADJECTIVE /ˌɪn.dɪ'pɛn.dənt/ not relying on anything else. *Example:* independent events. *Antonym: dependent.*

independent axiom NOUN /ˌɪn.dɪ'pɛn.dənt 'æk.si.əm/ an axiom that can not be proven from other axioms in an axiomatic system. *Antonym: dependent axiom.*

independent axis NOUN /ˌɪn.dɪ'pɛn.dənt 'æk.sɪs/ *See x-axis.*

independent events NOUN /ˌɪn.dɪ'pɛn.dənt ɪ'vɛntz/ events that do not affect each other. *Antonym: dependent events.*

independent variable NOUN /ˌɪn.dɪ'pɛn.dənt 'vɛər.i.ə.bəl/ a variable whose value can change without regard to other variables; an input of a function. By convention, x is often used to represent an independent variable. *Synonym: input. Antonyms: dependent variable, output.*

indeterminate /'ɪn.dɪˌtɜr.mə.nət/

1. ADJECTIVE having an infinite number of solutions.
   Example: indeterminate equation.
2. NOUN one of the undefined expressions $\frac{0}{0}$, $\frac{\infty}{\infty}$, $\infty \cdot 0$, 1^{∞}, 0^0, ∞^0, ∞-∞.

indeterminate equation NOUN /'ɪn.dɪˌtɜr.mə.nət ɪ'kweɪ.ʒən/ an equation that has infinite solutions.

Example: $y = x^2 - 2$. *Antonym: determinate equation.*

index NOUN /'ɪn.dɛks/

1. (British English) the number of times a number is multiplied by itself: $\text{base}^{\text{index}}$. *See also exponent.*
2. the number to the left of a radical that indicates the root to extract. *Example:* the 3 in $\sqrt[3]{x}$.

3. a subscript indicating order. *Example:* $a_1,\ a_2,\ a_3,\ \ldots$
4. an integer indicating which step in a repeated sum or product. *Example:* n in $\sum_{n=1}^{\infty}$. *Synonym: iterator.*

indexed ADJECTIVE /'ɪn.dɛksd/ ordered by assigning a nominal number to each item, usually starting with 1.

indexed variable NOUN /'ɪn.dɛksd 'vɛər.i.ə.bəl/ a variable with a subscript. Indexed variables are used when a set of variables are related. *Example:* $a_1,\ a_2,\ a_3,\ldots$

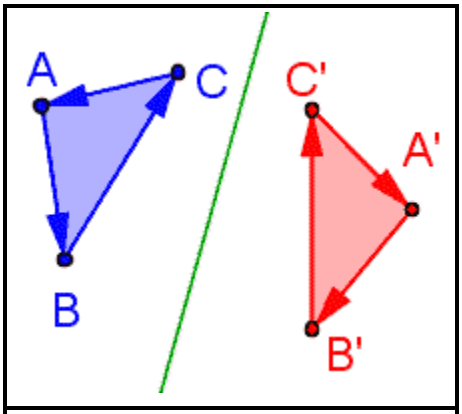
index laws NOUN /'ɪn.dɛks lɔz/ *See Properties of Exponents.*

indirect ADJECTIVE /ˌɪn.dər'ɛkt/
1. not by a direct route.
2. using a contradiction to lead to a conclusion.

Antonym: direct.

indirect argument NOUN /ˌɪn.dər'ɛkt 'ɑr.gyə.mənt/ *See proof by contradiction.*

indirect isometry NOUN /ˌɪn.dər'ɛkt aɪ'sɒm.ɪ.tri/ an isometry that does *not* preserve orientation and order. *Antonym: direct isometry. See also isometry.*



Indirect Isometry

indirect measurement NOUN /ˌɪn.dər'ɛkt 'mɛʒ.ər.mənt/ a way to measure something when it can *not* be directly measured. *Example:* using triangulation to find the height of a mountain.

indirect proof NOUN /ˌɪn.dər'ɛkt pruf/ *See proof by contradiction.*

indirect reasoning NOUN /ˌɪn.dərˈɛkt ˈriz.nɪŋ/ *See proof by contradiction.*

individual /ˌɪn.dɪˈvɪd.yu.əl/

1. NOUN a single person or entity.
2. NOUN a single member of a population being studied.
3. ADJECTIVE considered one at a time.

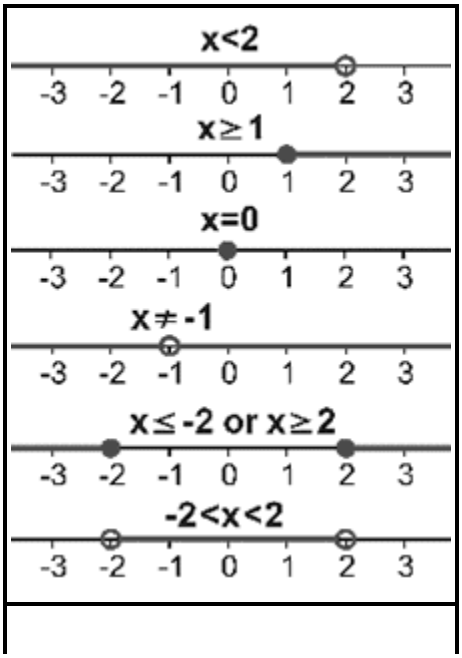
induction NOUN /ɪnˈdʌk.ʃən/ going from specific cases to an infinite general case, possibly using a recursive definition. *Important:* Mathematical induction is *not* the same as either logical induction or inductive reasoning. *For contrast, see mathematical induction.*

inductive ADJECTIVE /ɪnˈdʌk.tɪv/ using mathematical or logical induction. *Example:* inductive reasoning.

inductive proof NOUN /ɪnˈdʌk.tɪv pruf/ a proof that uses induction. The steps of an inductive proof are: 1) Show the first case is true; 2) Show that if an arbitrary case n is true, then case n+1 must be true.

inductive reasoning NOUN /ɪnˈdʌk.tɪv ˈriz.nɪŋ/ coming to a general conclusion from a limited number of specific cases. *Important:* Inductive reasoning is *not* accepted as a mathematical proof. *Example:* all the apples in my orchard are red, so all apples must be red.

inequality NOUN /ˌɪn.ɪˈkwɒl.ɪ.ti/ a mathematical statement comparing two values using $<$, $\leq$, $\neq$, $\geq$, $>$. *Example:* $x < 5$.



inequality operator NOUN /ˌɪn.ɪ'kwɒl.ɪ.ti 'ɒ.pəˌreɪ.tər/ one of the relationship operators $<$, $\leq$, $\neq$, $\geq$, $>$.

inequality sign NOUN /ˌɪn.ɪ'kwɒl.ɪ.ti saɪn/ *See inequality operator.*

inexact ADJECTIVE /ˌɪn.ɪg'zækt/

1. containing an error.
2. arrived at by measurement or estimation, or by a calculation that introduces error.

Antonym: exact.

infer VERB /ɪn'fɜr/ to come to an conclusion based on logical arguments.

inference NOUN /'ɪn.fər.əns/ a conclusion based on strict logical arguments.

inferential statistics NOUN /'ɪn.fər.ən.lt stə'tɪs.tɪks/ the extension of the results of a sample to a population with a measure of reliability.

infimum NOUN /ɪn'fi.mʌm/ *See greatest lower bound.*

infinite ADJECTIVE /'ɪn.fə.nɪt/

1. goes on forever; does *not* end.
2. increases without bound.
3. larger than any arbitrary value.

Notation: ∞. *Synonym: unbounded. Antonyms: finite, bounded.*

infinite decimal NOUN /'ɪn.fə.nɪt 'dɛs.ə.məl/ *See nonterminating decimal.*

infinite product NOUN /'ɪn.fə.nɪt 'prɒ.dəkt/ a product with an infinite number of factors. *Notation:*

$$\prod_{i=1}^{\infty} a_i = a_1 \cdot a_2 \cdot \ldots.$$

infinite sequence NOUN /ˈɪn.fə.nɪt ˈsi.kwəns/ a sequence that does *not* have a last term.

Example: $\{1, 2, 4, 8, \ldots\}$. *Antonym: finite sequence.*

infinite series NOUN /ˈɪn.fə.nɪt ˈsɪər.iz/ a sum that has an infinite number of terms.

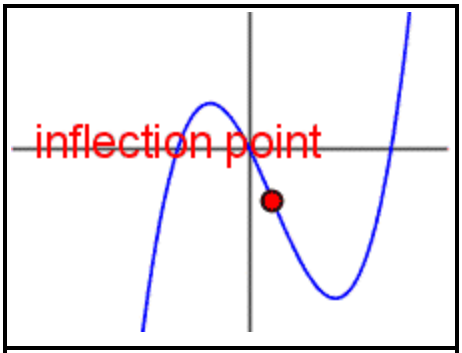
infinite set NOUN /ˈɪn.fə.nɪt sɛt/ a set that has no end. *Example:* the set of natural numbers.

infinitesimal /ˌɪn.fɪn.ɪˈtɛs.ə.məl/

1. ADJECTIVE immeasurably small; approaches zero usually without reaching zero.
2. NOUN a variable having zero as a limit.
3. NOUN a value that is very close to zero.

infinity NOUN /ɪnˈfɪn.ɪ.ti/ the property of never having an end; the property of being unbounded. *Notation:* ∞.

inflection point NOUN /ɪnˈflɛk.ʃən pɔɪnt/ a point where a graph changes from concave up to concave down or from concave down to concave up.



Inflection Point

information NOUN /ˌɪn.fərˈmeɪ.ʃən/ knowledge gained through an analysis of data.

information processing NOUN /ˌɪn.fərˈmeɪ.ʃən ˈprɒ.se.sɪŋ/ the analysis of data to produce information.

in general PREPOSITION /ɪn ˈdʒɛn.ər.əl/ a generalization of a specific case or cases.

Example: $\ldots, (-1)^2 > 0, 0^2 = 0, 1^2 > 0, \ldots$. In general, $a^2 \geq 0, a \in \mathbb{R}$. *See also generalization.*

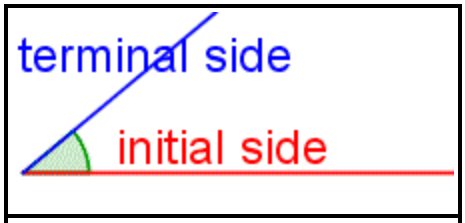
initial ADJECTIVE /ɪˈnɪ.ʃəl/

1. at the start; beginning with. *Example:* initial line.

2. the first of several. *Example:* initial value.

initial line NOUN /ɪ'nɪ.ʃəl laɪn/ *See initial side.*

initial side NOUN /ɪ'nɪ.ʃəl saɪd/ the ray or line segment from which an angle is measured. *Synonym: initial line. Antonym: terminal side.*

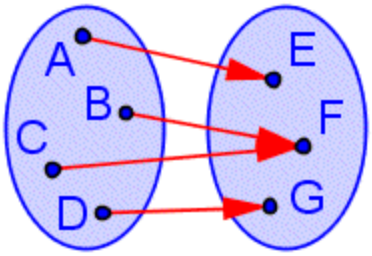


Initial Side

initial value NOUN /ɪ'nɪ.ʃəl 'væl.yu/ the starting value, usually of an independent variable.

initiator NOUN /ɪ'nɪ.ʃi.eɪ.tər/ the starting figure when drawing a classical fractal.

injection NOUN /ɪn'dʒɛk.ʃən/ a relation having exactly one output for each input. *Synonyms: function, one to one correspondence.*

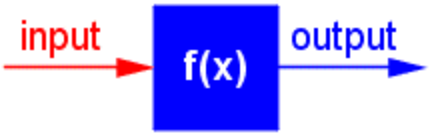


Injection

injective ADJECTIVE /ɪn'dʒɛk.tɪv/ having exactly one output for each input.

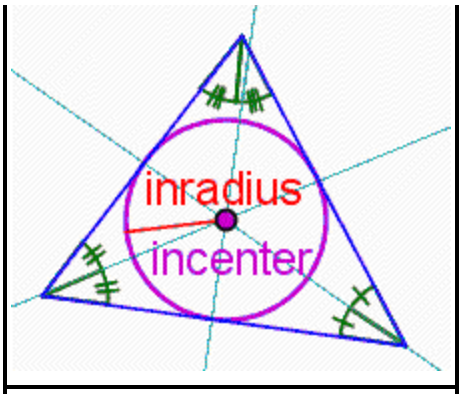
inner product NOUN /'ɪn.ər 'prɒ.dəkt/ *See dot product.*

input NOUN /'ɪnˌpʊt/ a set of values supplied to a function. *Synonyms: independent variable, abscissa, definition 1. Antonym: output.*



Input

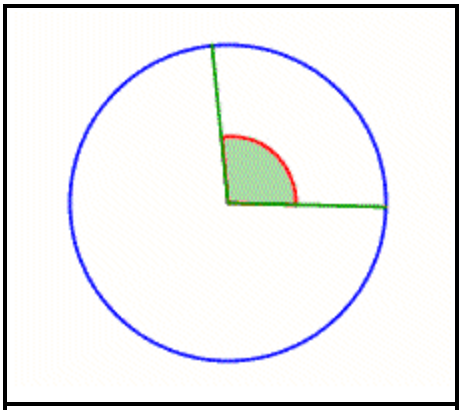
inradius NOUN /'ɪnˌreɪ.di.əs/ the radius of an incircle. *Plural: inradii* /'ɪn.reɪ.diˌaɪ/.



Inradius

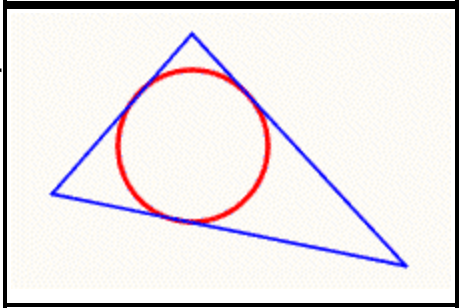
inscribe VERB /ɪn'skraɪb/ to draw inside of, touching as many points as possible.

inscribed angle NOUN /ɪn'skraɪbd 'æŋ.gəl/ an angle drawn inside a circle.



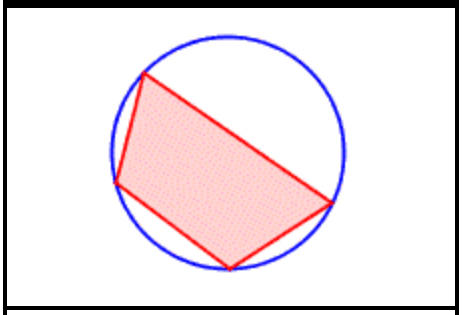
Inscribed Angle

inscribed circle NOUN /ɪn'skraɪbd 'sɜr.kəl/ a circle drawn inside another figure, usually intersecting all sides of the figure exactly once.



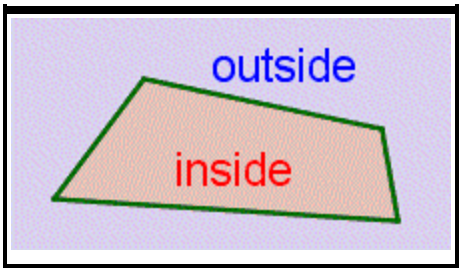
Inscribed Circle

inscribed polygon NOUN /ɪn'skraɪbd 'pɒl.iˌgɒn/ a polygon drawn inside a circle where the circle intersects all vertices of the polygon.



Inscribed Polygon

inside ADJECTIVE /ˈɪn.saɪd/ in the interior of. *Antonym: outside.*



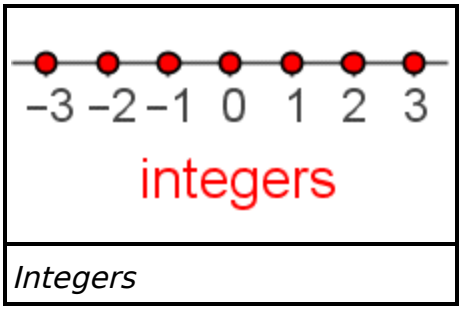
Inside

insignificant ADJECTIVE /ˌɪn.sɪgˈnɪf.ɪ.kənt/
1. not needed; does not make a difference.
2. so small it doesn't matter.

insignificant zero NOUN /ˌɪn.sɪgˈnɪf.ɪ.kənt ˈzɪər.oʊ/ a zero in a number that is *not* needed. *Examples:* 02.7, 3.250.

instance NOUN /ˈɪn.stəns/
1. a case or example.
2. one of a set of objects.

integer NOUN /ˈɪn.tɪ.dʒər/ a positive or negative whole number or zero having no decimal part. *Notation:* $\mathbb{Z}$ (set of all integers). *Math definition:* $\mathbb{Z}=\{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$.

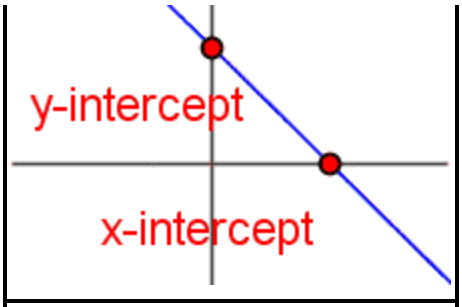


Integers

inter- PREFIX /ˈɪn.tər/
1. inside of. *Example:* interior.
2. between. *Example:* interactive.
3. together. *Example:* intercept.

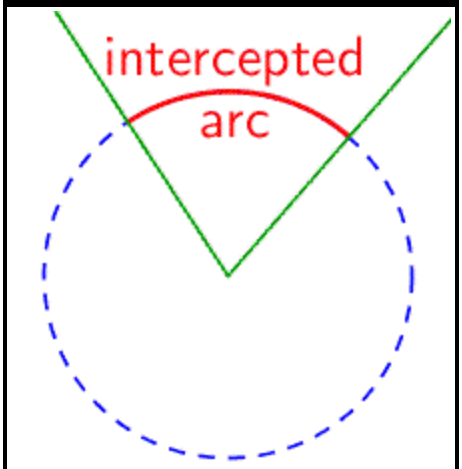
interactive geometry software NOUN /ˌɪn.tərˈæk.tɪv dʒiˈɒ.mɪ.tri ˈsɔftˌwɛər/ computer software that allows the user to create and manipulate geometric drawings. *See also GeoGebra.*

intercept NOUN /ˈɪn.tərˌsɛpt/ a point where the graph of a figure intersects an axis.



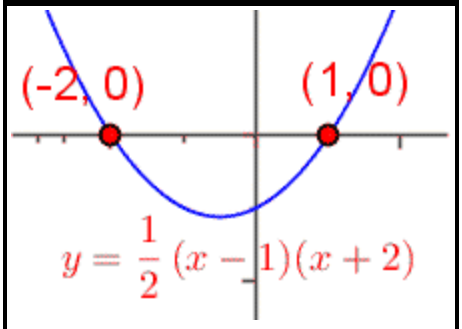
Intercept

intercepted arc NOUN /ˈɪn.tərˌsɛpt.ɪd ɑrk/ part of a circle between two rays that start inside or on the circle and intercept the circle.



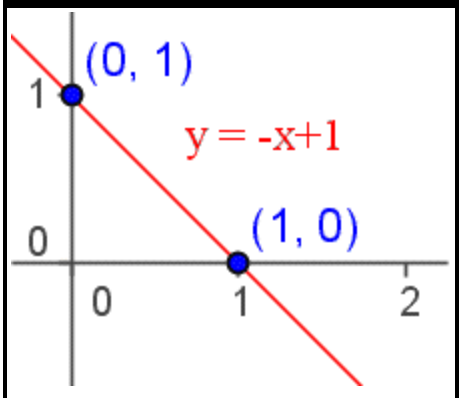
Intercepted Arc

intercept form NOUN /ˈɪn.tərˌsɛpt fɔrm/ a quadratic equation the form $y = a(x - x_1)(x - x_2)$ where x_1 and x_2 are the x-intercepts. *Synonym: [factored form](#).*



Intercept Form

intercept method NOUN /ˈɪn.tərˌsɛpt ˈmɛθ.əd/ an algorithm for graphing a linear equation using the x and y intercepts: 1) Plot the x-intercept. 2) Plot the y-intercept. 3) Draw the line containing the intercepts.



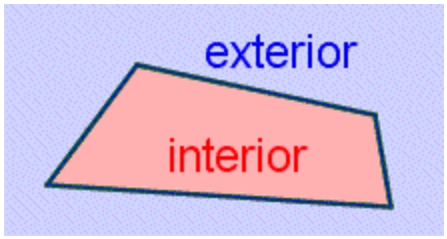
Intercept Method

interest NOUN /ˈɪn.trɪst/ an amount paid based on the principal of a loan for the use of the money. *Formula:* Interest + Principal = Total Payments. *Example:* If you borrow £100 and pay £110 at the end of the loan, the interest is £10.

interest rate NOUN /ˈɪn.trɪst ˈreɪt/ the portion of the principal that is charged as interest. *Formula:* principle × interest rate = interest amount. *Example:* if the principal of the loan is €140 and the interest rate is 12%, the interest amount is €140 × 0.12 = €16.8. *Synonym:* *rate of interest*.

interior /ɪnˈtɪər.i.ər/

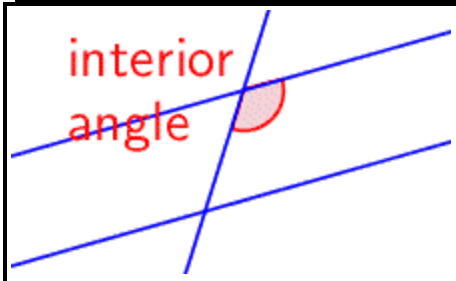
1. ADJECTIVE lying inside a boundary.
2. NOUN the inside of an object.
3. NOUN all points that are a part of a figure, but are *not* boundary points.



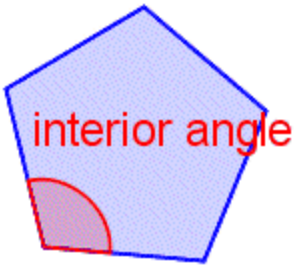
Interior

interior angle NOUN /ɪnˈtɪər.i.ər ˈæŋ.gəl/

1. an angle at a vertex of a polygon that is inside the polygon.
2. an angle between two lines that are intersected by a transversal.

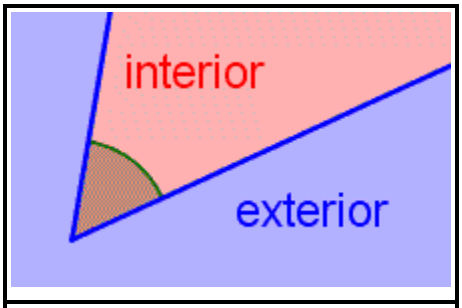


Interior Angle of a Transversal



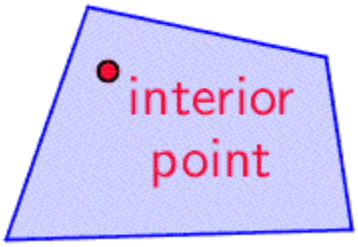
Interior Angle of a Polygon

interior of an angle NOUN /ɪnˈtɪər.i.ər ʌv ən ˈæŋ.gəl/ the area between the initial side and the terminal side.



Interior of an Angle

interior point NOUN /ɪnˈtɪər.i.ər pɔɪnt/ a point in the interior of a figure; *not* a boundary point nor an exterior point.



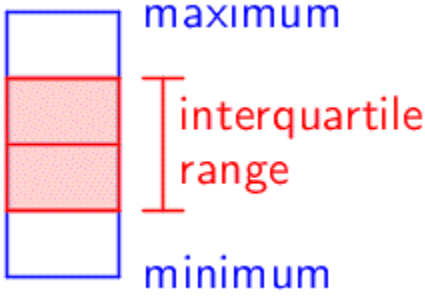
Interior Point

International System of Units NOUN /ˌɪn.tərˈnæ.ʃə.nl ˈsɪs.təm ʌv ˈyu.nɪtz/ an international convention for naming units of measure. *Examples:* meter, nanometer. *See also International System of Units.*

interpolate VERB /ɪnˌtɜr.pəˈleɪt/ to approximate a value starting with known values nearby. *Example:* interpolate the value of $\sqrt{2}$ to six decimal places.

interpolation NOUN /ɪnˌtɜr.pəˈleɪ.ʃən/ a process of approximating a value starting with known values nearby.

interquartile range NOUN /n.tɜr ˈkwɔr.taɪl reɪndʒ/ the difference between the first and the third quartiles of a dataset; a measure of the spread of the middle half of the dataset.

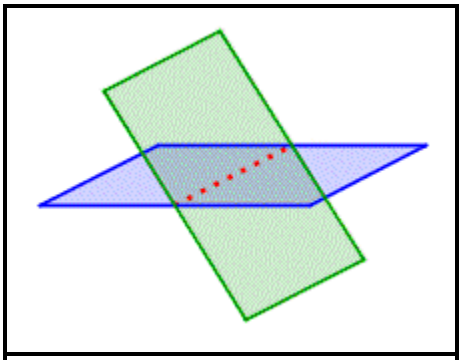


Interquartile Range

intersect VERB /ˌɪntərˈsɛkt/

1. to cross each other; to coincide at at least one point.
2. to overlap.

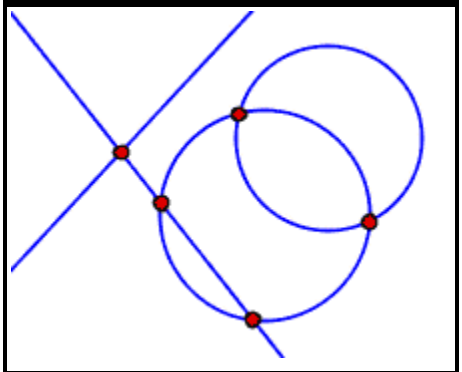
Intersecting Planes Postulate NOUN /ˌɪntərˈsɛkt.ɪŋg pleɪn ˈpɒs.tʃə.lɪt/ if two planes intersect, then their intersection is a line.



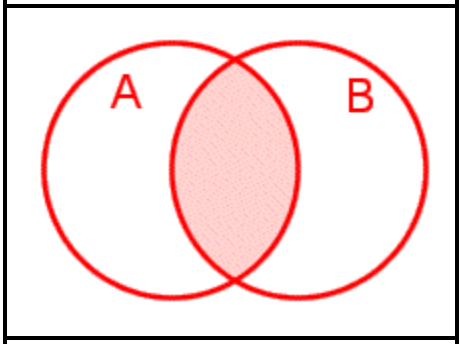
Intersecting Planes Postulate

intersection NOUN /ˌɪn.təˈsɛk.ʃən/

1. (geometry) one or more points at which geometric figures meet.
2. (sets) the set containing all the elements that are in both sets.



Intersection (Geometry)



Intersection (Sets)

intersection point NOUN /ˌɪn.təˈsɛk.ʃən pɔɪnt/ *See point of concurrency.*

interval NOUN /ˈɪn.tər.vəl/

1. an unbroken range of values. *Examples:* 1 to 4. Numeric intervals can be written using an inequality:

$1 \leq x \leq 4$, interval notation: $[1, 4]$, set notation: $\{x \in \mathbb{R}, 1 \leq x \leq 4\}$. *See also GeoApp!.*

2. a period of time with a beginning and an end. *Example:* a two second interval.

interval notation NOUN /ˈɪn.tər.vəl noʊˈteɪ.ʃən/ a convention for writing intervals. A square bracket '[ ]' means the end value is included. A parenthesis '( )' means the end value is not included. *Examples:* $(-\infty, \infty) =$ all real numbers.

$[3, 12) = \{x \mid 3 \leq x < 12\}$

$(-2, -1] = \{x \mid -2 < x \leq -1\}$

$[3, 49] = \{x \mid 3 \leq x \leq 49\}$. *See also GeoApp!.*

interview /ˈɪnˌtər.vyu/

1. NOUN a formal meeting where the interviewer asks questions of the person being interviewed.
2. VERB to conduct an interview as the interviewer.

interviewer error NOUN /ˈɪnˌtər.vyu.ər ˈɛr.ər/ a statistical error caused when an interview does *not* get truthful responses from individuals.

invalid ADJECTIVE /ɪnˈvæl.ɪd/

1. not well founded. *Example:* a invalid reason.
2. not justifiable.

Antonym: valid.

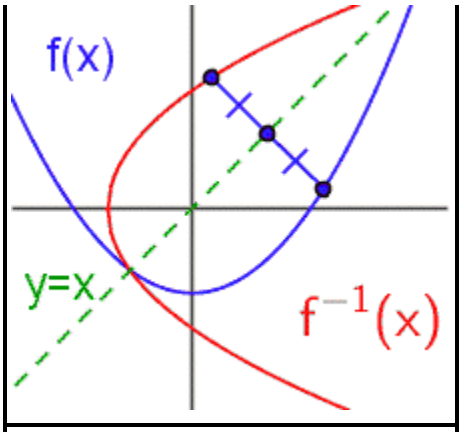
invariant ADJECTIVE /ɪnˈvɛər.yənt/

1. unchanging; does *not* change, perhaps under specific conditions.
2. of a property of a geometric figure undergoing a transformation that is unchanged by the transformation. *Example:* the measure of an angle is invariant under dilation.

inverse NOUN /ɪnˈvɜrs/

1. when one increases, the other decreases.

2. (of a relation or a function) another relation which, for every output of the original relation, returns the input of the original relation. *Notation:* $f^{-1}(x)$. *Math definition:* $f^{-1}(y) = x$ if and only if $f(x) = y$. *Example:* if $f(x) = 2x + 2$ then $f^{-1}(x) = \frac{1}{2}x - 1$. *See also GeoApp!*.



Inverse

3. (of an operation) another operation that 'undoes' the original operation. *Math definition:* given an element and an operation, another element when combined under the operation with the first gives the identity element. *Examples:* The inverse of addition is subtraction: $(x + 5) - 5 = x$. The inverse of multiplication is division: $5x \div 5 = x$.
4. (of a logical statement) the negation of a statement. *Notations:* $not\ P$, $\neg P$. *Example:* 'the ball is blue' is the inverse of 'the ball is not blue'.
5. (of a square matrix) a matrix A^{-1} such that $A \cdot A^{-1} = I$ and $A^{-1} \cdot A = I$. *Important:* not all square matrices have an inverse.

inverse element NOUN /ɪn'vɜrs 'ɛl.ə.mənt/ an element that undoes an operation on another element. *Example:* the inverse element of a under addition is $-a$ since $a + (-a) = 0$.

inversely ADJECTIVE /ɪn'vɜr.sli/ having or using an inverse. *Example:* inversely proportional.

inversely proportional ADJECTIVE /ɪnˈvɜr.sli prəˈpoʊr.ʃən.l/ *See inverse variation.*

inverse operation NOUN /ɪnˈvɜrs ˌɒ.pəˈreɪ.ʃən/ an operation that 'undoes' another operation. *Example:* the inverse of addition is subtraction, since $a + b - b = a$.

Inverse Operations	
Operation	**Inverse operation**
Addition	Subtraction
Multiplication	Division
Exponent (power)	Logarithm

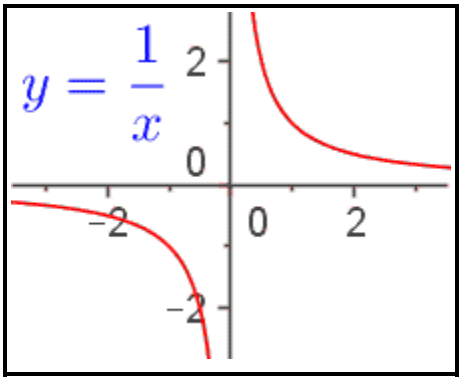
inverse property of addition NOUN /ɪnˈvɜrs ˈprɒ.pər.ti ʌv əˈdɪ.ʃən/ *See additive inverse.*

inverse property of multiplication NOUN /ɪnˈvɜrs ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən/ *See multiplicative inverse.*

inverse trigonometric function NOUN /ɪnˈvɜrs ˌtrɪg.ə.nəˈmɛ.trɪk ˈfʌŋk.ʃən/ a function that takes a ratio as an input and returns an angle as an output.

Examples: $\sin^{-1}$, $\arccos$.

inverse variation NOUN /ɪnˈvɜrs ˌvɛər.iˈeɪ.ʃən/ a relation between two variables such that $y = \frac{a}{x} = ax^{-1}$ or $xy = a$ where a is the constant of variation.



Inverse Variation

invert VERB /ˈɪn.vɜrt/

1. to turn upside down. *Example:* $\frac{3}{4}$ inverts to $\frac{4}{3}$.
2. to find the inverse of.

invertibility NOUN /ˈɪn.vɜrt.ɪ.bɪl.ɪ.ti/ whether or not an inverse exists.

invertible ADJECTIVE /ˈɪn.vɜrt.tɪ.bl/ having the property that an inverse exists. *Example:* Matrix A is invertible if the determinant of A is not zero.

investigate VERB /ɪnˈvɛ.stɪˌgeɪt/ to make a methodical exploration in order to discover truth. *Example:* investigate the properties of a triangle.

investigation NOUN /ɪnˌvɛs.tɪˈgeɪ.ʃən/

1. the process of exploring.
2. an act of exploration. *Example:* an investigation of the properties of triangles.

ir- PREFIX /ɪr/ not.

irrational /ɪˈræ.ʃə.nl/

1. ADJECTIVE can *not* be written as a ratio of integers.
2. NOUN an irrational number. *Synonym: surd.*

irrational number NOUN /ɪˈræ.ʃə.nl ˈnʌm.bər/ a real number that can *not* be written exactly as the ratio of two integers. *Examples:* $\sqrt{3}$, π. *Synonym: surd. Antonym: rational number.*

irrationals NOUN /ɪˈræ.ʃə.nlz/ the set of irrational numbers.

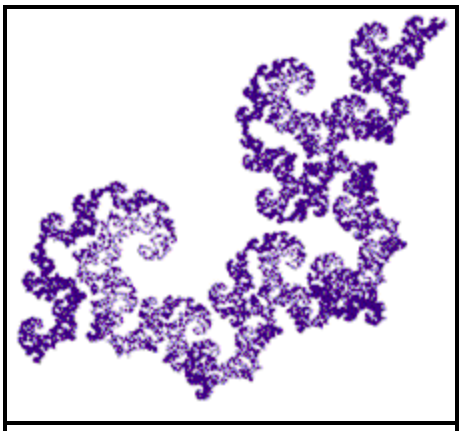
irreducible ADJECTIVE /ˌɪr.ɪˈdu.sə.bəl/ having no factors other than 1 and itself. *Examples:* 7, $x+2$. *Antonym: reducible.*

irreducible expression NOUN /ˌɪr.ɪˈdu.sə.bəl ɪkˈsprɛ.ʃən/ an expression that has no factors other than 1 and itself. *Example:* $\sin(x)+1$. *Antonym: reducible expression.*

irreducible polynomial NOUN /ˌɪr.ɪˈdu.sə.bəl ˌpɒl.əˈnoʊ.mi.əl/ a polynomial that can *not* be factored using expressions containing only real numbers. *Examples:* $x+2$, x^2+x+7. *Antonym: reducible polynomial. See also factor completely.*

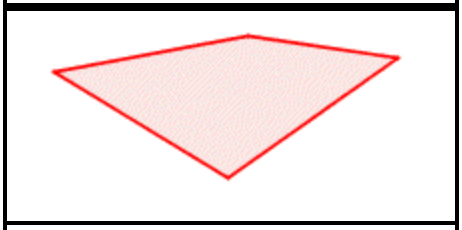
irregular ADJECTIVE /ˌɪrˈrɛg.yə.lər/ without symmetry; having an uneven shape. *Example:* irregular polygon. *Antonym: regular.*

irregular fractal NOUN /ˌɪrˈrɛg.yə.lər ˈfræk.tl/ a complex fractal whose dimensions are often difficult to determine and in some cases are unknown.



Irregular Fractal

irregular polygon NOUN /ˌɪrˈrɛg.yə.lər ˈpɒl.iˌgɒn/ a polygon that is concave or that has unequal sides. *Antonym: regular polygon.*



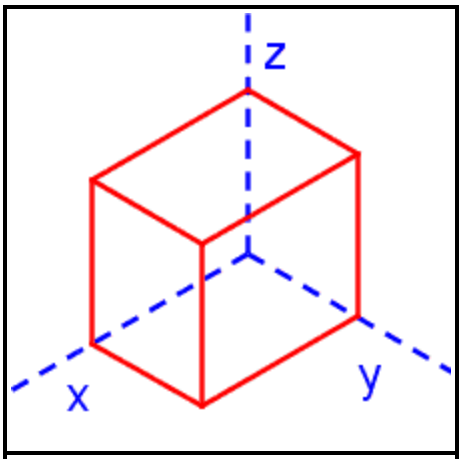
Irregular Polygon

iso- PREFIX /ˈaɪ.sə/ the same, equal. *Example:* isometry – having the same measure.

isometric ADJECTIVE /ˌaɪ.səˈmɛ.trɪk/ having the property of equality in measure. *Example:* isometric projection.

isometric drawing NOUN /ˌaɪ.səˈmɛ.trɪk ˈdrɔ.ɪŋ/ *See isometric projection.*

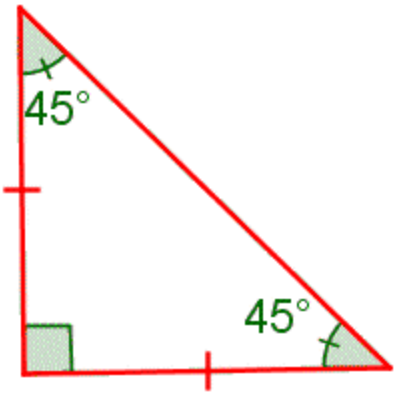
isometric projection NOUN /ˌaɪ.səˈmɛ.trɪk proʊˈdʒɛk.ʃən/ a 2-dimensional drawing of a 3-dimensional shape where the angles between the axes are equal. *See also perspective view.*



Isometric Projection

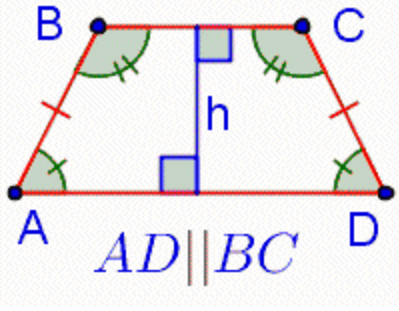
isometry NOUN /aɪˈsɒm.ɪ.tri/ a geometric transformation that preserves distance and length. *Examples:* reflection, rotation and translation. *See also GeoApp!.*

isosceles right triangle NOUN /aɪˈsɒ.səˌliz raɪt ˈtraɪˌæŋ.gəl/ a right triangle whose legs are the same length.



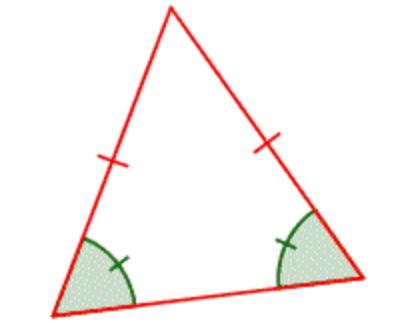
Isosceles Right Triangle

isosceles trapezoid NOUN /aɪˈsɒ.səˌliz ˈtræ.pəˌzɔɪd/ a trapezoid whose legs are congruent.



Isosceles Trapezoid

isosceles triangle NOUN /aɪˈsɒ.səˌliz ˈtraɪˌæŋ.gəl/ a triangle where exactly two of the sides are congruent. The base angles of an isosceles triangle are also congruent.



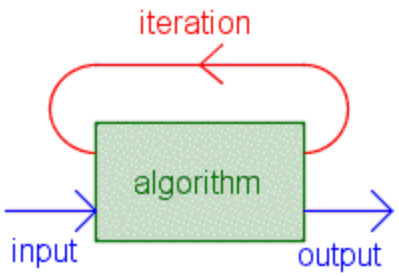
Isosceles Triangle

iterate VERB /ˌɪ.təˈreɪt/ to repeat steps in an iterative algorithm. *Example:* iterate through all the values.

iteration NOUN /ˌɪ.təˈreɪ.ʃən/

1. a single step in a repeating algorithm.
2. the process of iterating.

Synonym: recursion.



Iteration

iterative ADJECTIVE /ˈɪ.tər.ə.tɪv/ repeats all or part of itself. *Example:* iterative algorithm. *Synonym: recursive.*

iterative algorithm NOUN /ˈɪ.tər.ə.tɪv ˈæl.gəˌrɪ.ðəm/ an algorithm where part or all of the algorithm is repeated.

iterative process NOUN /ˈɪ.tər.ə.tɪv ˈprɒ.ses/ a process where part or all of the process is repeated.

iterator NOUN /ˌɪ.təˈreɪ.tɔr/ a parameter that is used to cycle through iterations. *Example:* i in $\sum_{n=1}^{\infty}$. *Synonym: index.*

J

J ABBREVIATION See joule.

join /dʒɔɪn/

1. NOUN *See union.*
2. VERB to bring together into one.

joint ADJECTIVE /dʒɔɪnt/ working together.

joint proportion NOUN /dʒɔɪnt prəˈpoʊr.ʃən/ *See joint variation.*

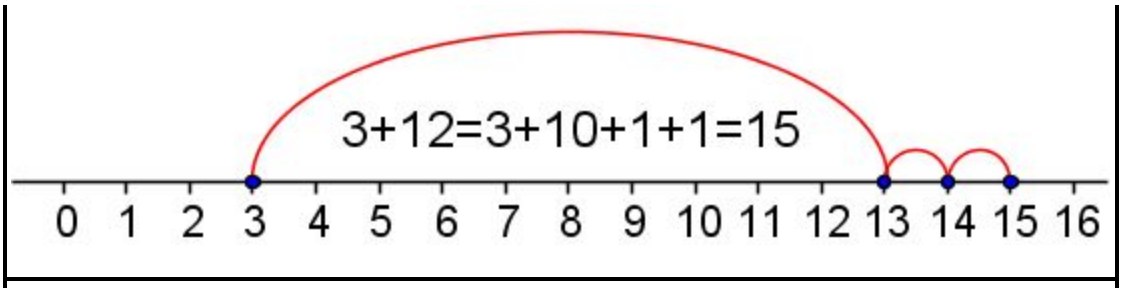
joint variation NOUN /dʒɔɪnt ˌvɛər.iˈeɪ.ʃən/ a relationship between two independent variables x and y and an dependent variable z where $z = axy$.

Jordan, Wilhelm PERSON /ˈdʒɔr.dn ˈvɪl.hɛlm/ (1842-1899) a surveyor who extended the Gaussian elimination method into the Gauss-Jordan method in order to find squaring errors in surveying.

Wilhelm Jordan

joule NOUN /dʒul/ a unit of measure for work or energy. *Abbreviation: J.*

jump strategy NOUN /dʒʌmp ˈstræ.tə.dʒ.i/ a strategy for using a number line where one 'jumps' by tens or hundreds.



Jump Strategy

junction NOUN /ˈdʒʌnk.ʃən/ *See node.*

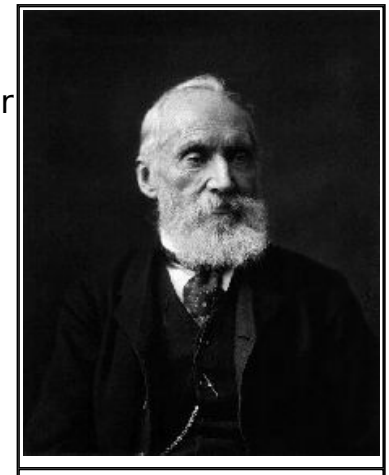
justifiable ADJECTIVE /ˌdʒʌs.təˈfaɪ.ə.bəl/ can be defended as valid; can be justified. *Example:* the conclusion is justifiable.

justification NOUN /ˌdʒʌs.tə.fɪˈkeɪ.ʃən/ why something is true; a statement justifying a step in a proof. *Example:* The justification for the claim is ....

justify VERB /ˈdʒʌ.stəˌfaɪ/ to defend as valid.

K

k ABBREVIATION See kilo-.
K ABBREVIATION See kelvin.
kCal ABBREVIATION *See kilocalorie.*
kelvin NOUN /ˈkɛl.vɪn/ a unit of measure of temperature based on absolute zero, the least possible temperature. $273.16\ \mathrm{K}$ is the triple point of water. *Notation: K. Formula:* $\mathrm{K} = {}^{\circ}\mathrm{C} + 273.15$, $^{\circ}\mathrm{C} = \mathrm{K} - 273.15$ where $^{\circ}\mathrm{C}$ is degrees Celsius.
Kelvin, William Thomson, 1st Barron PERSON /ˈkɛl.vɪn ˈwɪl.yəm ˈtɒm.sən fɜrst ˈbær.ən/ (1824–1907) an English physicist and mathematician after whom the kelvin temperature scale is named.



Lord William Thomson Kelvin

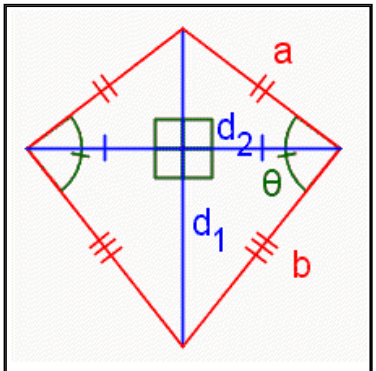
key NOUN /ki/
1. something that enables decryption of an encrypted message. *Example:* a 64 bit encryption key.
2. a note that explains symbols on a graph.

kg ABBREVIATION *See kilogram.*
kilo- PREFIX /ˈkɪl.oʊ/ $10^3 = 1000$. *Abbreviation: k.* *Example:* $4.7\ \text{kilogram} = 4.7 \times 10^3\ \text{grams} = 4700\ \text{grams}$. *Synonym: thousand.*
kilocalorie NOUN /ˈkɪl.oʊˌkæl.ə.ri/ 1000 calories. *Abbreviation: Kcal. See also calorie.*
kilogram NOUN /ˈkɪl.oʊˌgræm/ a unit of measure of mass. *Abbreviation: kg. Formulas:* $1\ \text{kilogram} = 1000\ \text{grams}$, $1\ \text{kilogram} \approx 2.2\ \text{pounds}$ on the Earth's surface.

kilometer NOUN /kɪˈlɒ.mɪ.tər/ a unit of measure of distance. *Abbreviation: km. Formulas:* $1 \text{ kilometer} = 1000 \text{ meters}$, $1 \text{ kilometer} \approx 0.62 \text{ miles}$.

kilometers per hour NOUN /kɪˈlɒ.mɪ.tərz pər ˈaʊ.ər/ a unit of measure of speed. *Abbreviation: kph. Formulas:* $1 \text{ kph} \approx 0.2778 \text{ m/s}$, $1 \text{ kph} \approx 0.6214 \text{ mph}$.

kite NOUN /kaɪt/ a geometric figure formed by two perpendicular line segments, one of which is bisected by the other. *Synonym: deltoid.*



Kite

km ABBREVIATION *See kilometer.*

kn ABBREVIATION *See knot.*

knot NOUN /nɒt/ a unit of measure of speed on water equal to one nautical mile per hour. *Abbreviation: kn. Formulas:* $1 \text{ knot} = 1.852 \text{ kph}$, $1 \text{ knot} \approx 1.51 \text{ mph}$.

known /noʊn/

1. ADJECTIVE specified or discovered. *Example:* the known world.
2. NOUN a quantity that has been identified. *Synonym: known value. Antonym: unknown.*

known value NOUN /noʊn ˈvæl.yu/ *See known, definition 2.*

kph ABBREVIATION *See kilometers per hour.*

L

l ABBREVIATION See liter.

L SYMBOL 50 in Roman numerals.

label /'leɪ.bəl/

1. NOUN a letter, letters or symbol used to identify an object. *Examples:* A, d, ℑ, ℘, β, €, ∡.
2. VERB to mark an object with a symbol, letter or letters so that it can be identified.

lambda SYMBOL /'læm.bdə/ the Greek letter λ, used as a variable for wavelength.

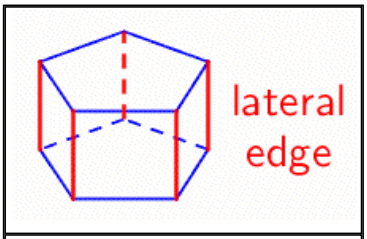
last ADJECTIVE /læst/ after any other. *Antonym: first.*

lateral ADJECTIVE /'læt.ər.əl/

1. having to do with a side. *Example:* lateral area.
2. being part of the surface of a 3-dimensional object that is *not* a base. *Synonym: of the side(s).*

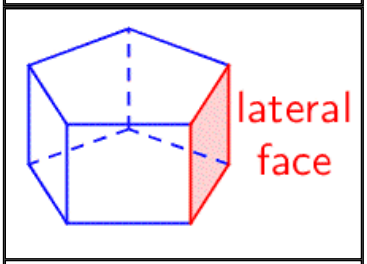
lateral area NOUN /'læt.ər.əl 'ɛər.i.ə/ the surface area of the faces of a polyhedron *not* including the bases.

lateral edge NOUN /'læt.ər.əl ɛdʒ/ an edge between two adjacent lateral faces.



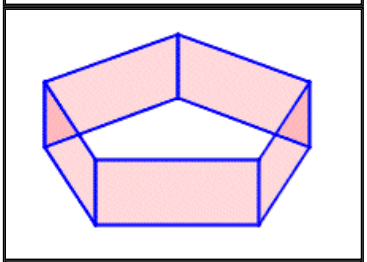
Lateral Edge

lateral face NOUN /'læt.ər.əl feɪs/ a face of a polyhedron that is *not* a base.



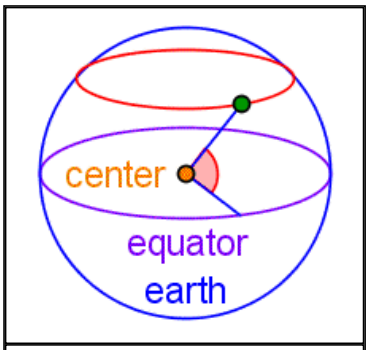
Lateral Face

lateral surface NOUN /'læt.ər.əl 'sɜr.fɪs/ the surface of a polyhedron excluding the bases.


Lateral Surface

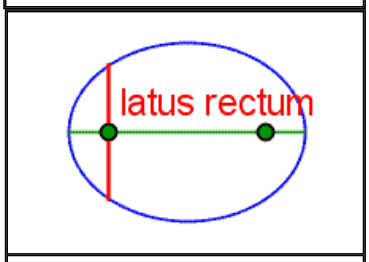
lateral surface area NOUN /ˈlæt.ər.əl ˈsɜr.fɪs ˈɛər.i.ə/ the surface area of a polyhedron excluding the bases.

latitude NOUN /ˈlæ.tɪ.tud/ an angular distance north or south of the equator of a point on the Earth's surface.



Latitude

latus rectum NOUN /ˈleɪ.təs ˈrɛk.təm/ a chord perpendicular to the major axis and passing through a focus of an ellipse, parabola, or hyperbola.

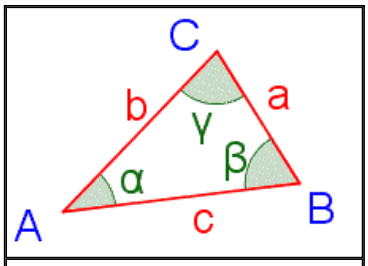


Latus Rectum

law NOUN /lɑ/ a property or rule that does *not* change. *Example:* law of sines. *Synonyms: axiom, theorem.*

Law of Cosines NOUN /lɑ ʌv ˈkoʊ.saɪnz/ a rule relating the lengths of the sides of a triangle:

$$c^2 = a^2 + b^2 - 2ab\cos\gamma.$$



Law of Cosines

Law of Detachment NOUN /lɑ ʌv dɪˈtætʃ.mənt/ if $P \rightarrow Q$, and P is true, then Q must be true. *Example:* If a rectangle has congruent sides, then it is a square. Rectangle A has congruent sides, so rectangle A must be a square.

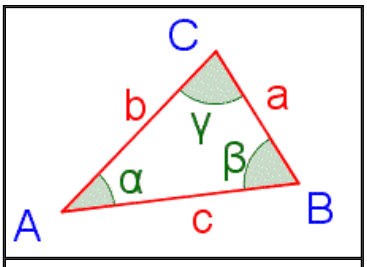
Law of Exponents NOUN /lɑ ʌv ˈɛk.spoʊ.nənts/ *See Properties of Exponents.*

Law of Logarithms NOUN /lɑ ʌv ˈlɔ.gəˌrɪð.əmz/ *See Properties of Logarithm.*

Law of Signs NOUN /lɑ ʌv saɪnz/ if a negative and a positive number are multiplied, the product is negative. If two negative or two positive numbers are multiplied, the product is positive. *Formulas:* for $a,b > 0$: $a \cdot b = ab$; $-a \cdot b = -ab$; $a \cdot (-b) = -ab$; $-a \cdot (-b) = ab$.

Law of Sines NOUN /lɑ ʌv saɪnz/ a rule relating the lengths of the sides of a triangle. *Formula:*

$$\frac{a}{sin\alpha} = \frac{b}{sin\beta} = \frac{c}{sin\gamma}.$$

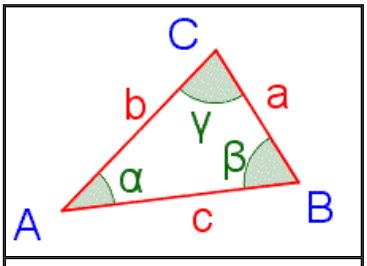


Law of Sines

Law of Syllogism NOUN /lɑ ʌv 'sɪl.əˌdʒɪz.əm/ if $P \rightarrow Q$ and $Q \rightarrow R$, then $P \rightarrow R$. This is the logical equivalent of the transitive property of equality.

Law of Tangents NOUN /lɑ ʌv 'tæn.dʒəntz/ a rule relating the lengths of the sides of a triangle.

Formula: $$\frac{a-b}{a+b} = \frac{\tan\left(\frac{1}{2}(\alpha-\beta)\right)}{\tan\left(\frac{1}{2}(\alpha+\beta)\right)}.$$



Law of Tangents

lb ABBREVIATION *See pound.*

lcd ACRONYM *See least common denominator.*

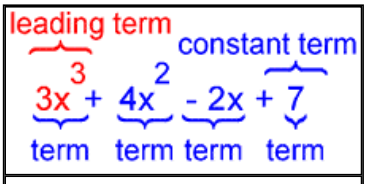
lcm ACRONYM *See least common multiple.*

lead VERB /lid/
1. to go in front of.
2. to go first.

leading ADJECTIVE /'li.dɪŋ/
1. in front of.
2. going first. *Example:* leading term.

leading coefficient NOUN /'li.dɪŋ ˌkoʊ.ə'fɪ.ʃənt/ in a polynomial, the coefficient of the term with the highest degree. *Example:* in $3x^2 + 2x - 4$, the leading coefficient is 3.

leading term NOUN /'li.dɪŋ tɜrm/ in a polynomial, the term with the highest degree.



Leading Term

leading zero NOUN /'li.dɪŋ 'zɪər.oʊ/ a zero on the left of a numeral; a zero with no nonzero digits in a higher place value. *Example:* the numeral 00152.7 has two leading zeroes.

Leading Zeros

leap year NOUN /lip yɪər/ a year when February has 29 days. In the Gregorian calendar, a year is a leap year if it is divisible by 4, but *not* divisible by 100, unless it is divisible by 400.

lease NOUN /lis/ a contract that transfers use of an object in exchange for a rent payment. *Example:* lease a car.

least ADJECTIVE /list/

1. the smallest.
2. the closest to negative infinity.
3. one number from a set of numbers that is less than all the other numbers in the set. *Example:* the least value of $\{-3, 2, 1, 0, 1, 2\}$ is -3.

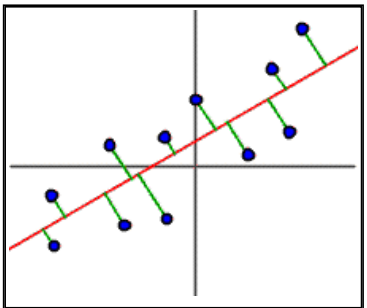
least common denominator NOUN /list 'kɒm.ən dɪ'nɒm.əˌneɪ.tər/ the least common multiple of two or more denominators. *Abbreviation: lcd.*

Example: $lcd\left(\frac{3}{2}, \frac{5}{6}\right) = 6$. *See also least common multiple.*

least common divisor NOUN /list 'kɒm.ən dɪ'vaɪ.zər/ the least common multiple of two or more divisors. *Example:* $\text{lcd}(2,5) = 10$. *See also least common multiple.*

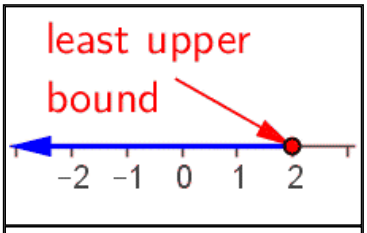
least common multiple NOUN /list 'kɒm.ən 'mʌl.tə.pəl/ the smallest integer or expression that is a multiple of two or more integers or expressions. *Abbreviation: lcm. Example:* $\text{lcm}(12,10) = 60$ since $12 = 2{\cdot}2{\cdot}3$, $10 = 2{\cdot}5$ and $60 = 2{\cdot}2{\cdot}3{\cdot}5$.

least squares line NOUN /list skwɛərz laɪn/ a line generated by a linear least squares method that minimizes the distance between the data points it represents and the line itself.


Least Squares Line

least squares method NOUN /list skwɛərz 'mɛθ.əd/ a method of finding a best fit solution for a dataset that minimizes the sum of the squares of the distance from data points to the generated curve.

least upper bound NOUN /list 'ʌp.ər baʊnd/ the least value that is greater than or equal to all members of a set. *Synonym: supremum.*

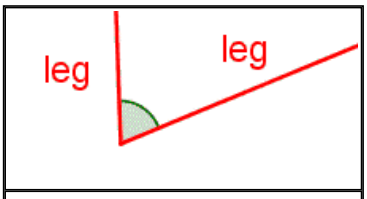


Least Upper Bound

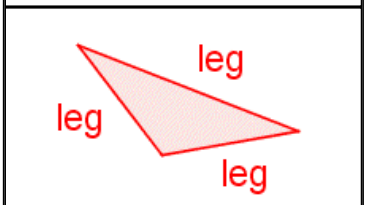
left to right PREPOSITION /lɛft tu raɪt/ starting on the left and moving to the right.

leg NOUN /lɛg/

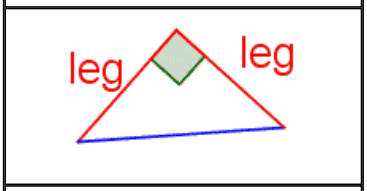
1. (of an angle) the line segments or rays that define the angle. *Synonyms: side, definition 2, arm.*
2. (of a triangle) one of the sides of a triangle. *Synonym: side, definition 1.*
3. (of an isosceles triangle) one of the congruent sides of an isosceles triangle. *Synonym: side, definition 1.*
4. (of a right triangle) one of the sides of a right triangle that is not the hypotenuse.



Leg of an Angle



Leg of a Triangle



Leg of a Right Triangle

lemma NOUN /'lɛm.ə/ a theorem that is used as a stepping stone to prove a more important theorem.

lemniscate NOUN /'lɛm.nɪˌskeɪt/ a geometric figure shaped like an infinity sign. *Equations:* (rectangular coordinates): $(x^2 + y^2)^2 = 2a^2(x^2 - y^2)$, (polar coordinates): $r^2 = a^2 \cos 2\theta$, $r^2 = a^2 \sin 2\theta$.

length NOUN /lɛŋkθ/

1. the measure of a 1-dimensional object from one end to the other.
2. the longest measure of distance of a multidimensional object.

less /lɛs/

1. ADJECTIVE smaller, more negative, less positive. *Notation:* $<$. *Example:* 1 is less than 3, $1 < 3$.

2. PREPOSITION subtract. *Example:* 4 less 1 is 3, $4 - 1 = 3$.

like ADJECTIVE /laɪk/

1. the same in some way. *Example:* like terms.
2. similar.

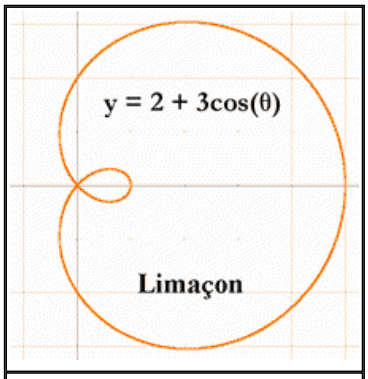
Antonym: unlike.

like fractions NOUN /laɪk 'fræk.ʃənz/ fractions with the same denominator. *Example:* $\frac{3}{5}$ and $\frac{2}{5}$. *Antonym: unlike fractions.*

likely ADJECTIVE /'laɪk.li/ has a good chance of happening. *Example:* It is likely that the sun will rise tomorrow. *Antonym: unlikely.*

like terms NOUN /laɪk tɜrmz/ terms that have the same variables with the same exponents. *Example:* x^2 and $-2x^2$ are like terms; $3y^2$ and $2y^3$ are unlike terms. *Synonym: similar terms. Antonym: unlike terms.*

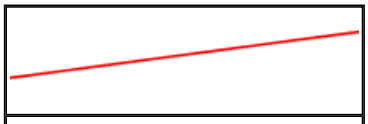
limaçon NOUN /'lɪm.ə,sɒn/ a geometric figure that can be shaped like an oval, a heart, or having an inner and outer loop. *Equations:* (rectangular coordinates) $(x^2 + y^2 - ax)^2 = b^2(x^2 + y^2)$, (polar coordinates) $r = b + a \cos \theta$.



Limaçon

limit NOUN /'lɪ.mɪt/ a value that a sequence or function gets closer and closer to without ever reaching it. *Notation:* $\lim_{n \to a} f(n)$ is read "the limit of $f(n)$ as n approaches a.".

line NOUN /laɪn/ a straight one-dimensional figure that does *not* end.


Line

linear ADJECTIVE /'lɪn.i.ər/

1. having to do with a line. *Example:* linear equation. *Antonym: nonlinear.*
2. having only one dimension.

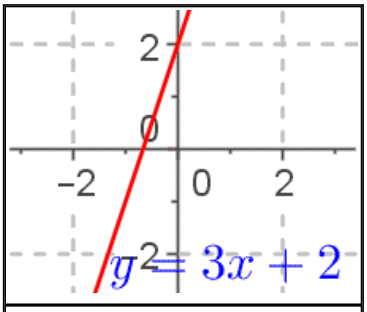
linear algebra NOUN /'lɪn.i.ər 'æl.dʒə.brə/ an algebra of structures such as linear systems, matrices and vectors.

linear combination NOUN /'lɪn.i.ər ˌkɒm.bə'neɪ.ʃən/ a linear combination of A and B is $a \cdot A + b \cdot B$, where a and b are nonzero numbers.

linear equation NOUN /ˈlɪn.i.ər ɪˈkweɪ.ʒən/ an equation that, when graphed, makes a line; a polynomial equation of degree 1. *Formula:* $y = mx + b$. *Example:* $y = 3x - 2$. *Antonym:* *nonlinear equation*.

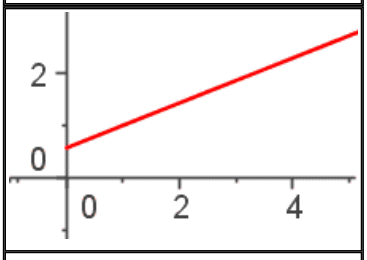
linear factor NOUN /ˈlɪn.i.ər ˈfæk.tər/ a factor of a polynomial that is a linear expression in the form $x+a$. *See also* *quadratic factor*.

linear function NOUN /ˈlɪn.i.ər ˈfʌŋk.ʃən/ a function that, when graphed, makes a line; a polynomial function of degree 1. *Formula:* $f(x) = mx + b$. *Example:* $f(x) = 3x - 4$.



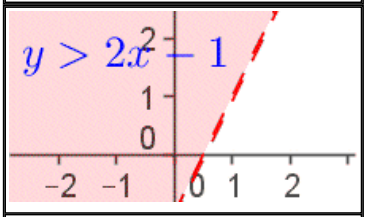
Linear Function

linear growth NOUN /ˈlɪn.i.ər groʊθ/ growth that happens at a constant rate each time period. *Formula:* $y = mx + b$ where $m>0$ is the growth rate and b is the initial value. *Synonym:* *constant growth*.



Linear Growth

linear inequality NOUN /ˈlɪn.i.ər ˌɪn.ɪˈkwɒl.ɪ.ti/ an inequality with one or more variables without exponents. *Example:* $y > 2x - 1$.

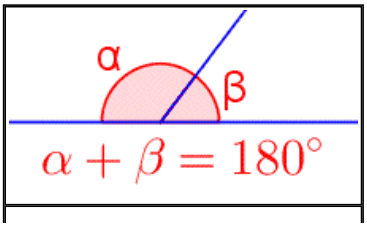


Linear Inequality

linearly dependent ADJECTIVE /ˈlɪn.i.ər.li dɪˈpɛn.dənt/ at least one linear combination of the elements equals zero. *Math definition:* A, B are linearly dependent if, for some $a,b \neq 0$, $aA + bB = 0$. *Antonym:* *linearly independent*.

linearly independent ADJECTIVE /ˈlɪn.i.ər.li ˌɪn.dɪˈpɛn.dənt/ no linear combination of the elements equals zero. *Math definition:* A, B are linearly independent if there exists no $a,b \neq 0$ such that $aA + bB = 0$. *Antonym:* *linearly dependent*.

linear pair NOUN /ˈlɪn.i.ər pɛər/ a pair of adjacent angles whose non-common legs are opposite rays.



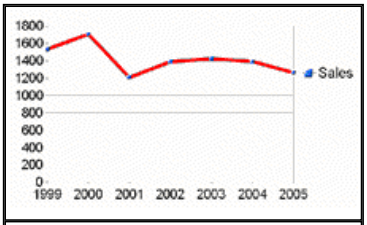
Linear Pair

linear programming NOUN /ˈlɪn.i.ər ˈproʊ.græm.ɪŋ/ a method for determining the best outcome using a set of linear equations or linear inequalities to represent a real-life situation.

linear regression NOUN /ˈlɪn.i.ər rɪˈgrɛ.ʃən/ any method of finding a best fit line for a set of data. *See also best fit line.*

linear system NOUN /ˈlɪn.i.ər ˈsɪs.təm/ a set of linear objects that may all be simultaneously true. *Example:* $\begin{matrix} 3x + 2y = 1 \\ x - 2y = -5 \end{matrix}$.

line chart NOUN /laɪn tʃɑrt/ a graph that shows data as a set of points connected by line segments. *Synonyms: line graph, line plot.*



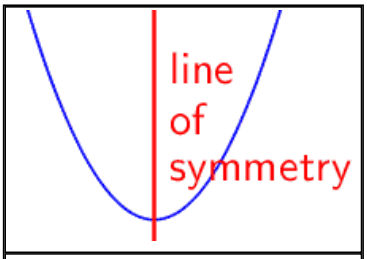
Line Chart

line graph NOUN /laɪn græf/ *See line chart.*

line of fit NOUN /laɪn ʌv fɪt/ *See best fit line.*

line of reflection NOUN /laɪn ʌv rɪˈflɛk.ʃən/ *See axis of reflection.*

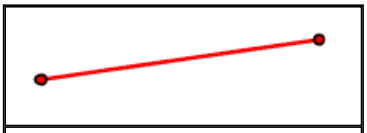
line of symmetry NOUN /laɪn ʌv ˈsɪm.ɪ.tri/ a line about which an object or multiple objects are symmetric. *Synonym: axis of symmetry.*



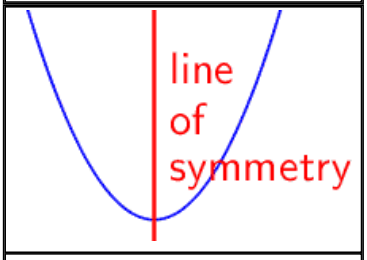
Line of Symmetry

line plot NOUN /laɪn plɒt/ *See line chart.*

line segment NOUN /laɪn ˈsɛg.mənt/ a continuous portion of a straight line with two endpoints.


Line Segment

line symmetry NOUN /laɪn ˈsɪm.ɪ.tri/ if a geometric figure can be rotated about a line without changing the figure, the figure is said to have line symmetry. The line about which the figure is rotated is called the line of symmetry. *Synonym: axial symmetry.*



Line Symmetry

list /lɪst/

1. NOUN item by item entries of objects, usually in a particular order.
2. VERB to show entries of objects item by item, usually in a particular order.

liter NOUN /'li.tər/ a unit of measure of volume. *Abbreviation: l.* *Formulas:* $1000 \text{ milliliters} = 1 \text{ liter}$, $1 \text{ liter} \approx 0.264 \text{ US gallons}$, $1 \text{ liter} \approx 1 \text{ US quart}$. *Math definition:* $1\text{l} = 1000 \text{ cm}^3$.

literal NOUN /'lɪ.tər˽əl/ any object written as an explicit value, and *not* as a variable. *Example:* 5 is a literal number.

ln ABBREVIATION natural logarithm. *Formula:* $\ln a = \log_e a$.

ln( ) COMPUTERS the natural logarithmic function in most computer languages.

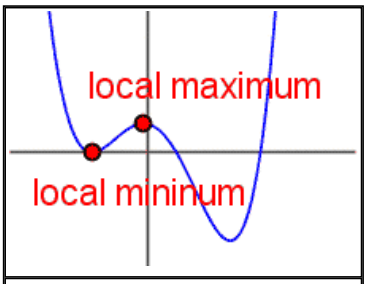
loan /loʊn/

1. NOUN an agreement to borrow and repay money.
2. NOUN money that is borrowed.
3. VERB to agree to lend money.

local ADJECTIVE /'loʊ.kəl/ restricted to a region; *not* global. *Antonym: global.*

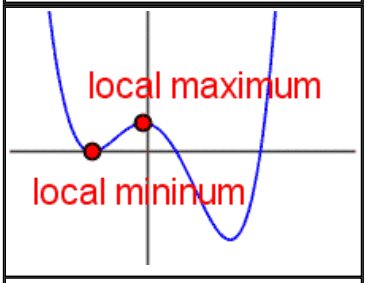
local extremum NOUN /'loʊ.kəl ɪk'stri.məm/ either a local maximum or a local minimum.

local maximum NOUN /'loʊ.kəl 'mæk.sə.məm/ the greatest value of a function in a local subdomain. *Synonym: relative maximum.*



Local Minimum

local minimum NOUN /'loʊ.kəl 'mɪn.ə.məm/ the least value of a function in a local subdomain. *Synonym: relative minimum.*



Local Minimum

local subdomain NOUN /'loʊ.kəl 'sʌb.doʊ.meɪn/ a continuous subset of a domain; a subdomain that does not extend to either negative infinity or positive infinity.

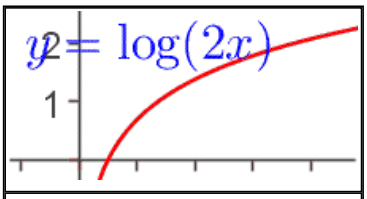
location NOUN /loʊ'keɪ.ʃən/ where an object exists in a geometric space. *Example:* the location of point A is $(2, -1)$. *See also GeoApp!.*

locus NOUN /'loʊ.kəs/ a continuous set of points that satisfy one or more conditions. *Example:* a circle is the locus of all points equidistant from a center point. *Plural: loci* /'loʊ.saɪ/.

log ABBREVIATION logarithm. If the base is not shown, either base 10 (business, social sciences) or base e (physics, engineering) is assumed. *Examples:* $\log_{12} 3.6$, $\log\ 6$, $\ln\ 7.2$

log( ) COMPUTERS the common logarithmic function for most computer languages. In some computer languages, `log( )` represents the natural logarithm.

logarithm NOUN /'lɔ.gəˌrɪð.əm/ the value of an exponent; the inverse of exponentiation. *Math definition:* $\log_b a = c$ if and only if $b^c = a$. *Inverse: exponent. See also Properties of Logarithms, common logarithm, natural logarithm.*



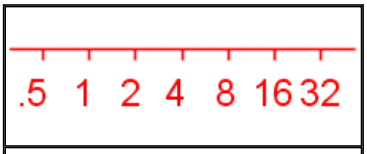
Logarithm

logarithmic ADJECTIVE /ˌlɔg.əˈrɪð.mɪk/ having to do with logarithms. *Example:* logarithmic equation.

logarithmic equation NOUN /ˌlɔg.əˈrɪð.mɪk ɪˈkweɪ.ʒən/ an equation that contains a logarithm of a variable. *Example:* $y = \log_{10} x$.

logarithmic function NOUN /ˌlɔg.əˈrɪð.mɪk ˈfʌŋk.ʃən/ a function that contains a logarithm of a variable. *Example:* $f(x) = \log_{10} x$.

logarithmic scale NOUN /ˌlɔg.əˈrɪð.mɪk skeɪl/ a scale of a graph where the value is multiplied by a given factor each tick mark.



Logarithmic Scale

logic NOUN /'lɒdʒ.ɪk/
1. the study of sound reasoning.
2. a series of statements that make use of the science of logic.

logical ADJECTIVE /'lɒdʒ.ɪ.kəl/
1. having to do with logic. *Example:* logical value.
2. following the rules of logic. *Example:* logical argument.

logical argument NOUN /'lɒdʒ.ɪ.kəl 'ɑr.gyə.mənt/ one or more premises followed by one or more valid conclusions. *Example:*

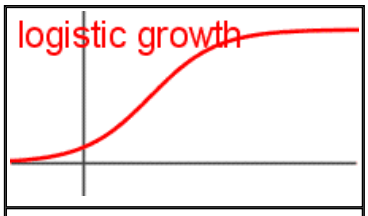
Socrates is a man. (premise)
All men are mortal. (premise)
So, Socrates is mortal. (conclusion)

logically ADVERB /'lɒdʒ.ɪ.kə.li/ in agreement with the rules of logic.

logical value NOUN /'lɒdʒ.ɪ.kəl 'væl.yu/
1. *See truth value.*
2. *See Boolean value.*

logistic curve NOUN /lɑ'dʒɪˌstɪk kɜrv/ *See logistic growth.*

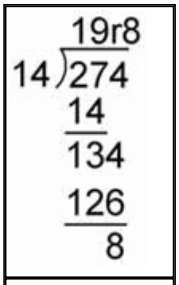
logistic growth NOUN /lɑ'dʒɪˌstɪk groʊθ/ growth in natural populations where there is a limiting factor to growth. A general equation for logistic growth is $y = \frac{1}{1 + e^{-t}}$.



Logistic Growth

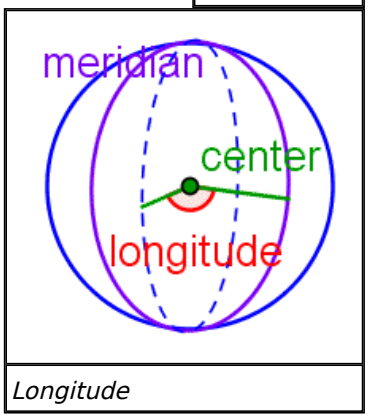
log-log graph NOUN /lɔg lɔg græf/ a graph where both axes use a logarithmic scale.

long division NOUN /lɒŋ dɪ'vɪ.ʒən/ an algorithm for dividing real numbers where each step is shown in detail.



Long Division

longitude NOUN /'lɒŋdʒ.ɪ.tud/ the angle of a point on the Earth's surface measured from Greenwich, England to the meridian on which the point lies.



Longitude

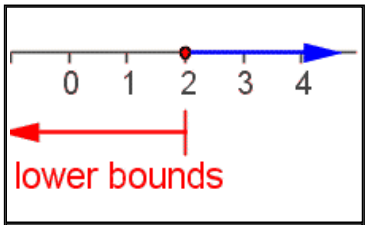
long scale NOUN /lɒŋ skeɪl/ a standard for naming multiples of powers of 10 where $10^{12} = 1$ billion. *Antonym: short scale.*

loss NOUN /lɒs/
1. a decrease in amount. Keyword for negative and for subtraction.
2. an amount by which expenses are more than income.

Formula: Expenses - Income = Loss, Expenses > Income.

lower ADJECTIVE /'loʊ.ər/ less than; below. *Example:* lower bound. *Antonym: upper.*

lower bound NOUN /'loʊ.ər baʊnd/ a number that is less than all numbers in a set. *Antonym: upper bound. See also greatest lower bound.*



Lower Bound

lower extreme NOUN /'loʊ.ər ɪk'strim/ the least value of a variable in a dataset. *Synonym: minimum.*

lower quartile NOUN /'loʊ.ər 'kwɔr.taɪl/ the first quartile of a dataset.

lower triangular matrix NOUN /'loʊ.ər traɪ'æŋ.gyə.lər 'meɪ.trɪks/ a matrix having all zeros below and to the left of the main diagonal. *Plural: lower triangular matrices* /'loʊ.ər traɪ'æŋ.gyə.lər 'meɪ.trɪˌsiz/.

$$\begin{bmatrix} 3 & -1 & 2 \\ 0 & 2 & 1 \\ 0 & 0 & -2 \end{bmatrix}$$

Lower Triangular Matrix

lowest ADJECTIVE /'loʊ.ɛst/

1. (numbers) *See least, definition 3.*
2. (geometry) closest to the bottom.

lowest common denominator NOUN /'loʊ.ɛst 'kɒm.ən dɪ'nɒm.əˌneɪ.tər/ *See least common denominator.*

lowest common multiple NOUN /'loʊ.ɛst 'kɒm.ən 'mʌl.tə.pəl/ *See least common multiple.*

lurking variable NOUN /'lər.kiŋ 'vɛər.i.ə.bəl/ a variable that is *not* identified in a study but may affect the result.

M

µ ABBREVIATION See micro-.

m ABBREVIATION

1. *See meter.*
2. *See milli-.*
3. *See minute.*

M

1. ABBREVIATION *See mega-.*
2. SYMBOL Roman numeral for 1,000.

M̲ ABBREVIATION *See million.*

MAB block NOUN /ɛm eɪ bi blɔk/ *See base ten block.*

macro- PREFIX /ˈmæk.roʊ/ very large in scale.

magic square NOUN /ˈmædʒ.ɪk skwɛər/ a square matrix containing numbers where the rows and columns all add up to the same number:

4	9	2
3	5	7
8	1	6

Magic Square

magnitude NOUN /ˈmæg.nɪˌtud/

1. the distance of a point from zero. The distance formula is used to calculate magnitudes. *Notation:* $|x|$. *Formulas:* $|a| = \sqrt{a^2}$, $|a + bi| = \sqrt{a^2 + b^2}$. *Example:* $|-3 + 4i| = \sqrt{(-3)^2 + 4^2} = \sqrt{9 + 16} = \sqrt{25} = 5$. *Synonym: absolute value.*
2. (vector) the length of a vector disregarding direction. *Notation:* $|\langle x, y \rangle|$. *Formulas:*

$$\left|\langle x, y\rangle\right| = \sqrt{x^2 + y^2},$$
$$\left|\langle x, y, z\rangle\right| = \sqrt{x^2 + y^2 + z^2}.$$

3. a number that is a relative quantity, particularly of a unit of measure. *Example:* magnitude of a star.

main ADJECTIVE /meɪn/ the most important. *Example:* main diagonal. *Synonym: major.*

main diagonal NOUN /meɪn daɪˈæg.ə.nl/ the diagonal of a square matrix going from the upper left to the lower right. *Synonym: principle diagonal.*

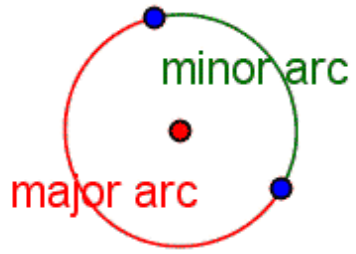
$$\begin{bmatrix} 2 & -2 & 1 \\ 1 & 3 & 2 \\ -2 & 6 & -1 \end{bmatrix}$$

Main Diagonal

major ADJECTIVE /meɪˌdʒər/

1. larger or largest; greater or greatest. *Example:* major sector.
2. most important. *Synonym: main.*

major arc NOUN /meɪˌdʒər ɑrk/ an arc of a circle that is longer than a semicircle of the same circle. *Antonym: minor arc.*



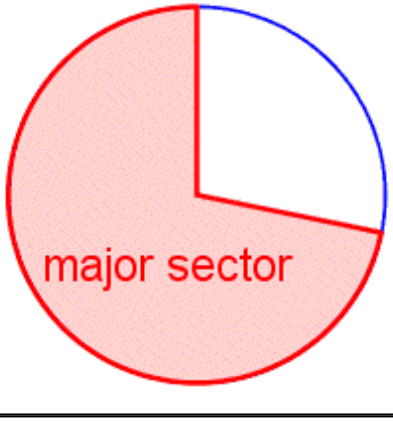
Normal Curve

major axis NOUN /meɪˌdʒər ˈæk.sɪs/ the longer axis of two axes. *Plural: major axes* /meɪˌdʒər ˈæk.siz/. *Antonym: minor axis, definition 1.*

Major Axis

majority NOUN /məˈdʒɔr.ɪ.ti/ more than one half of a population. *Example:* the bill passed the legislature by a majority vote. *Antonym: minority.*

major sector NOUN /meɪˌdʒər ˈsɛk.tər/
the larger of two circular sectors into which a circle has been divided.
Antonym: minor sector.



Major Sector

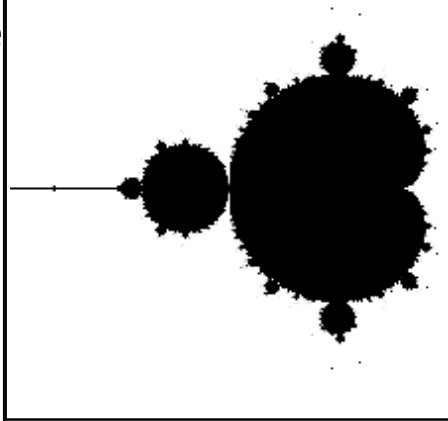
make VERB /meɪk/
1. to bring into existence.
2. to produce.

Mandelbrot, Benoît B. PERSON /ˈmæn.dl.brɔt bɛnˈwɑ bi/ a Poland-born Franco-American mathematician known for his work with fractals and credited for creation of the Mandelbrot set.

Benoît B. Mandelbrot

Mandelbrot set NOUN /ˈmæn.dl.brɔt sɛt/ a set of points in a complex plane generated by iterating through the complex polynomial

$$z_{n+1} = z_n^2 + C.$$



Mandelbrot Set

manipulative NOUN /ˈmæn.ɪ.pyu.lə.tɪv/ a physical or virtual object than can be handled or changed. *Example:* Algebra tiles.

mantissa NOUN /mænˈtɪs.ə/

1. the part of a number written in scientific notation or e notation that contains the significant digits of the number. *Example:* In 3.529×10^5, the mantissa is 3.529. *Synonym: significand.*
2. the decimal part of a logarithm. *Example:* In $\log_{10} 12.2 \approx 1.08636$, the mantissa is $.08636$.

mapping NOUN /ˈmæp.ɪŋ/ *See relation.*

map scale NOUN /mæp skeɪl/ the ratio of distances in a map to the actual distances in the thing being mapped. *Example:* a 1:20 map scales means that real objects are 20 times bigger than shown on the map. *See also representative fraction.*

margin of error NOUN /ˈmɑr.dʒɪn ʌv ˈɛr.ər/ a measure of the expected accuracy of the results. *Example:* a margin of error of 3% means that the actual value is likely to vary from 0.97 to 1.03 times the measured result.

markup NOUN /ˈmɑrk.ʌp/ an amount or percentage that is added to a cost to get the retail price.

Formula: $\text{cost} + \text{markup} = \text{retail price}$.

mass NOUN /mæs/ the amount of matter contained in a substance as determined by Newton's second law of motion. *Example:* the mass of the moon is 7.36×10^{22} kg.

math NOUN /ˌmæθ/ *See mathematics.*

mathemagically ADVERB /ˌmæθ.əˈmæ.dʒɪ.kli/ doing something according to the principles of mathematics that seems like magic.

mathematical ADJECTIVE /ˌmæθ.əˈmæt.ɪ.kəl/ having to do with mathematics. *Example:* mathematical logic.

mathematical expectation NOUN /ˌmæθ.əˈmæt.ɪ.kəl ˌɛk.spɛkˈteɪ.ʃən/ *See expected value.*

mathematical induction NOUN /ˌmæθ.əˈmæt.ɪ.kəl ɪnˈdʌk.ʃən/ a method for proving a proposition involving an infinite sequence of elements. The steps of mathematical induction are: 1) Show the first case is true; 2) Show that if an arbitrary case (n) is true, then the next case ($n+1$) must be true. *For contrast, see induction.*

mathematical logic NOUN /ˌmæθ.əˈmæt.ɪ.kəl ˈlɒdʒ.ɪk/ a subset of logic used in mathematics based on axiomatic systems, deductive logic and mathematical induction. Mathematical logic is more rigorous than standard logic.

mathematical model NOUN /ˌmæθ.əˈmæt.ɪ.kəl ˈmɒd.l/ *See model.*

mathematical reasoning NOUN /ˌmæθ.əˈmæt.ɪ.kəl ˈriz.nɪŋ/ forming conclusions using mathematical logic.

mathematical situation NOUN /ˌmæθ.əˈmæt.ɪ.kəl ˈsɪt.u.eɪ.ʃən/ a mathematical problem where the context is *not* known. *Example:* Solve the equation $0 = x + 2$.

mathematician NOUN /ˌmæθ.ə.məˈtɪʃ.ən/ one who studies mathematics.

Historical Note

Brahmagupta, an (Asiatic) Indian born in 598, gave this definition of a mathematician:

> “He who distinctly knows addition and the rest of the twenty operations and the eight processes including measurement by shadows is a mathematician.”

translated from Sanskrit by G. Thibaut. G. R. Kaye. *Indian Mathematics (1915)*.

mathematics NOUN /ˌmæθ.əˈmæ.tɪks/

1. the study of numbers, shapes, patterns and relationships.
2. the science of necessary conditions.

Synonym: math.

matrix NOUN /'meɪ.trɪks/ values arranged in rows and columns that are enclosed in brackets. *Plural: matrices* /'meɪ.trɪˌsiz/. *Synonym: array.*

$$\begin{bmatrix} -1 & 4 & 2 \\ 0 & 3 & 6 \end{bmatrix}$$

Matrix

matrix addition NOUN /'meɪ.trɪks ə'dɪ.ʃən/ addition of corresponding elements of matrices with the same dimensions. *Example:* $\begin{bmatrix} 2 & -2 \\ 3 & 0 \\ -1 & 2 \end{bmatrix} + \begin{bmatrix} 1 & 3 \\ -1 & 0 \\ -1 & -3 \end{bmatrix} = \begin{bmatrix} 2+1 & -2+3 \\ 3-1 & 0+0 \\ -1-1 & 2-3 \end{bmatrix} = \begin{bmatrix} 3 & 1 \\ 2 & 0 \\ -2 & -1 \end{bmatrix}$.

matrix algebra NOUN /'meɪ.trɪks 'æl.dʒə.brə/ an algebra for manipulating matrices. Matrix algebra includes addition, subtraction, multiplication, multiplicative identities and additive identities.

matrix dimension NOUN /ˈmeɪ.trɪks dɪˈmɛn.ʃən/ the number of rows and columns in a matrix.

Notation: $dim(A) = m \times n$ (the dimension of matrix A with m rows and n columns).

$$\begin{bmatrix} 1 & 3 & 0 \\ 2 & 4 & 2 \end{bmatrix}$$

2×3 matrix

Matrix Dimension

matrix element NOUN /ˈmeɪ.trɪks ˈɛl.ə.mənt/ a matrix entry at a particular row and column.

Notation: $a_{r,c}$ where r is the row and c is the column.

$$\begin{bmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \end{bmatrix}$$

Matrix Elements

matrix inverse NOUN /ˈmeɪ.trɪks ɪnˈvɜrs/ a square matrix A^{-1} such that $A \cdot A^{-1} = I$ and $A^{-1} \cdot A = I$ where I is the identity matrix with the same dimensions as A. A square matrix with a determinant of zero has no inverse.

matrix multiplication NOUN /ˈmeɪ.trɪks ˌmʌl.tə.plɪˈkeɪ.ʃən/ multiplication of the rows of the first matrix by the columns of the second matrix. *Example:* $\begin{bmatrix} 0 & 1 & 4 \\ 3 & 2 & 5 \end{bmatrix} \cdot$

$$\begin{bmatrix} 2 & -2 \\ 3 & 0 \\ 1 & 4 \end{bmatrix} =$$

$$\begin{bmatrix} 0 \cdot 2 + 1 \cdot 3 + 4 \cdot 1 & 0 \cdot (-2) + 1 \cdot 0 + 4 \cdot 4 \\ 3 \cdot 2 + 2 \cdot 3 + 5 \cdot 1 & 3 \cdot (-2) + 2 \cdot 0 + 5 \cdot 4 \end{bmatrix} =$$

$$\begin{bmatrix} 0 + 3 + 4 & 0 + 0 + 16 \\ 6 + 6 + 5 & -6 + 0 + 20 \end{bmatrix} = \begin{bmatrix} 7 & 16 \\ 17 & 14 \end{bmatrix}.$$

matrix subtraction NOUN /ˈmeɪ.trɪks səbˈtræk.ʃən/
subtraction of corresponding elements of two matrices that have the same dimensions. *Example:* $\begin{bmatrix} 4 & 5 \\ -1 & 1 \\ 0 & 3 \end{bmatrix} - \begin{bmatrix} 2 & 3 \\ -1 & 3 \\ -1 & 4 \end{bmatrix} = \begin{bmatrix} 4-2 & 5-3 \\ -1-(-1) & 1-3 \\ 0-(-1) & 3-4 \end{bmatrix} = \begin{bmatrix} 2 & 2 \\ 0 & -2 \\ 1 & -1 \end{bmatrix}$.

matrix transposition NOUN /ˈmeɪ.trɪks ˌtræns.pəˈzɪ.ʃən/
swapping the rows of a matrix with the columns. *Examples:*

$$A = \begin{bmatrix} 4 & 5 \\ -1 & 1 \\ 0 & 3 \end{bmatrix}, A^T = \begin{bmatrix} 4 & -1 & 0 \\ 5 & 1 & 3 \end{bmatrix}.$$

maximum ADJECTIVE, NOUN /ˈmæk.sə.məm/
1. the greatest of several quantities.
2. the greatest value of a function on an interval.

Plural: maxima. Antonym: minimum.

maximum point NOUN /ˈmæk.sə.məm pɔɪnt/ *See local maximum.*

mean NOUN /min/
1. an average; a value that is a center of a set of values. *Example:* arithmetic mean.
2. (statistics) the arithmetic mean of a set of numbers.

mean absolute deviation NOUN /min æbs.əˈlut ˌdi.viˈeɪ.ʃən/
See average absolute deviation.

mean absolute residual NOUN /min æbs.əˈlut rɪˈzɪdʒ.u.əl/
See average absolute deviation.

mean deviation NOUN /min ˌdi.viˈeɪ.ʃən/ the arithmetic average of the absolute values of deviations in a dataset.

Formula: $D_m = \frac{|d_1| + |d_2| + \cdots + |d_n|}{n}$ where d_i is the deviation of the i^{th} item and n is the number of values in the dataset.

mean proportional NOUN /min prəˈpoʊr.ʃən.l/ *See geometric mean.*

mean square deviation NOUN /min skwɛər ˌdi.viˈeɪ.ʃən/ *See variance.*

measure /ˈmɛ.ʒər/

1. NOUN a distance, quantity, volume or other dimension associated with an object.
2. VERB to find a distance, quantity, volume or other dimension of an object.
3. VERB compare a dimension of an object to a unit of measure.
4. VERB assign a number to a location based upon a unit of measure.

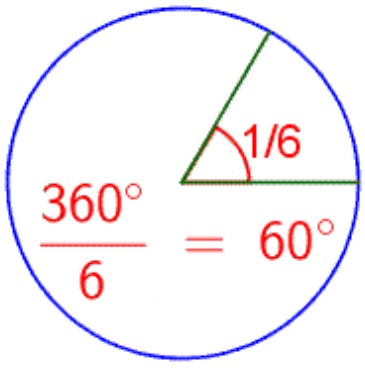
measurement NOUN /ˈmɛʒ.ər.mənt/

1. a measure associated with an object.
2. the act of measuring.

measurement system NOUN /ˈmɛʒ.ər.mənt ˈsɪs.təm/ set set of units of measure.

measure of an angle NOUN /ˈmɛ.ʒər ʌv ən ˈæŋ.gəl/ the portion of a full circle formed by an angle, measured in degrees, radians, or gradians.

Notation: $m\angle\alpha$ is read 'the measure of angle alpha.'.



Measure of an Angle

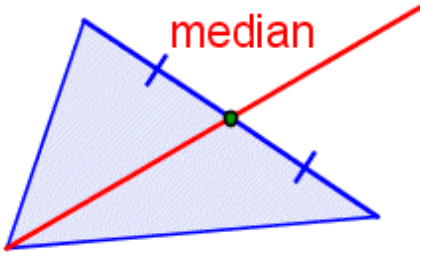
Measure of an Angle					
Unit of Measure	**Notation**	**¼ Circle**	**½ Circle**	**¾ Circle**	**Full Circle**
Degree	°	90°	180°	270°	360°
Radian	rad.	$\frac{\pi}{2}$ rad.	π rad.	$\frac{3\pi}{2}$ rad.	2π rad.
Gradian	grad.	100 grad.	200 grad.	300 grad.	400 grad.

measure of central tendency NOUN /ˈmɛ.ʒər ʌv ˈsɛn.trəl ˈtɛn.dən.si/ any formula that identifies a center of a set of numbers. *Examples:* mean, median and mode.

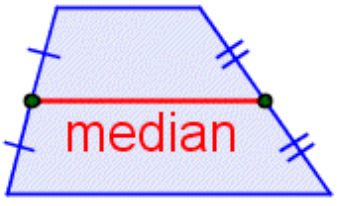
Mechanic's Rule NOUN /məˈkæn.ɪks rul/ an iterative algorithm for approximating $\sqrt{n}$. Start with an estimate n. Apply the iterative formula $n' = \frac{1}{2}\left(n + \frac{x}{n}\right)$ until the desired accuracy is achieved.

median NOUN /ˈmi.di.ən/

1. (numbers) the middle value of a set of numbers. If there are an even number of elements in the set, the median is the mean of the middle two numbers.
   Example: The median of $\{1, 2, 3, 5, 6, 7, 10, 14, 15\}$ is 6. The median



Median of a Triangle



Median of a Trapezoid

of $\{1, 2, 3, 4, 5, 6, 7, 10, 14, 15\}$ is $(5 + 6)/2 = 5.5$.

2. (triangle) a line through the vertex of a triangle and the midpoint of the opposite side.
3. (trapezoid) a line segment between midpoints of the non-parallel sides.

median point NOUN /'mi.di.ən pɔɪnt/ *See centroid.*

mediator NOUN /'mi.di.eɪ.tər/ *See perpendicular bisector.*

mega- PREFIX /'mɛg.ə/ million; $10^6 = 1{,}000{,}000$.

Abbreviation: M, definition 1.

Formula: $2 \text{ megawatts} = 2{\times}10^6 \text{ watts}$.

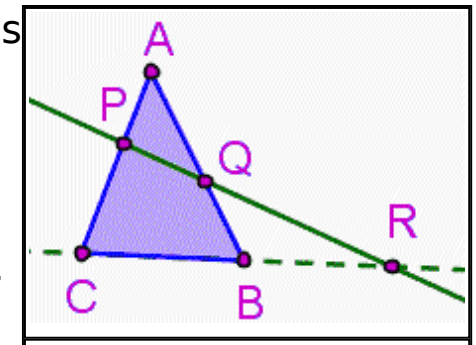
Synonym: million.

member NOUN /'mɛm.bər/ an object belonging to a set.

Notation: $x \in A$. *Synonym: element.*

Menelaus of Alexandria PERSON /ˌmɛn.l'eɪ.əs ʌv ˌæl.ɪg'zæn.dri.ə/ (70-130) an Egyptian astronomer and mathematician.

Menelaus Theorem NOUN /ˌmɛn.l'eɪ.əs 'θɪər.əm/ given points A, B, and C that are vertices of a triangle and points P on AC, Q on AB and R on the extended BC, then points P, Q, and R are collinear if and only if $\frac{AP}{PC} \cdot \frac{CR}{BR} \cdot \frac{BQ}{QA} = 1$.



Menelaus Theorem

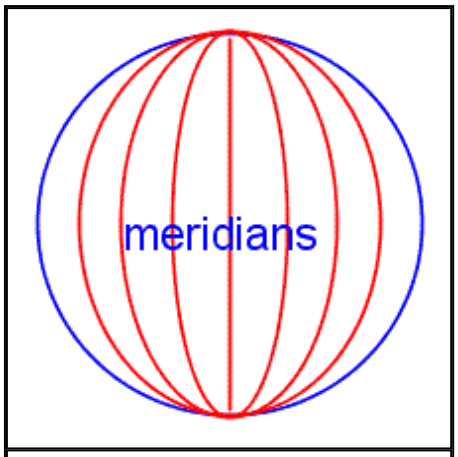
mensuration NOUN /ˌmɛn.sə'reɪ.ʃən/

1. measurement of distance, area and volume.
2. calculations of measurements using other dimensions and angles.

mental computation NOUN /'mɛn.təl ˌkɒm.pyu'teɪ.ʃən/ *See mental math.*

mental math NOUN /ˈmɛn.təl ˌmæθ/ math computations that are done in the head without aid of pencils, calculators or other devices.

meridian NOUN /məˈrɪd.i.ən/ any great circle passing through the north and south poles.



Meridian

meter NOUN /ˈmi.tər/ a unit of measure of distance. *Abbreviation: m.*

Formulas: $1 \text{ meter} = 100 \text{ centimeters}$, $1 \text{ kilometer} = 1000 \text{ meters}$, $1 \text{ meter} \approx 3.28 \text{ feet}$. *Example:* a baseball bat is about 1 meter long.

meters per second NOUN /ˈmi.tərz pər ˈsɛ.kənd/ a unit of measure of speed. How many meters something moves in one second. *Abbreviation: m/s.*

Formulas: $1 \text{ m/s} = 3.6 \text{ kph}$, $1 \text{ m/s} \approx 3.218 \text{ f/s}$.

Example: an average person walks at about 1.8 m/s.

method NOUN /ˈmɛθ.əd/ a way to do things. *Synonym: algorithm.*

metric /ˈmɛ.trɪk/

1. ADJECTIVE having to do with measurement. *Example:* metric geometry.
2. ADJECTIVE having to do with the metric system of measurement. *Example:* metric ton.
3. NOUN a non-negative measure of distances.

metric geometry NOUN /ˈmɛ.trɪk dʒiˈɒ.mɪ.tri/ a geometry in which distances can be measured relative to one or more units of measure.

metric space NOUN /ˈmɛ.trɪk speɪs/ a geometric space: 1) that has a unit of measure for each dimension, 2) that has an origin, and 3) where the distance between any two points can be calculated. *Example:* Cartesian 2-space.

metric system NOUN /ˈmɛ.trɪk ˈsɪs.təm/ a set of units of measures and notations that form the basis of the International System of Units. Metric units of measure include kilogram, meter, and second.

metric ton NOUN /ˈmɛ.trɪk tʌn/ 1000 kilogram. *Abbreviation: t. Formula:* $1 \text{ metric ton} \approx 1.1 \text{ tons}$. *Example:* an average mid-sized car weighs about 1.6 metric tons. *Synonym: tonne.*

metric unit NOUN /ˈmɛ.trɪk ˈyu.nɪt/ one of the units of measure of the metric system. *Examples:* meter, liter, and gram.

mi ABBREVIATION mile.

micro- PREFIX /ˈmaɪ.kroʊ/ $10^{-6} = 0.000001$. *Abbreviation: μ. Examples:* 2.4 micrometer $= 2.4 \times 10^{-6}$ meters. The diameter of a human hair is about 50-100 μm. *Synonym: millionth.*

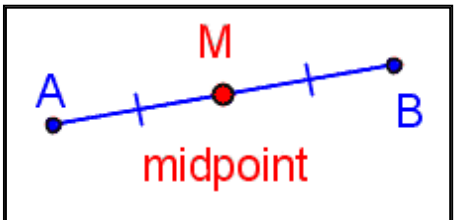
mid- PREFIX /mɪd/ in the middle.

midday NOUN /ˈmɪdˌdeɪ/ *See noon.*

midnight NOUN /ˈmɪdˌnaɪt/ the middle of the night; 12:00 AM or 0000.

midpoint NOUN /ˈmɪdˌpɔɪnt/

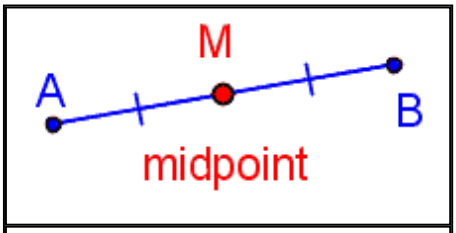
1. the center point of a line segment.
2. a point between two other points that is equidistant from both



Midpoint

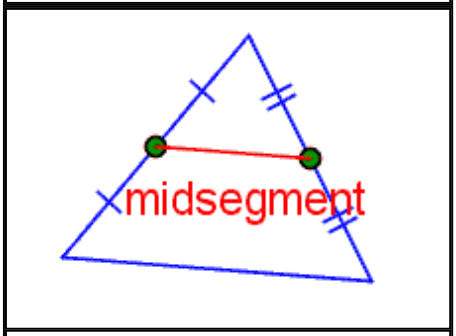
points. *Formula:* The midpoint of (x_1,y_1) and (x_2,y_2) is $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$.
See also GeoApp! (1-D).

Midpoint Theorem NOUN /ˈmɪdˌpɔɪnt ˈθɪər.əm/ if M is the midpoint of $\overline{AB}$ then $\overline{AM} \cong \overline{MB}$ and $AM = MB$.



Midpoint Theorem

midsegment NOUN /ˈmɪdˌsɛg.mənt/ a line segment joining midpoints of two sides of a triangle.



Midsegment

mi/gal ABBREVIATION miles per gallon.

mile NOUN /maɪl/ a unit of measure of distance. *Abbreviation: mi. Formulas:* $1 \text{ mile} = 5280 \text{ feet}$, $1 \text{ mile} \approx 1.61 \text{ kilometers}$, $1 \text{ kilometer} \approx 0.621 \text{ miles}$. *Example:* 1 mile is about 8-10 city blocks.. *See also nautical mile.*

mileage NOUN /ˈmaɪl.ɪdʒ/ the number of miles per gallon. *Synonym: miles per gallon.*

miles per gallon NOUN /maɪlz pər ˈgæl.ən/ the average number of miles that can be traveled while using a gallon of gas. *Abbreviation: mi/gal. Synonym: mileage.*

miles per hour NOUN /maɪlz pər ˈaʊ.ər/ a unit of measure of speed; how many miles are traveled each hour. *Abbreviation: mph. Formulas:* $1 \text{ mph} \approx 1.467 \text{ f/s}$, $1 \text{ mph} \approx 1.609 \text{ kph}$. *Example:* an average human walks about 3-4 mph.

millennium NOUN /mɪˈlɛn.i.əm/ a period of 1000 years.

milli- PREFIX /ˈmɪl.ə/ one thousandth; $10^{-3} = 0.001$. *Abbreviation: m. Examples:* $3 \text{ millimeters} = 3 \times 10^{-3} \text{ meters} = 0.003 \text{ meters}$, A human fingernail is about .3-.5mm thick. *Synonym: thousandth, definition 2.*

milligram NOUN /ˌmɪl.əˈgræm/ a unit of measure of mass. *Abbreviation: mg. Formulas:* $1000 \text{ milligrams} = 1 \text{ gram}$, $1 \text{ milligram} = 0.001 \text{ gram}$. *Example:* a honey bee weighs about 90 mg.

milliliter NOUN /ˌmɪl.əˈli.tər/ a unit of measure of volume. *Abbreviation: ml. Formulas:* $1000 \text{ milliliters} = 1 \text{ liter}$, $1 \text{ milliliter} = 0.001 \text{ liter}$, $1 \text{ milliliter} = 1 \text{ cm}^3$.

millimeter NOUN /ˌmɪl.əˈmi.tər/ a unit of measure of distance. *Abbreviation: mm. Formulas:* $1000 \text{ millimeters} = 1 \text{ meter}$, $1 \text{ millimeter} = 0.001 \text{ meter}$. *Example:* Ants are between 3 mm – 12 mm long.

million ADJECTIVE, NOUN /ˈmɪl.yən/ $1{,}000{,}000 = 10^6$. *Abbreviations: M, MM. Synonym: mega-.*

millionth ADJECTIVE, NOUN /ˈmɪl.yənθ/ $10^{-6} = 0.000001$. *Synonym: micro-.*

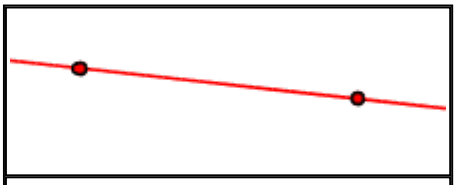
min ABBREVIATION *See minute.*

min- PREFIX /mɪn/ smaller or smallest.

minimum ADJECTIVE, NOUN /ˈmɪn.ə.məm/
1. the least of several quantities.
2. the least value of a function on an interval.

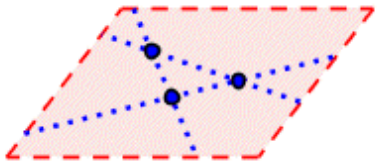
Plural: minima /ˈmɪn.ə.mə/. *Antonym: maximum.*

Minimum Line Postulate NOUN /ˈmɪn.ə.məm laɪn ˈpɒs.tʃə.lɪt/ a line contains at least two distinct points.



Minimum Line Postulate

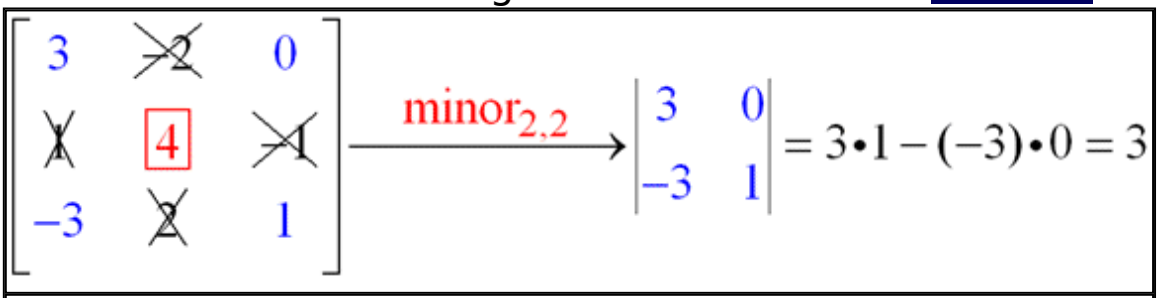
Minimum Plane Postulate NOUN /ˈmɪn.ə.məm pleɪn ˈpɒs.tʃə.lɪt/ a plane contains at least three distinct points not on the same line.



Minimum Plane Postulate

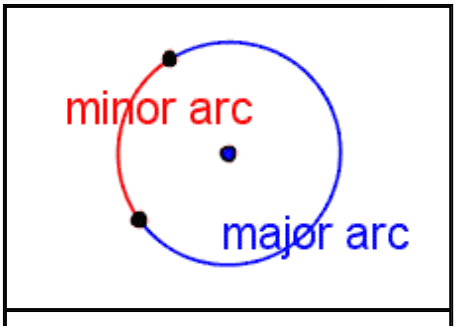
minimum point NOUN /ˈmɪn.ə.məm pɔɪnt/ *See local minimum.*

minor /ˈmaɪ.nər/
1. ADJECTIVE smaller or less important.
2. NOUN (of a matrix) the determinant of a smaller matrix obtained by eliminating the row and column of the element from the original matrix. *See also cofactor.*

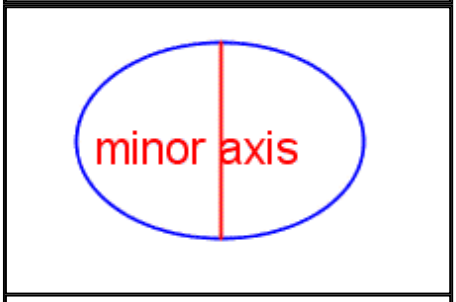


Minor of a Matrix

minor arc NOUN /ˈmaɪ.nər ɑrk/ an arc of a circle that is shorter than a semicircle of the same circle. *Antonym: major arc.*



Minor Arc



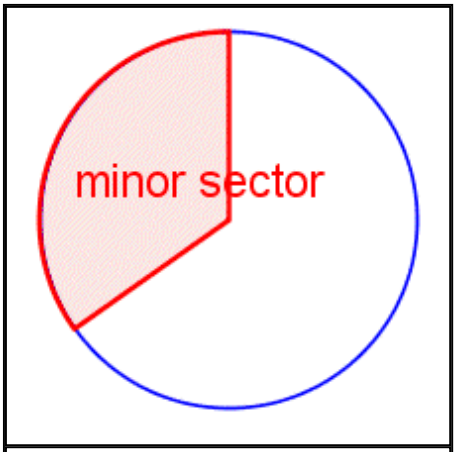
Minor Axis

minor axis NOUN /ˈmaɪ.nər ˈæk.sɪs/
1. the smaller of two axes.
   Antonym: major axis.
2. (hyperbola) the axis that does *not* intersect the foci.

Plural: minor axes /ˈmaɪ.nər ˈæk.siz/*. See also major axis.*

minority NOUN /ˈmaɪ.nɔr.ɪ.ti/ less than half of a population.
Example: a minority of voters voted against the proposition.
Antonym: majority.

minor sector NOUN /ˈmaɪ.nər ˈsɛk.tər/ the smaller of two circular sectors into which a circle has been divided.
Antonym: major sector.



Minor Sector

minuend NOUN /ˈmɪn.yuˌɛnd/ a number or expression from which a value is subtracted. *Formula:* minuend – subtrahend = difference.

minus /ˈmaɪ.nəs/
1. PREPOSITION subtract from. *Example:* 5 minus 2 means 5–2.
2. ADJECTIVE negative. *Example:* minus 5 means -5.

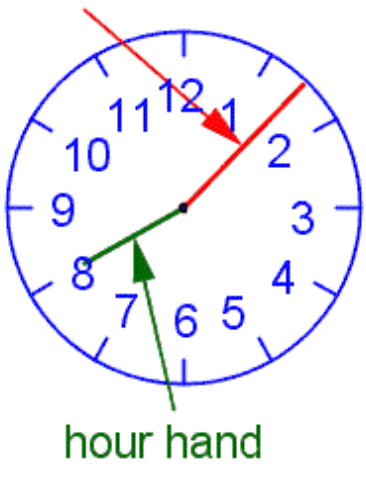
minus or plus PREPOSITION /ˈmaɪ.nəs ɔr plʌs/ an operator than can be either addition or can be subtraction. If the first $\pm$ is taken to be addition, then the $\mp$ is taken to be subtraction. If the first $\pm$ is taken to be subtraction, then the $\mp$ is taken to be addition. *Notation:* $\mp$. *Example:* $3 \mp 4 = 3 - 4 = -1$ or $3 + 4 = 7$. *See also* *plus or minus*.

minus sign NOUN /ˈmaɪ.nəs saɪn/ the symbol '–' which represents subtraction ($3 - 1 = 2$); or negation (-5).

minute NOUN /ˈmɪn.ɪt/

1. a unit of measure of time. *Abbreviations: m, min.* *Formulas:* $1 \text{ minute} = 60 \text{ seconds}$, $1 \text{ hour} = 60 \text{ minutes}$.
2. a unit of measure of rotation. *Notation:* $'$. *Formulas:* $60 \text{ arc minutes} = 1 \text{ degree}$, $1 \text{ arc minute} = 60 \text{ arc seconds}$. *Synonym:* *arc minute*.

minute hand NOUN /ˈmɪn.ɪt hænd/ the longer hand on an analog clock that points to the number of minutes after the hour.



Minute Hand

mirror VERB /ˈmɪər.ər/ *See* *reflect*.

mirror image NOUN /ˈmɪər.ər ˈɪm.ɪdʒ/ *See* *reflection*.

mixed ADJECTIVE /mɪkst/ containing more than one type of object.

mixed decimal NOUN /mɪkst 'dɛs.ə.məl/ a decimal numeral with a whole part and a decimal part. *Example:* 3.69.

mixed number NOUN /mɪkst 'nʌm.bər/ a whole number and a proper fraction together. *Example:* 1½ = 1+½ = 1.5.

ml ABBREVIATION *See milliliter.*

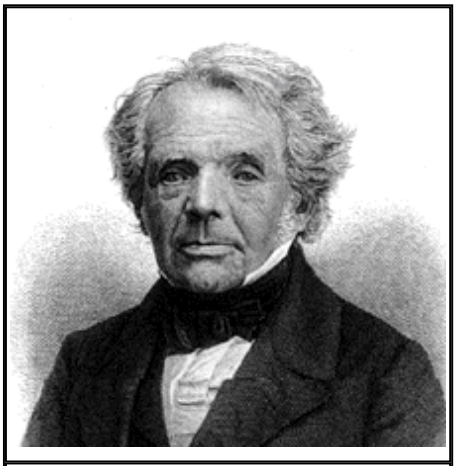
mm ABBREVIATION *See millimeter.*

MM ABBREVIATION *See million.*

mnemonic NOUN /nɪ'mɒ.nɪk/ a mental device designed to help people remember something. *Example:* SOHCAHTOA.

mo ABBREVIATION month.

Möbius, August Ferdinand PERSON /'mœ.bi.əs ɔ'gʌst 'fɜr.dn̩ænd/ (1790-1868) a German mathematician remembered for the Möbius strip.



August Ferdinand Möbius

Möbius band NOUN /'mœ.bi.əs bænd/ *See Möbius strip.*

Möbius strip NOUN /'mœ.bi.əs strɪp/ a 3-dimensional geometric figure with one side and one edge. *Synonym: Möbius band.*

mod. ABBREVIATION *See modulo n.*

mod- PREFIX /mɒd/ *See modular.*

mode NOUN /moʊd/ the value(s) that appear most frequently in a dataset. *Example:* The mode of {-4, 3, 3, 7, 14, 14, 27, 27, 27} is 27. 27 appears 3 times in the set, more than any other number.

model /'mɒd.l/

1. NOUN a graph, table, function or other device that approximates real world data or situations, or helps visualize a mathematical relationship. *Example:* an exponential growth equation models unrestricted bacteria growth.
2. VERB to make a graph, table, function or other device that approximates real world data or situations, or helps visualize a mathematical relationship.

modeling NOUN /ˈmɒd.əl.ɪŋ/ the act or process of making a graph, table, function or other device that approximates real world data or situations, or helps visualize a mathematical relationship.

modern ADJECTIVE /ˈmɒd.ərn/ based on complete axiomatic system(s). *Examples:* modern geometry, modern algebra.

modern algebra NOUN /ˈmɒd.ərn ˈæl.dʒə.brə/ algebra based on set theory, including groups. *See also abstract algebra.*

modern geometry NOUN /ˈmɒd.ərn dʒiˈɒ.mɪ.tri/ geometry based on complete axiomatic systems.

modular ADJECTIVE /ˈmɒdʒ.ə.lər/ having to do with modular arithmetic.

modular arithmetic NOUN /ˈmɒdʒ.ə.lər əˈrɪθ.mə.tɪk/ an arithmetic on numbers that wrap around and begin again at 0; an arithmetic that uses the remainders after division. *Example:* $(3+4) \bmod. 5 = 7 \bmod. 5 = 2$. *Synonym: clock arithmetic. See also GeoApp!.*

modulo PREPOSITION /ˈmɒdʒ.əˌloʊ/ having to do with modular arithmetic.

modulo n NOUN /ˈmɒdʒ.əˌloʊ ɛn/ the remainder of division by n. *Notation:* $mod.$. *Math definition:* Given integers $a \neq 0$, $n \neq 0$ and $c \geq 0$, $a \bmod. n = c$ if and only if $c < |n|$ and for some integer d, $a \div n = d\mathrm{R}c$. *Example:* $17 \bmod. 5 = 2$ since $17 \div 5 = 3\mathrm{R}2$. *Synonym: remainder.*

modulus NOUN /ˈmɒdʒ.ə.ləs/
1. the base used to compute congruence modulo n.
   Example: the 5 in $7 \bmod 5 = 2$.
2. (British English) *See absolute value.*

mol ABBREVIATION mole.

mole NOUN /moʊl/ a unit of measure of the amount of a substance. *Abbreviation: mol.*

mon- PREFIX /mɒn/ one.

monic ADJECTIVE /ˈmɒn.ɪk/ having a coefficient of the highest term equal to 1. *Example:* monic polynomial.

monic equation NOUN /ˈmɒn.ɪk ɪˈkweɪ.ʒən/ a monic polynomial set equal to either zero or a dependent variable. *Example:* $x - 3 = 0$.

monic polynomial NOUN /ˈmɒn.ɪk ˌpɒl.əˈnoʊ.mi.əl/ a polynomial of one variable where the leading coefficient is 1. *Example:* $x - 3$.

monomial NOUN /moʊˈnoʊ.mi.əl/ a polynomial with one term; any expression that does not include addition or subtraction. *Example:* $3x^2$. *Antonym: multinomial.*

month NOUN /mʌnθ/ a unit of measure of time. *Abbreviation: mo. Formulas:* 1 month = 28, 29, 30, or 31 days. $12 \text{ months} = 1 \text{ year}$.
$1 \text{ month} \approx 4.3 \text{ weeks}$.

more ADJECTIVE /moʊr/
1. in addition to. Keyword for addition.
2. greater than.

most ADJECTIVE /moʊst/ greatest. *Example:* Who has the most apples?

motion NOUN /ˈmoʊ.ʃən/ the act of changing location.

mph ABBREVIATION *See miles per hour.*

m/s ABBREVIATION *See meters per second.*

multi- PREFIX /ˈmʌl.tɪ/

1. many.
2. more than one. *Example:* multiple bar graph.
3. more than two. *Example:* multinomial.
4. having to do with multiplication. *Example:* multiple.

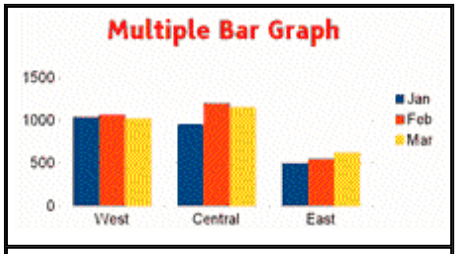
multilateral ADJECTIVE /ˌmʌl.tɪˈlæt.ər.l/ having many sides.

multinomial NOUN /ˌmʌl.tɪˈnoʊ.mi.əl/ a polynomial with two or more terms. *Antonym:* *monomial*.

multiple /ˈmʌl.tə.pəl/

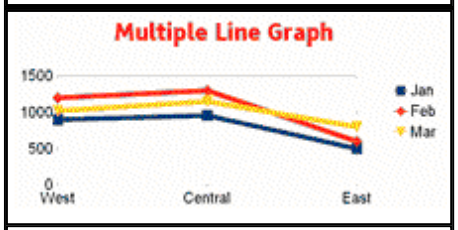
1. NOUN the product of two quantities, especially integers. *Example:* 15 is a multiple of 5 since $5 \cdot 3 = 15$.
2. ADJECTIVE more than one.

multiple bar graph NOUN /ˈmʌl.tə.pəl bɑr græf/ a bar graph with multiple bars grouped together useful for comparing data.



Multiple Bar Graph

multiple line graph NOUN /ˈmʌl.tə.pəl laɪn græf/ a line graph with multiple lines useful for comparing data.

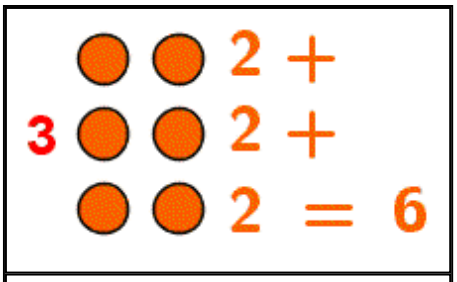


Multiple Line Graph

multiple root NOUN /ˈmʌl.tə.pəl rut/ a root that happens more than once. If the roots of $x^3 - 3x + 2$ are 1, 1, and -2, then 1 is a multiple root of $x^3 - 3x + 2$.

multiplicand NOUN /ˌmʌl.tə.plɪˈkænd/ a number or expression that is to be multiplied. *Formula:* $\text{multiplicand} \times \text{multiplier} = \text{product}$. *Example:* In $a \times b = c$, the multiplicand is a.

multiplication NOUN /ˌmʌl.tə.plɪ'keɪ.ʃən/ the process of repeated addition. *Notations:* ×, ·.



Multiplication

Formula: $\text{multiplicand} \times \text{multiplier} = \text{product}$ *Example:* $2 \times 3 = 2+2+2 = 6$. *Inverse: division. See also Properties of Multiplication, Multiplication Facts.*

multiplication fact NOUN /ˌmʌl.tə.plɪ'keɪ.ʃən fækt/ two integers and the result of their multiplication. *See also Multiplication Facts.*

multiplication of polynomials NOUN /ˌmʌl.tə.plɪ'keɪ.ʃən ʌv ˌpɒl.ə'noʊ.mi.əlz/ to multiply two polynomials, multiply each term of the first polynomial by each term of the second polynomial.

multiplication principle NOUN /ˌmʌl.tə.plɪ'keɪ.ʃən 'prɪn.sə.pəl/ *See counting principle.*

Multiplication Property of Equality NOUN /ˌmʌl.tə.plɪ'keɪ.ʃən 'prɒ.pər.ti ʌv ɪ'kwɒl.ɪ.ti/ both sides of an equation can be multiplied by a nonzero value without changing the truth value of the equation. *Math definition:* For any real or complex numbers a, b and $c \neq 0$; if $a = b$ then $a \cdot c = b \cdot c$ and if $a \neq b$ then $a \cdot c \neq b \cdot c$.

Multiplication Property of Inequality NOUN /ˌmʌl.tə.plɪ'keɪ.ʃən 'prɒ.pər.ti ʌv ˌɪn.ɪ'kwɒl.ɪ.ti/ if both sides of an inequality are multiplied by a positive value, the truth value of the inequality does not change. If both sides of an inequality are multiplied by a negative value, '$>$' flips to '$<$' and '$<$' flips to '$>$'. *Math definition:* For any real or complex numbers a, b and $c>0$; if $a < b$ then $a \cdot c < b \cdot c$ and if $a > b$ then $a \cdot c > b \cdot c$. For any real or complex numbers a, b and $c < 0$; if $a < b$ then $a \cdot c > b \cdot c$ and if $a > b$ then $a \cdot c < b \cdot c$.

multiplication sign NOUN /ˌmʌl.tə.plɪ'keɪ.ʃən saɪn/ one of the symbols '$\times$' and '$\cdot$', used to indicate multiplication. *Important:* In multiplication of vectors, '$\times$' has a different meaning than '$\cdot$'. *Synonym: times sign.*

multiplicative ADJECTIVE /'mʌl.tə.plɪˌkə.tɪv/ having to do with multiplication. *Example:* multiplicative identity.

multiplicative identity NOUN /'mʌl.tə.plɪˌkə.tɪv aɪ'dɛn.tɪ.ti/ the number 1 that, when multiplied by any real number, gives a product equal to the real number. *Formulas:* $a \cdot 1 = a$, $1 \cdot a = a$.

multiplicative inverse NOUN /'mʌl.tə.plɪˌkə.tɪv ɪn'vɜrs/ a number that, when multiplied by its inverse, gives 1. The multiplicative inverse of a is $\frac{1}{a}$, $a \neq 0$, because $a \cdot \frac{1}{a} = \frac{a}{\not{1}} \cdot \frac{\not{1}}{a} = \frac{\not{a}}{\not{a}} = 1$. *Synonym: reciprocal. See also inverse, definition 3.*

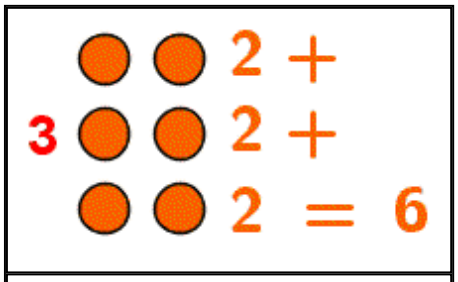
multiplicity NOUN /ˌmʌl.tə'plɪ.sɪ.ti/

1. the state of being a multiple.

2. the number of times an object occurs. *Example:* If an object occurs 3 times then it has a multiplicity of 3.

multiplier NOUN /ˈmʌl.təˌplaɪ.ər/ a number by which another number is multiplied. *Formula:* multiplicand × multiplier = product. *Example:* 3×2=6.

multiply VERB /ˈmʌl.təˌplaɪ/ add repeatedly; to find a product of two or more factors. *Notations:* ·, ×.



Multiply

Example: $2 \times 4 = 2+2+2+2 = 8$. *Inverse:* *divide*.

multiplying by 0 *See* *0, Property of Multiplication by*.

multiplying by 1 *See* *1, Property of Multiplication by*.

multistage sampling NOUN /ˌmʌl.tɪˈsteɪdʒ ˈsɑm.plɪŋ/ a sampling that uses multiple sampling methods.

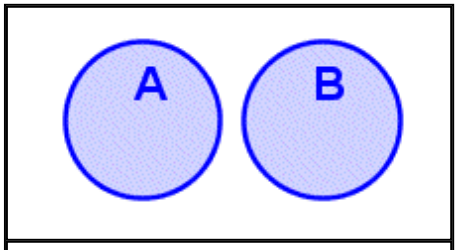
multistep ADJECTIVE /ˌmʌl.tiˈstɛp/ requiring more than two steps to solve.

multistep equation NOUN /ˌmʌl.tiˈstɛp ɪˈkweɪ.ʒən/ an equation that takes more than 2 steps to solve.

Example: $2x-2 = x+4 \rightarrow 2x = x+6 \rightarrow x = 6$.

mutually exclusive ADJECTIVE /ˈmyu.tʃu.ə.li ɛkˈsklu.sɪv/

1. (sets) none of the sets includes any of the others.
2. (events) if one of the events happens the others can not happen. *Example:* in a single flip of a coin, heads and tails are mutually exclusive events.



Mutually Exclusive

N

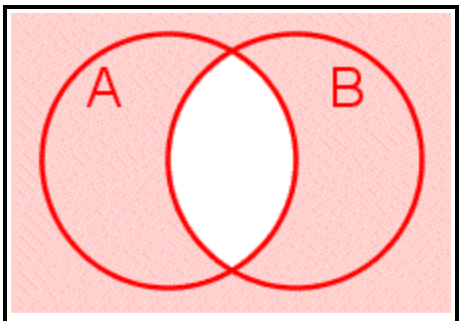
n ABBREVIATION nano-.

n- PREFIX /ɛn/

1. any positive integer can be substituted. *Example:* n-gon.
2. not. *Example:* nand.

nand NOUN /nænd/ a combination of NOT and AND.

Formulas: $A \text{ nand } B = \text{not}(A \text{ and } B)$, $A \text{ nand } B = \neg(A \wedge B)$.



Nand

NAND Truth Table		
A	***B***	***A* NAND *B***
False	False	True
False	True	True
True	False	True
True	True	False

nano- PREFIX /ˈnæ.noʊ/ one billionth.

$10^{-9} = 0.000000001$. *Abbreviation: n.*

Example: $6 \text{ nanometers} = 6 \times 10^{-9} \text{ meters}$.

Synonym: billionth.

natural ADJECTIVE /ˈnæt.ʃrəl/

1. related to nature.
2. existing in nature. *Example:* natural number.

natural logarithm NOUN /ˈnæt.ʃrəl ˈlɔ.gəˌrɪð.əm/ a logarithm with base e. *Important:* In engineering, the natural log is written $\log x$. *Abbreviation:* *ln*. *Notation:* $\ln x$. *Math definition:* $\ln x \equiv \log_e x$.

natural number NOUN /ˈnæt.ʃrəl ˈnʌm.bər/ a positive whole number. *Notations:* $\mathbb{N}$, $\mathbb{Z}+$. *Math definition:* $\mathbb{N} \equiv \{1, 2, 3, 4, \ldots\}$. *Synonyms:* *counting number*, *positive integer*.

nautical mile NOUN /ˈnɔ.tɪ.kəl maɪl/ a unit of measure of distance used for ocean-going vessels. *Formulas:* $1 \text{ nautical mile} = 1.852 \text{ kilometers}$, $1 \text{ nautical mile} \approx 1.15 \text{ miles}$.

n-dimensional ADJECTIVE /ɛn dɪˈmɛn.ʃə.nl/ having n dimensions. *Example:* a 3-dimensional solid.

near ADVERB /nɪər/
1. close to in distance or time.
2. close to in value.

nearest ADJECTIVE /ˈnɪər.ɪst/ the one closest to in distance, time or value.

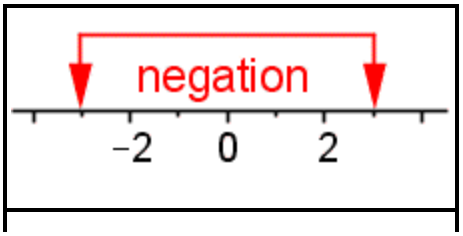
necessary ADJECTIVE /ˈnɛs.əˌsɛr.i/
1. must be true for the rest to be valid.
2. required.

necessary condition NOUN /ˈnɛs.əˌsɛr.i kənˈdɪ.ʃən/ a condition that must be true; a condition that is required.

negate VERB /nɪˈgeɪt/
1. to take the negative of a number.
2. to perform logical negation ($\text{NOT } P$).

negation NOUN /nɪˈgeɪ.ʃən/
1. taking the negative of a number.

Example: the negation of a is $-a$.



2. logical NOT; change the truth value of a logical or Boolean value. *Notations:* $\neg$, not. *Synonym:* *not*.

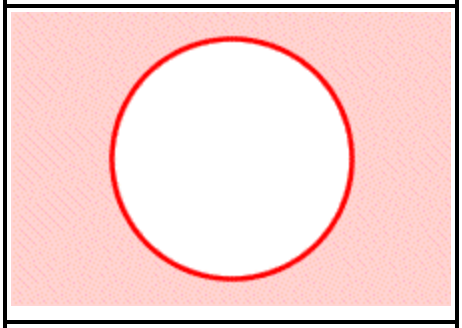
Negation	
P	**¬P**
True	False
False	True

negative /ˈnɛg.ə.tɪv/

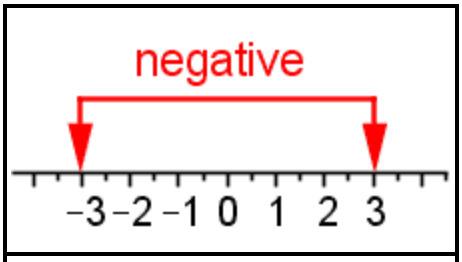
1. NOUN additive inverse.
   Example: The negative of x is $-x$.
2. NOUN a number less than zero.
   Example: -5.
   Antonym: *nonnegative*.
3. ADJECTIVE expressing negation.
   Example: negative number.
4. ADJECTIVE in a negative direction.

Antonym: *positive*.

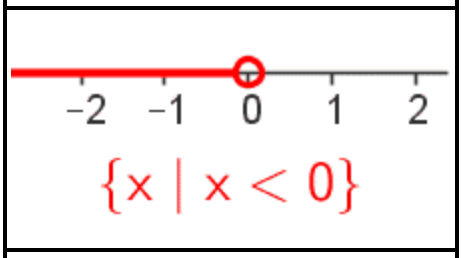
Arithmetic Negation



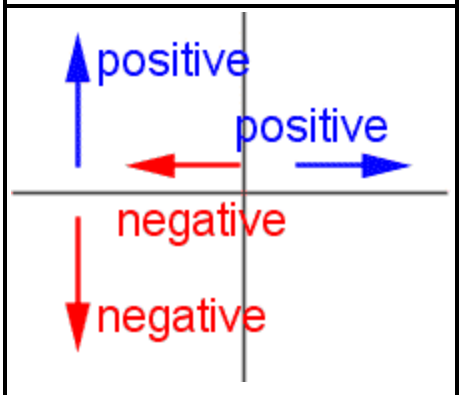
Logical Negation



Negative of a Number

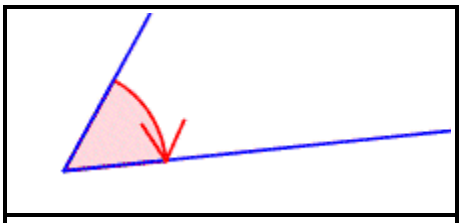


Negative Number



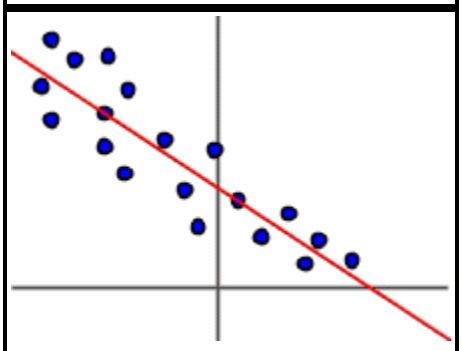
Negative Direction

negative angle NOUN /ˈnɛg.ə.tɪv ˈæŋ.gəl/ an angle measured in a clockwise direction. *Antonym: positive angle.*



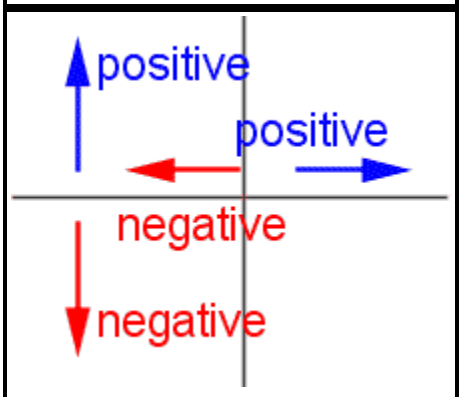
Negative Angle

negative correlation NOUN /ˈnɛg.ə.tɪv ˌkɒr.əˈleɪ.ʃən/ a relationship between variables such that when one increases, the other decreases. *Antonym: positive correlation.*



Negative Correlation

negative direction NOUN /ˈnɛg.ə.tɪv dɪˈrɛk.ʃən/ a direction opposite of positive. *Example:* depth is the negative of height. *Antonym: positive direction.*



Negative Direction

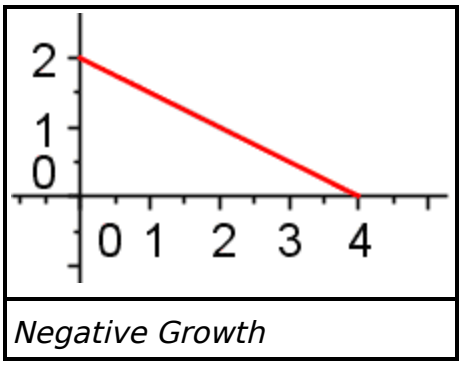
negative exponent NOUN /ˈnɛg.ə.tɪv ˈɛks.poʊ.nənt/ the reciprocal of. *Math definition:* $x^{-b} = x^{-b} \equiv \frac{1}{x^b}, x \neq 0.$

Example: $2^{-3} = \frac{1}{2^3} = \frac{1}{8} = 0.125.$

negative growth NOUN /ˈnɛg.ə.tɪv groʊθ/ decreases at a constant rate each time period.

Formula: $y = mx + b, m<0$

where m is the growth rate and b is the initial value. *See also constant growth.*

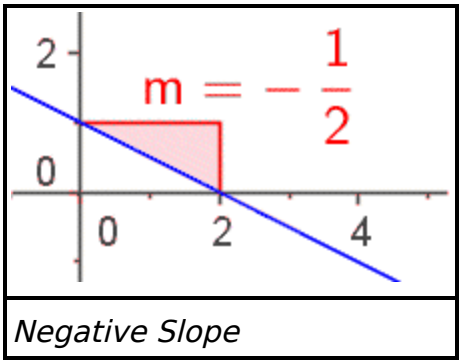


Negative Growth

negative reciprocal NOUN /ˈnɛg.ə.tɪv rɪˈsɪp.rə.kəl/ the negative reciprocal of a is $-1/a$. *See also reciprocal.*

negative sign NOUN /ˈnɛg.ə.tɪv saɪn/ the symbol '-' which indicates negation. *Example:* $-x$ or -5.

negative slope NOUN /ˈnɛg.ə.tɪv sloʊp/ a slope that slants downward from left to right; a slope that can be written using a negative number. *Antonym: positive slope.*



Negative Slope

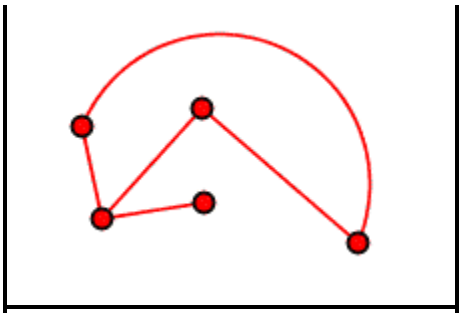
neighborhood NOUN /ˈneɪ.bɔr.hʊd/ everything contained in a disk whose center is a particular point.

net /nɛt/

1. NOUN *See geometric net.*
2. NOUN *See network.*
3. ADJECTIVE what is left over after a deduction. *Example:* net profit.

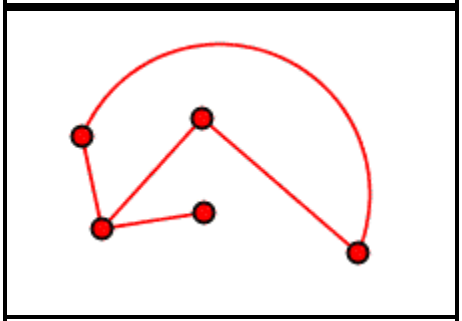
net weight NOUN /nɛt weɪt/ the weight of product *not* including the packaging material.

network NOUN /ˈnɛtˌwɜrk/ a set of objects that are connected together. Each object is called a node and each connection is called a path.



Network

network graph NOUN /ˈnɛtˌwɜrk græf/ a drawing of a network where dots represent nodes and curved or straight line segments represent paths.



Network Graph

n-gon NOUN /ɛn gɒn/ an n-sided polygon. *Example:* a 14-gon is a 14 sided polygon.

nickel NOUN /ˈnɪ.kəl/ (U.S.A.) a coin with a value of five cents. 1/20 of a dollar. *Synonym: half-dime.*

nine ADJECTIVE, NOUN /naɪn/ the number 9.

nineteen ADJECTIVE, NOUN /naɪnˈtin/ the number 19.

ninety ADJECTIVE, NOUN /ˈnaɪn.ti/ the number 90.

ninth ADJECTIVE /naɪnθ/

1. coming in position 9 in an ordered list. *Notation:* 9^{th}.
2. one of nine equal parts; 1/9.

no correlation ADJECTIVE /noʊ ˌkɒr.əˈleɪ.ʃən/ no significant relations exists between two variables. A value of one of the variables can not be used to predict the value of the other.

node NOUN /noʊd/ an object in a network that may be connected to other nodes by a path. Nodes are usually drawn as dots. *Synonym: junction.*

nominal ADJECTIVE /ˈnɒm.ə.nl/

1. in name only.

2. stated.

nominal APR NOUN /ˈnɒm.ə.nl eɪ pi ɑr/ an annualized interest rate without the effect of any fees.

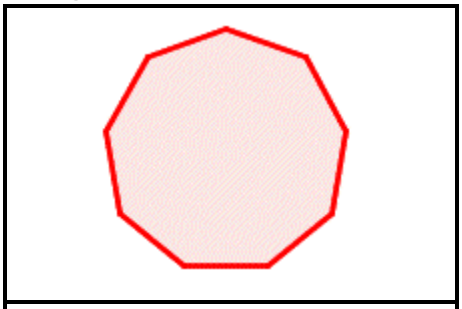
nominal interest rate NOUN /ˈnɒm.ə.nl ˈɪn.trɪst ˈreɪt/ the stated interest rate before the effects of compounding or fees are added in.

nominal number NOUN /ˈnɒm.ə.nl ˈnʌm.bər/ a number that is used for identification only; a number that does *not* represent a quantity. *Examples:* zip codes, postal codes.

non- PREFIX /nɒn/ not. *Example:* non-collinear.

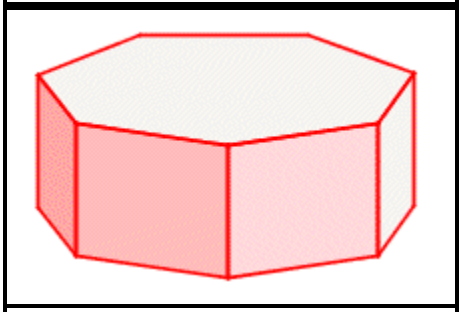
nona- PREFIX /ˈnɒn.ə/ nine. *Example:* nonagon.

nonagon NOUN /ˈnɒn.əˌgɒn/ any polygon with 9 sides and 9 angles.



Nonagon

nonahedron NOUN /nɒn.əˈhi.drən/ any polyhedron with nine faces.

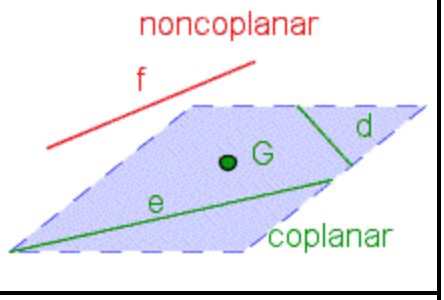


Nonahedron

noncollinear ADJECTIVE /nɒn.koʊˈlɪn.i.ər/ not contained by one line. *Antonym: collinear.*

Noncollinear

noncoplanar ADJECTIVE /nɒn.koʊ'pleɪ.nər/ does *not* exist in the same plane. In the illustration, the line segment f is *not* coplanar with e, d, and G. *Antonym: coplanar.*



Noncoplanar

nondenumerable ADJECTIVE /non.dɪ'nu.mər.ə.bəl/ *See uncountable. Antonym: denumerable.*

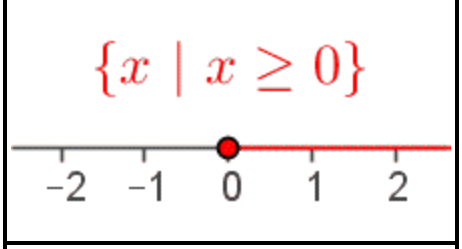
none PRONOUN /nʌn/
1. nothing.
2. not one.
3. zero.

non-Euclidean geometry NOUN /nɒn yu'klɪ.di.ən dʒi'ɒ.mɪ.tri/ one of several geometries that are *not* based on all of the basic five postulates of Euclidean geometry or their modern equivalents. *Examples:* elliptic geometry, hyperbolic geometry. *Antonym: Euclidean geometry.*

nonlinear ADJECTIVE /non'lɪn.i.ər/ not linear; not associated with a line. *Example:* nonlinear equation. *Antonym: linear.*

nonlinear equation NOUN /non'lɪn.i.ər ɪ'kweɪ.ʒən/ an equation that has variables with exponents not equal to 1 or that has operations other than arithmetic operations. *Examples:* $y = 2x^2$, $y = \sin x$. *Antonym: linear equation.*

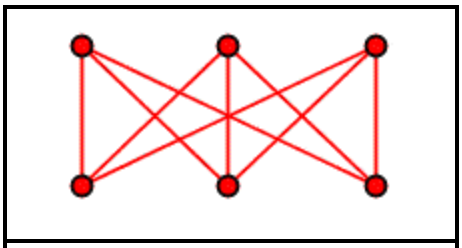
nonnegative ADJECTIVE /nɒn'nɛg.ə.tɪv/ zero or positive; $\{n \mid n \geq 0\}$. *Antonym: negative.*



Nonnegative

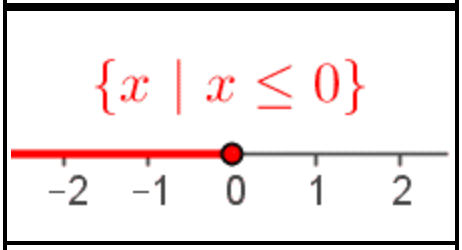
nonplanar ADJECTIVE /ˌnɒn'pleɪ.nər/ not contained within a single plane. *Antonym: planar.*

nonplanar graph NOUN /ˌnɒnˈpleɪ.nər græf/ a network graph whose paths cross. *Antonym: planar graph.*



Nonplanar Graph

nonpositive NOUN /nɒnˈpɒz.ɪ.tɪv/ a negative number or zero. *Math definition:* $\{x \mid x \leq 0\}$. *Antonym: positive.*



Nonpositive

nonrepeating decimal NOUN /nɒn.rɪˈpit.iŋg ˈdɛs.ə.məl/ a decimal that does *not* repeat a series of digits infinitely. *Examples:* an integer, irrational number. *Antonym: repeating decimal.*

nonresponse NOUN /nɒn.riˈspɒns/ not returning a survey; not answering a question.

nonsampling error NOUN /nɒnˈsæmp.lɪŋ ˈɛr.ər/ an error that results from the survey process. *Examples:* nonresponse, poorly worded question.

nonsingular matrix NOUN /nɒnˈsɪŋ.gyə.lər ˈmeɪ.trɪks/ *See invertible. Plural: nonsingular matrices* /nɒnˈsɪŋ.gyə.lər ˈmeɪ.trɪˌsiz/.

nonstandard ADJECTIVE /nɒnˈstænd.ərd/

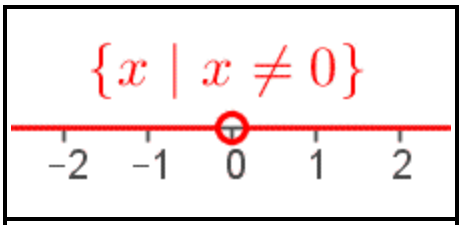
1. not described in an accepted standard.
2. uncommon.
3. not generally accepted.

Antonym: standard.

nonterminating ADJECTIVE /nɒnˈtɜr.məˌneɪt.iŋg/ not having an end. *Example:* nonterminating decimal. *Antonym: terminating.*

nonterminating decimal NOUN /nɒnˈtɜr.məˌneɪt.iŋ ˈdɛs.ə.məl/ a decimal number whose digits go on forever; a decimal number that is a repeating decimal or an irrational number. *Examples:* 3.1, $\pi = 3.14159\ldots.$ *Antonym: terminating decimal.*

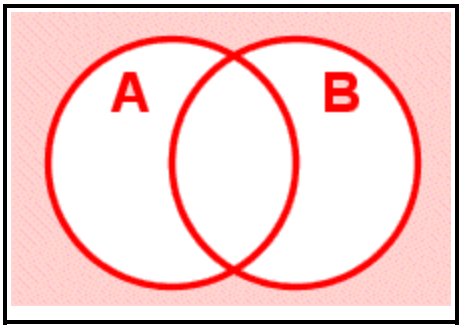
nonzero ADJECTIVE /nɒnˈzɪər.oʊ/ either positive or negative, but *not* zero. *Notation:* $x \neq 0$. *Math definition:* $x < 0$ or $x > 0$. *Antonym: zero.*



Nonzero

noon NOUN /nun/ the middle point of the day. 12:00 PM or 1200. *Synonym: midday.*

nor NOUN /nɔr/ NOT OR. A Boolean operator that returns true only when both operands are false. *Math definition:* $A \text{ nor } B = \text{not } (A \text{ or } B) = \text{not } A \text{ and not } B = \neg(A \vee B)$.



Nor

NOR Truth Table		
A	***B***	***A* nor *B***
False	False	True
True	False	False
False	True	False
True	True	False

norm NOUN /ˈnɔrm/ *See magnitude, definition 2.*

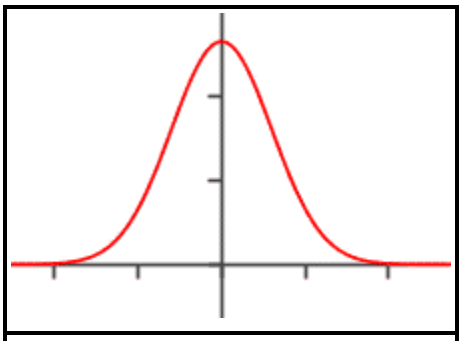
normal ADJECTIVE /ˈnɔr.məl/

1. perpendicular to. *Example:* normal to a curve.
2. most common or regular. *Example:* normal distribution.

normal curve NOUN /ˈnɔr.məl kɜrv/ a curve shaped like a bell that shows the normal distribution of populations. *Formula:*

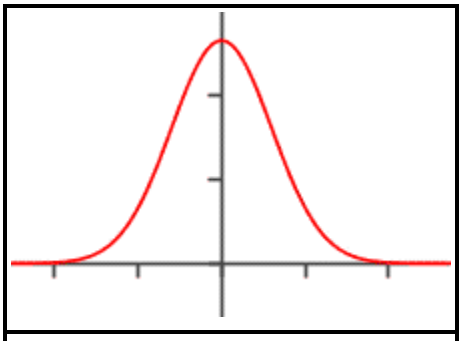
$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\frac{(x-\mu)^2}{2\sigma^2}}.$$

Synonyms: bell curve, bell shaped curve, Gaussian curve.



Normal Distribution

normal distribution NOUN /ˈnɔr.məl dɪˈstrɪ.byu.ʃən/ a distribution of statistical data that follows the shape of a normal curve. *Synonym: Gaussian distribution. See also normal curve, standard normal distribution.*



Normal Distribution

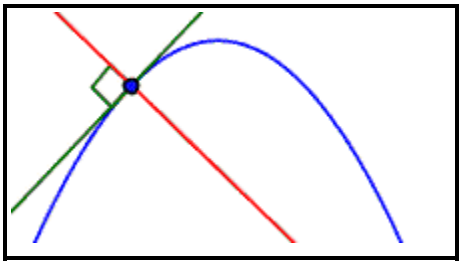
normal line NOUN /ˈnɔr.məl laɪn/ *See normal to a curve.*

normal magic square NOUN /ˈnɔr.məl ˈmædʒ.ɪk skwɛər/ a magic square using the sequential numbers $1..n$ where n is the number of cells. In a magic square, the rows, columns and diagonals of the magic square all add up to the same number. *See also magic square.*

2	7	6
9	5	1
4	3	8

Normal Magic Square

normal to a curve NOUN /ˈnɔr.məl tu eɪ kɜrv/ a line that passes through a curve and is perpendicular to the tangent to the curve at that point.

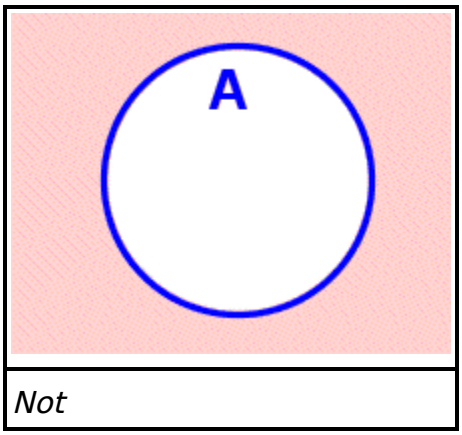


Normal to a Curve

no solution ADJECTIVE /noʊ soʊˈlu.ʃən/ (system of equations) there are no values that satisfy all of the equations.

not NOUN /nɒt/ a unary Boolean operator that returns false if the operand is true and true if the operand is false. *Notation:* $\neg$. *Synonym: negation.*

NOT	
A	$\neg A$
False	True
True	False



Not

notation NOUN /noʊˈteɪ.ʃən/ a way to write things down using special signs or symbols. *Example:* interval notation. *See also Notation section.*

nothing NOUN /ˈnʌ.θɪŋ/
1. not any.
2. zero.

nought NOUN /nɔt/ zero.

n-space NOUN /ɛn speɪs/ an n-dimensional geometric construct in which other geometric objects can be placed. *Example:* 3-space is a 3-dimensional space that can contain geometric solids.

nth root NOUN /ɛnθ rut/ a value that, when multiplied by itself n times, equals the number. *Formula:* $\sqrt[n]{x} = x^{\frac{1}{n}}$. *Math definition:* $y = \sqrt[n]{x}$ if and only if $y^n = x$, $y=0$ if n is even, $n \in \mathbb{Z}$. *Example:* $\sqrt[3]{27} = 3$ since $3^3 = \sqrt[3]{27}$.

null ADJECTIVE /nʌl/
1. having to do with zero. *Example:* null vector.
2. empty; has zero elements or members. *Example:* null set.

null element NOUN /nʌl ˈɛl.ə.mənt/ an element of a set that, when multiplied by any member of the set, returns itself. *Example:* $a \cdot 0 = 0$; 0 is the null element.

null matrix NOUN /nʌl 'meɪ.trɪks/ *See zero matrix. Plural: null matrices* /nʌl 'meɪ.trɪˌsiz/.

null set NOUN /nʌl sɛt/ *See empty set.*

null vector NOUN /nʌl 'vɛk.tər/ *See zero vector.*

number NOUN /'nʌm.bər/ how many or how much; a quantity. *Important:* A number is an abstract quantity. A numeral is a representation of a number.

number cube NOUN /'nʌm.bərz kyub/ *See die.*

number line NOUN /'nʌm.bər laɪn/ a line where each point on the line represents a real number. *See also Ruler Postulate.*

Number Line

number pattern NOUN /'nʌm.bər 'pɑt.ərn/ *See sequence.*

number sense NOUN /'nʌm.bər sɛns/ an understanding of numbers, their characteristics and operations on numbers.

number sentence NOUN /'nʌm.bər 'sɛn.təns/ an expression or equation that contains only numbers and operators. *Example:* $3 + 6 = 9$.

number theory NOUN /'nʌm.bər 'θɪər.i/ the study of the properties of integers, including divisibility.

numeral NOUN /'num.ər.əl/ symbols used together to represent a number. *Example:* 124.3.

numeration NOUN /ˌnum.ə'reɪ.ʃən/

1. how numbers are written; the representation of numbers. *Example:* decimal numeration.
2. the act of counting.

numeration system NOUN /ˌnum.ə'reɪ.ʃən 'sɪs.təm/ a system for writing numbers. *Example:* decimal numeration system.

numerator NOUN /'num.əˌreɪ.tər/ the top half of a fraction; the dividend. *Notation:* $\frac{\text{numerator}}{\text{denominator}}$. *Example:* in $\frac{3}{7}$, the numerator is 3.

numeric ADJECTIVE /nu'mɛr.ɪk/ having to do with or containing numbers. *Example:* numeric data. *Synonym: numerical.*

numerical ADJECTIVE /nu'mɛr.ɪ.kl/ *See numeric.*

numerical analysis NOUN /nu'mɛr.ɪ.kl ˌæ'næl.ɪ.sɪs/ a branch of mathematics that deals with approximation and error.

numerically ADVERB /nu'mɛr.ɪ.kli/ using numbers.

numeric data NOUN /nu'mɛr.ɪk 'deɪ.tə/ data whose values are numbers. *Singular: numeric datum* /nu'mɛr.ɪk 'deɪ.tʌm/.

numeric expression NOUN /nu'mɛr.ɪk ɪk'sprɛ.ʃən/ an expression with numbers, but no variables.

O

ob- PREFIX /ɒb/
1. towards.
2. inversely.

object NOUN /ˈɒb.dʒɛk/ something being considered; an arbitrary entity.

objective NOUN /ˈɒb.dʒɛk.tɪv/ a goal.

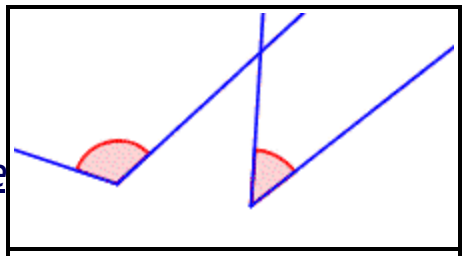
oblate ADJECTIVE /ˈɒb.leɪt/ being flattened at the top and bottom; being flattened at the poles. *Example:* because of centrifugal force caused by its spin, the Earth is slightly oblate.

oblate spheroid NOUN /ˈɒb.leɪt ˈsfɪər.ɔɪd/ a sphere that is flattened at the poles; an ellipsoid that can be made by rotating an ellipse around its minor axis. *For contrast, see prolate spheroid.*

oblique ADJECTIVE /oʊˈblik/
1. neither perpendicular nor parallel. *Example:* oblique line.
2. neither vertical or horizontal.
3. (geometric solid) having an altitude that is *not* perpendicular to the base(s). *Example:* oblique cylinder.
4. slanting or sloping.

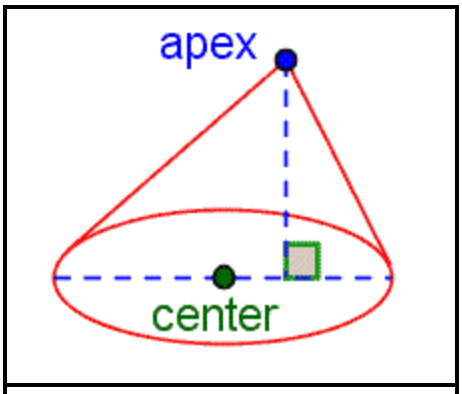
Antonym: right.

oblique angle NOUN /oʊˈblik ˈæŋ.gəl/ an angle that is *not* a right angle nor a multiple of a right angle. *Antonym: right angle. See also Angle Classes!.*



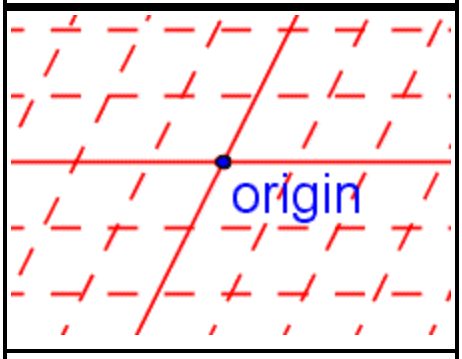
Oblique Angles

oblique cone NOUN /oʊˈblik koʊn/ a cone that is *not* a right cone. *Antonym: right cone.*



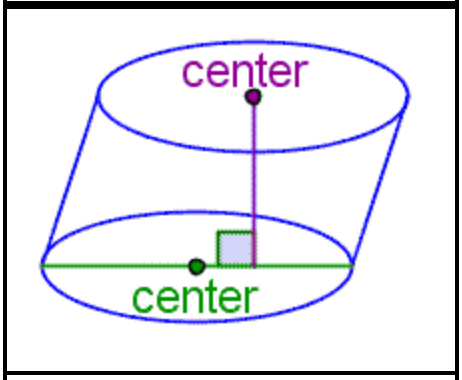
Oblique Cone

oblique coordinate system NOUN /oʊˈblik koʊˈɔr.dnɪt ˈsɪs.təm/ a coordinate system whose axes are *not* perpendicular. *Antonym: rectangular coordinate system.*



Oblique Coordinate System

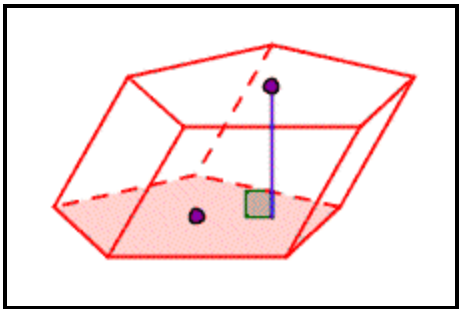
oblique cylinder NOUN /oʊˈblik ˈsɪl.ɪn.dər/ a cylinder that is *not* a right cylinder. *Antonym: right cylinder.*



Oblique Cylinder

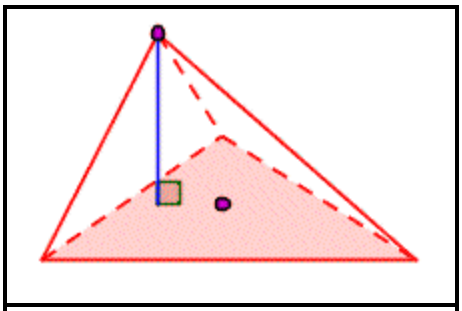
oblique line NOUN /oʊˈblik laɪn/ *See skew line.*

oblique prism NOUN /oʊˈblik ˈprɪz.əm/ a prism where the line segment between the centroids of the bases is *not* perpendicular to the bases. *Antonym: right prism.*



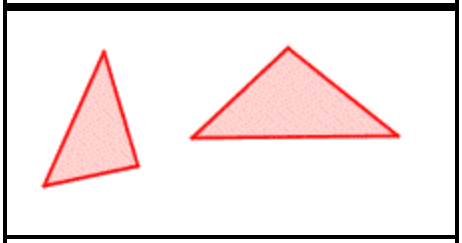
Oblique Prism

oblique pyramid NOUN /oʊ'blik 'pɪr.ə.mɪd/ a pyramid whose apex is *not* centered over the centroid of the base. *Antonym: right pyramid.*



Oblique Pyramid

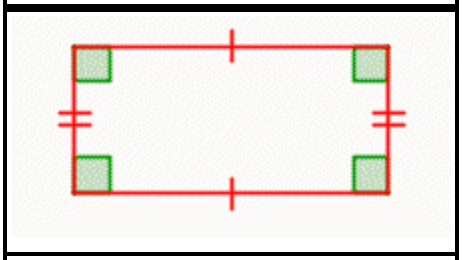
oblique triangle NOUN /oʊ'blik 'traɪˌæŋ.gəl/ a triangle that is *not* a right triangle. *Antonym: right triangle.*



Oblique Triangles

oblong /'ɑb.lɔŋ/

1. NOUN a rectangle that is *not* a square.
2. ADJECTIVE in the shape of a rectangle, but *not* a square.



Oblong

observation NOUN /'ɑb.sərˌveɪ.ʃən/

1. watching what happens and writing down the results without trying to influence what happens.
2. collecting a single row of data.

observational ADJECTIVE /'ɑb.sərˌveɪ.ʃən.l/ based on watching what happens without trying to influence what happens. *Example:* observational data. *Antonym: experimental.*

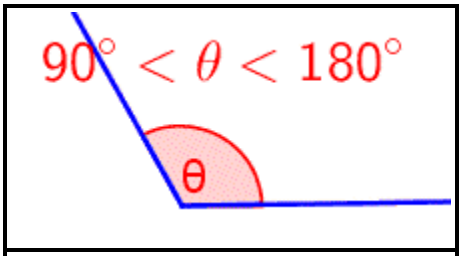
observational data NOUN /'ɑb.sərˌveɪ.ʃən.l 'deɪ.tə/ data collected by watching what happens without trying to influence what happens. *Example:* Watching a gorilla and writing down the gorilla's behavior. *Antonym: experimental data.*

observational study NOUN /'ɑb.sərˌveɪ.ʃən.l 'stʌ.di/ a study where the administrators watch what happens without trying to influence what happens.

observer NOUN /ˌəbˈsər.vər/
1. a person or object from whose point of view an angle or distance is measured.
2. a person collecting data in an observational study.

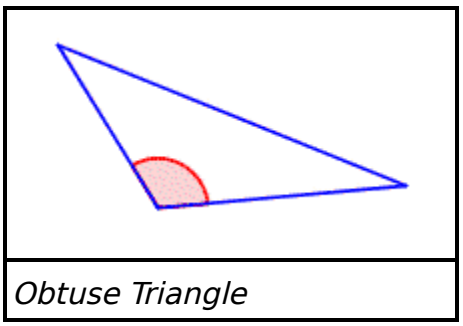
obtuse ADJECTIVE /əbˈtus/ being or having an angle that measures between $90°$ and $180°$, between $\frac{\pi}{2}$ rad. and π rad.

obtuse angle NOUN /əbˈtus ˈæŋ.gəl/ an angle that measures between $90º$ and $180º$. *Math definition:* angle θ is obtuse if and only if $90º < \theta < 180º$, $\frac{\pi}{2}$ rad. $< \theta < \pi$ rad.. *See also Angle Classes!.*



Obtuse Angle

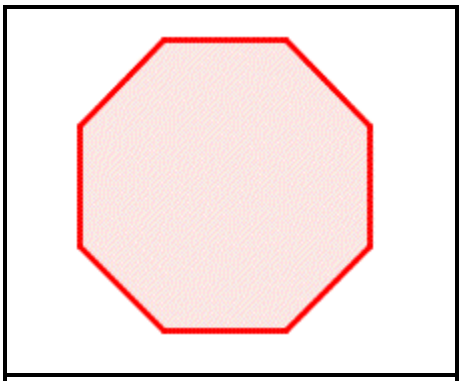
obtuse triangle NOUN /əbˈtus ˈtraɪˌæŋ.gəl/ a triangle that has exactly one obtuse angle. *See also GeoApp!.*


Obtuse Triangle

o'clock ADVERB /əˈklɒk/ hour of day according to a clock. *Example:* 5 o'clock in the evening.

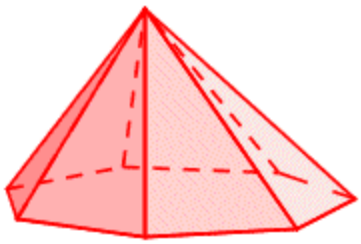
octa- PREFIX /ˈɒk.tə/ eight.

octagon NOUN /ˈɒk.təˌgɒn/ any eight sided polygon. *See also GeoApp!.*



octahedron NOUN /ˌɒk.təˈhi.drən/ any polyhedron with eight faces.

Octagon



Octahedron

octal ADJECTIVE /ˈɒk.tl/ having to do with a base 8 numeration system. *Example:* octal digit.

octal digit NOUN /ˈɒk.tl ˈdɪdʒ.ɪt/ one of eight digits used in an octal numeration system: $0, 1, 2, 3, 4, 5, 6, 7$.

octal numeration system NOUN /ˈɒk.tl ˌnum.əˈreɪ.ʃən ˈsɪs.təm/ a base 8 numeration system that uses the digits 0-7 and whose place values are exponents of 8.

Example: $213_8 = 2 \times 8^2 + 1 \times 8 + 3 = 128 + 8 + 3 = 139_{10}$.

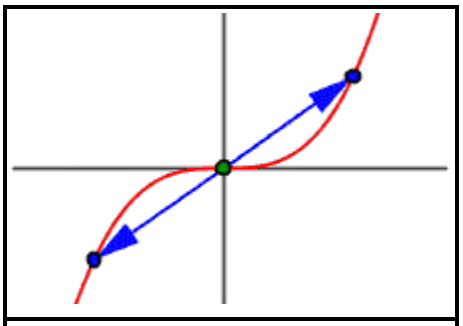
octant NOUN /ˈɒkt.ənt/ in a 3-dimensional rectangular coordinate system, one of eight sections into which the coordinate space is divided by the perpendicular planes containing the x, y, and z axes.

odd ADJECTIVE /ɒd/

1. (integers) not divisible by 2.
2. having to do with an integer that is *not* a multiple of 2.
3. (figures) having reflective symmetry about a point.
4. having a property related to oddness.

Antonym: even.

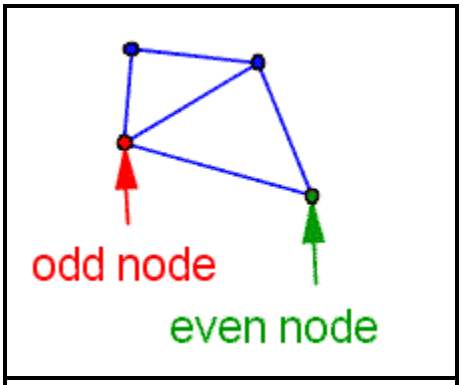
odd function NOUN /ɒd ˈfʌŋk.ʃən/ a function that is symmetric about the origin; a function where $f(-x) = -f(x)$. *Math definition:* $f(x)$ is an odd function if and only if $f(-x) = -f(x)$ for all x in the domain of the function.



Odd Function

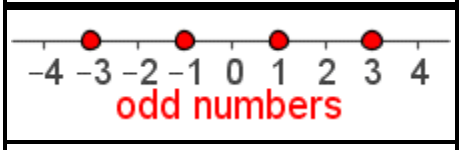
Examples: $f(x) = x^3$, $f(-x) = (-x)^3 \rightarrow f(-x) = (-x)^3 \rightarrow f(-x) = -f(x)$. *See also GeoApp!.*

odd node NOUN /ɒd nəʊd/ a node of a network graph that has an odd number of paths connecting it to other nodes. *Antonym: even node.*



Odd Node

odd number NOUN /ɒd ˈnʌm.bər/ an integer that is *not* divisible by 2. *Math*



Odd Numbers

definition: $\{x \mid x = 2k - 1, k \in \mathbb{Z}\}$. *Examples:* $1, -3, 11, 27$.

odd polynomial NOUN /ɒd ˌpɒl.əˈnəʊ.mi.əl/ a polynomial that is an odd function. All odd polynomials have an odd degree, but *not* all polynomials with an odd degree are odd functions. *Example:* x^3.

odds NOUN /ɒdz/

1. the likelihood of an event happening.
2. an estimate of the probability that an event will happen.

odometer NOUN /oʊ'dɑm.ɪ.tər/ a device that shows or records distance traveled, usually on a car or truck.

Odometer

one ADJECTIVE, NOUN /wʌn/ the number 1.

one and only one ADJECTIVE /wʌn ænd oʊnli wʌn/ unique; no other object exists with the same properties.

one dimensional ADJECTIVE /wʌn dɪ'mɛn.ʃə.nl/

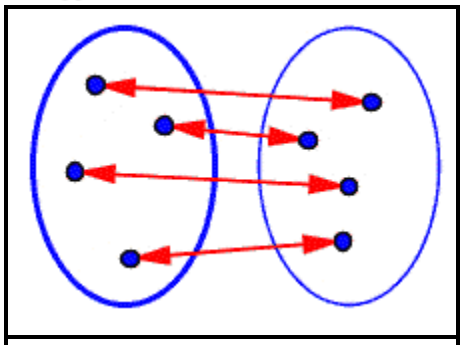
1. having only one dimension. *Example:* a line is one dimensional.
2. having length but *not* width or height.

Abbreviation: 1-D.

one point perspective ADJECTIVE /wʌn pɔɪnt pər'spɛk.tɪv/ a perspective drawing with one vanishing point. *See also GeoApp!.*

one step equation NOUN /wʌn stɛp ɪ'kweɪ.ʒən/ an equation that can be solved using one operation. *Example:* $x + 1 = 2 \rightarrow x + 1 - 1 = 2 - 1\, x = 1$.

one to one correspondence NOUN /wʌn tu wʌn ˌkɒr.ə'spɒn.dəns/ a relationship where every member of set A can be matched with exactly one member of set B and every member of set B can be matched with exactly one member of set A. *Synonym: bijection.*



One to One Correspondence

one to one function NOUN /wʌn tu wʌn 'fʌŋk.ʃən/ a function that has exactly one output for each input, and exactly one input for each output. *Synonym: bijection.*

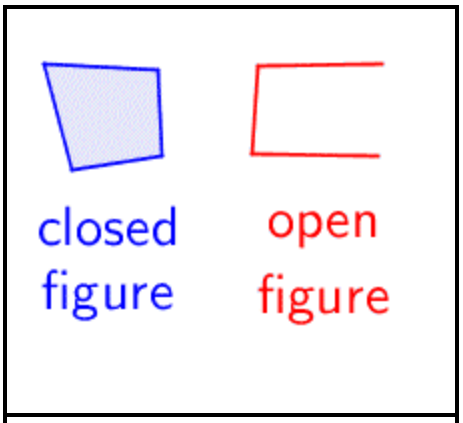
one to one mapping NOUN *See one to one correspondence.*

op- PREFIX /ɒp,.oʊp/

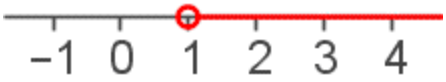
1. toward.
2. inversely.

open ADJECTIVE /ˈoʊ.pən/

1. (figure) the boundary of the figure can *not* be traced from any point by any path and always return to the starting point without retracing. *Antonym: closed.*
2. (sets) a set is open if any part of the boundary of the set is *not* contained in the set. *Antonym: closed.*
3. (dot) a hollow dot showing that a point is *not* included in the set.
4. (intervals) an interval that does *not* include two endpoints. *Example:* $-3 \geq x > 1$ is open since it does not included the endpoint 1. *Antonym: closed.*
5. (curve) the curve can not be traced by a path that covers the entire curve and returns to the point of origin without retracing. *Antonym: closed.*



Open Figure



Open Interval

Open Curve

open sentence NOUN /ˈoʊ.pən ˈsɛn.təns/ a mathematical statement that may be true or false depending on what values are substituted for the variables. *Example:* $1 + ? = 5$.

operand NOUN /ˈɒ.pəˌrænd/ something on which an operation is performed. *Example:* In $3 + 4$, the operands are 3 and 4.

operation NOUN /ˌɒ.pəˈreɪ.ʃən/ a mathematical function performed on one or more operands. *Example:* in $3 + 4$, the operation is addition. *See also algebraic operation.*

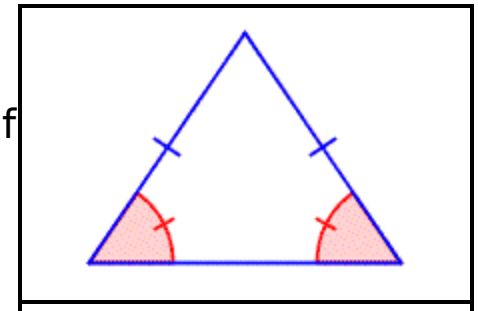
operator NOUN /ˈɒ.pəˌreɪ.tər/ a symbol representing a mathematical operation. *Examples:* '+', '−', '×', '÷'.

opposed ADJECTIVE /ɒˈpoʊzd/ on opposite sides of.

opposite /ˈɒp.ə.sɪt/

1. ADJECTIVE situated directly across from. *Example:* opposite side.
2. NOUN inverse of. *Example:* the opposite of a is $-a$.

Opposite Angle Congruence Theorem NOUN /ˈɒp.ə.sɪt ˈæŋ.gəl kənˈgru.əns ˈθɪər.əm/ if two angles of a triangle are congruent, then the sides opposite the congruent angles are also congruent.

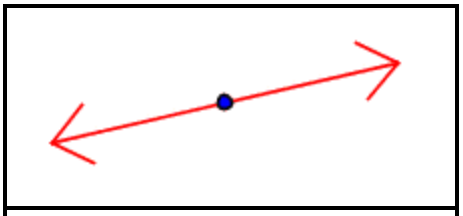


Opposite Angle Congruence

opposite isometry NOUN /ˈɒp.ə.sɪt aɪˈsɒm.ɪ.tri/ *See indirect isometry.*

opposite number NOUN /ˈɒp.ə.sɪt ˈnʌm.bər/ the negative of a number. *Example:* the opposite of 5 is -5; the opposite of -3 is 3. *Synonym: additive inverse.*

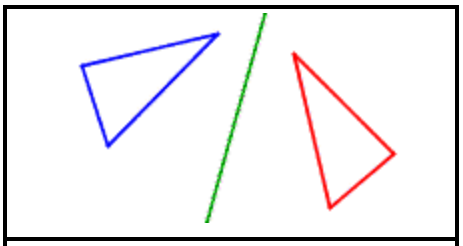
opposite rays NOUN /ˈɒp.ə.sɪt reɪz/ two rays with a common endpoint going in opposite directions.



Opposite Rays

opposites ADJECTIVE /ˈɒp.ə.sɪtz/ two things that are opposite each other.

opposite transformation NOUN /ˈɒp.ə.sɪt ˈtræns.fərˌmeɪ.ʃən/ a transformation that changes the orientation of a figure so that if the order of the points in the preimage is clockwise, the order of the points in the image is counterclockwise. *Examples:* reflection, glide reflection.



Opposite Transformation

optical ADJECTIVE /ˈɒp.tɪk.l/ having to do with the eye or with vision.

optical illusion NOUN /ˈɒp.tɪk.l ɪˈlu.ʃən/ a drawing or picture that 'tricks' the eye.

or /ɔr/ *See disjunction.*

orbit NOUN /ˈɔr.bɪt/ one revolution around a sphere.

order /ˈɔr.dər/

1. NOUN the sequence in which events happen or operations are performed. *Example:* order of operations.
2. NOUN an arrangement of a set such that, for any element, it is known if another element comes before or after that element. *Example:* alphabetical order.
3. NOUN a relative ranking. *Example:* order of magnitude.
4. NOUN a number assigned to a property of an object indicating magnitude. *Example:* order of rotational symmetry.
5. VERB to place a set in order.
6. VERB to declare the order of the set.

ordered ADJECTIVE /ˈɔr.dərd/ having an order. A set is ordered if, for every distinct pair of elements a and b, exactly one of $a < b$ or $b < a$ is always true.

Notations: $(a,b,c,\ldots)$, $<a,b,c,\ldots>$.

ordered list NOUN /ˈɔr.dərd lɪst/ a list of objects placed in a specific order.

ordered pair NOUN /ˈɔr.dərd pɛər/ a set of two values where the order has a specific meaning. $(x,y) \neq (y,x)$. *Example:* $(8, 4)$.

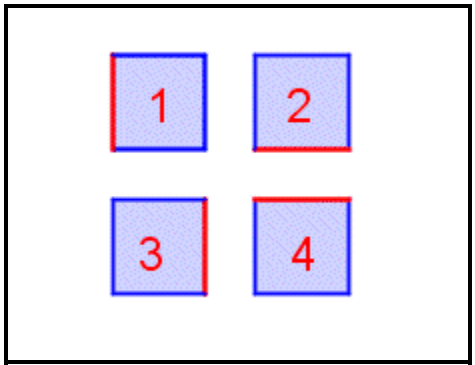
ordered triple NOUN /ˈɔr.dərd ˈtrɪ.pəl/ a set of three values where the order has a specific meaning. $(x,y,z) \neq (y,x,z)$. *Example:* $(-2, 3.5, 7)$.

ordering NOUN /ˈɔr.dər.iŋ/ the specific order of a set. *Example:* alphabetic ordering.

order of magnitude NOUN /ˈɔr.dər ʌv ˈmæg.nɪˌtud/ the relative size of a number measured by the exponent of ten used for that number in scientific notation. *Example:* 6.4×10^4 is 3 orders of magnitude less than 2.7×10^7.

order of operations NOUN /ˈɔr.dər ʌv ˌɒ.pəˈreɪ.ʃənz/ the order in which arithmetic operations are performed on an expression: 1) parenthesis, 2) exponents, 3) multiplication and division (left to right), 4) addition and subtraction (left to right). *Mnemonic:* '**P**lease **E**xcuse **M**y **D**ear **A**unt **S**ally', representing **p**arentheses, **e**xponentiation, **m**ultiplication and **d**ivision, **a**ddition and **s**ubtraction.

order of rotational symmetry NOUN /ˈɔr.dər ʌv roʊˈteɪ.ʃə.nl ˈsɪm.ɪ.tri/ the number of distinct angles of rotation that show symmetry. *Example:* the order of rotational symmetry of a square about its center is 3.



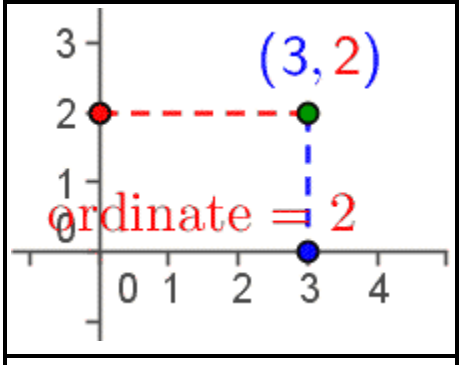
Order of Rotational Symmetry

order property of addition NOUN /ˈɔr.dər ˈprɒ.pər.ti ʌv əˈdɪ.ʃən/ *See* *Commutative Property of Addition*.

order property of multiplication NOUN /ˈɔr.dər ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən/ *See Commutative Property of Multiplication.*

ordinal number NOUN /ˈɔr.dn.əl ˈnʌm.bər/ first, second, third, ... used to describe the position of entries in an ordered set.

ordinate NOUN /ˈɔrd.ɪ.nɑt/ the second entry in an ordered pair: $(\text{abscissa, ordinate})$; a value of a coordinate on the vertical axis; the value of a dependent variable. *Synonym: y-coordinate. See also abscissa, GeoApp!.*



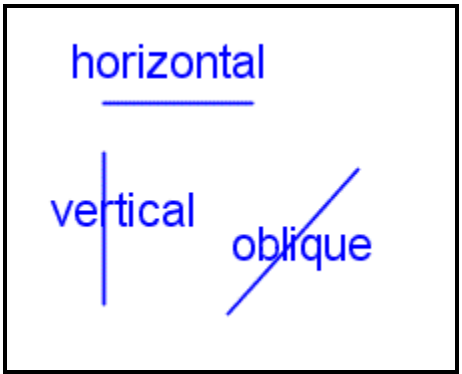
Ordinate

or function NOUN /ɔr ˈfʌŋk.ʃən/ *See disjunction.*

organize VERB /ˈɔr.gə.naɪz/ to arrange in a pattern.

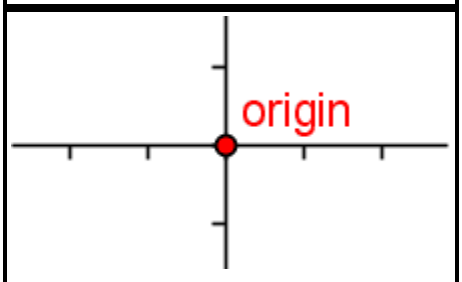
orient VERB /ˈɔr.i.ənt/ to rotate an object so that it lies in a particular direction.

orientation NOUN /ˌɔr.i.ənˈteɪ.ʃən/ the rotation of an object relative to a space. *Example:* The orientation of a line can be vertical, horizontal or oblique.



Orientation

origin NOUN /ˈɔr.ɪ.dʒɪn/ an arbitrary point from which all locations in a metric space are measured. The point at $(0,0)$ in a rectangular coordinate system.

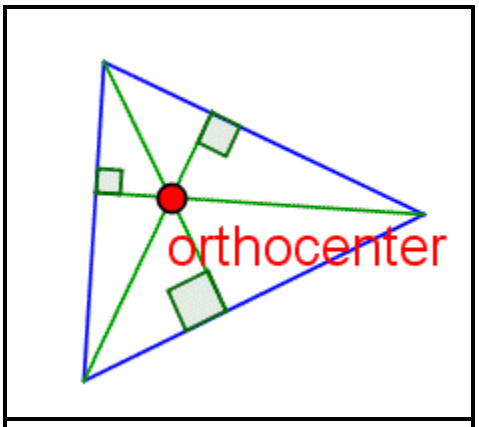


Origin

or rule NOUN /ɔr rul/ when it has been established that either P or Q is true, but not both, and P is known to be not true, then Q is true. *Math definition:* $(P \oplus Q) \wedge (\neg P) \rightarrow Q$.

ortho- PREFIX /ˈɔrθ.oʊ/
1. straight. *Example:* orthogonal.
2. regular.
3. right (especially right angle).

orthocenter NOUN /ˈɔrθ.oʊˌsɛn.tər/ the point where the altitudes of the triangle coincide. *See also GeoApp!.*



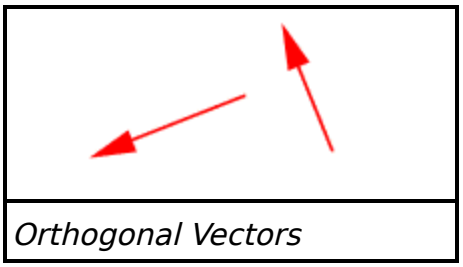
Orthocenter

orthogonal ADJECTIVE /ɔrˈθɒ.gə.nl/
1. perpendicular. *Example:* orthogonal line.
2. right angled.
3. having no common dimensional measure. *Example:* orthogonal vector.
4. vertical.

orthogonal lines NOUN /ɔrˈθɒ.gə.nl lainz/ *See perpendicular lines.*

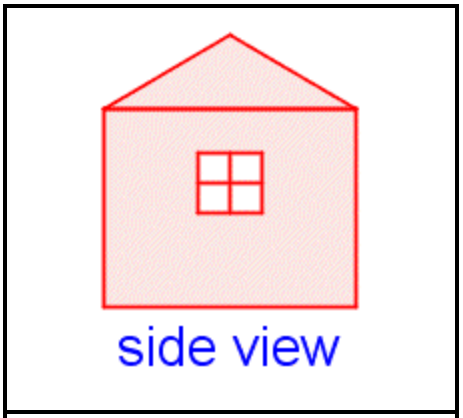
orthogonal matrix NOUN /ɔrˈθɒ.gə.nl ˈmeɪ.trɪks/ a square matrix that, when multiplied by its transpose, the product is an identity matrix. *Formula:* $A \cdot A^{\mathrm{T}} = I, A^{-1} = A^{\mathrm{T}}$. *Plural: orthogonal matrices* /ɔrˈθɒ.gə.nl ˈmeɪ.trɪˌsiz/.

orthogonal vectors NOUN /ɔrˈθɒ.gə.nl ˈvɛk.tərz/ vectors that: 1) have an inner product of zero; 2) have no common components; and 3) are perpendicular to each other. *Antonym: parallel vectors. See also GeoApp!.*



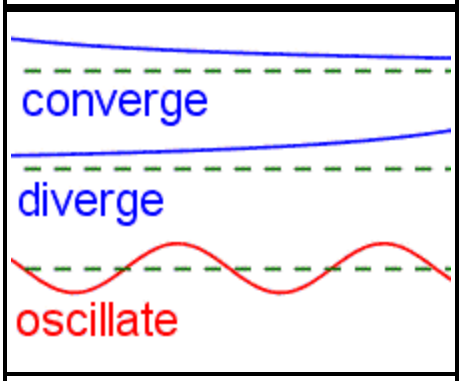
Orthogonal Vectors

orthographic drawing NOUN /ˌɔr.θɒˈgræf.ɪc ˈdrɔ.ɪŋ/ a drawing of a 3-dimensional object on a 2-dimensional surface from a particular viewpoint.



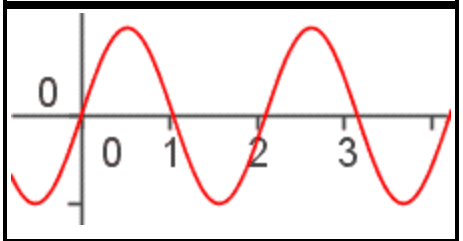
Orthographic Drawing

oscillate VERB /ˈɒs.əˌleɪt/ to change in value back and forth.



Oscillate

oscillating function NOUN /ˌɒ.səˈleɪ.tɪŋ ˈfʌŋk.ʃən/ a function that has no limit, including no infinite limit. The output of an oscillating function does not 'settle down' as the input approaches positive or negative infinity. *Antonyms: convergent function, divergent function.*



Oscillating Function

oscillating series NOUN /ˌɒ.səˈleɪ.tiŋ ˈsɪər.iz/ a series that does *not* 'settle down'; a series that does *not* approach a specific value or infinity. *Example:* $\{1, -1, 1, -1, \ldots\}$.

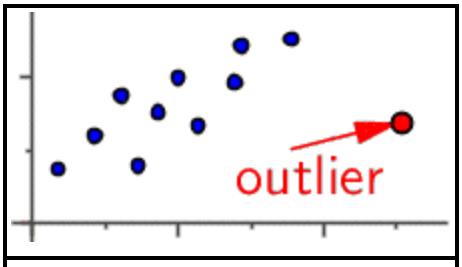
oscillation NOUN /ˌɒs.əˈleɪ.ʃən/
1. the act of oscillating.
2. a single instance of going back and forth.

ounce NOUN /aʊns/ a unit of measure of weight. *Abbreviation: oz. Formula:* $16 \text{ ounces} = 1 \text{ pound}$. $1 \text{ ounce} \approx 28.4 \text{ grams}$.

outcome NOUN /ˈaʊtˌkʌm/ the result of a probability experiment. *Example:* Given a flip of a coin, the outcome is either heads or tails.

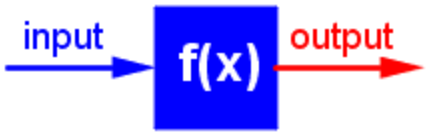
outcome space NOUN /ˈaʊtˌkʌm speɪs/ all of the possible outcomes of an experiment. *Example:* of the roll of a single die: $\{1, 2, 3, 4, 5, 6\}$.

outlier NOUN /ˈaʊtˌlaɪ.ər/ an element of data which lies well outside the rest of the dataset.



Outlier

output NOUN /ˈaʊtˌpʊt/ the set of values generated by a function. *Synonym: dependent variable. Antonym: input.*

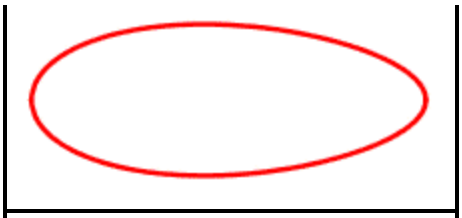


Output

outside /ˈaʊtˌsaɪd/
1. ADJECTIVE the exterior of an object.
2. NOUN the space past the boundary of an object.

Antonym: inside.

oval /ˈoʊ.vəl/
1. ADJECTIVE egg shaped.
2. NOUN an object that is egg shaped.



Oval

overbar NOUN /ˈoʊ.vər.bɑr/ a line segment over a symbol, which changes the meaning of the symbol.

Example: $\overline{5.174}$.

overestimate VERB /ˌoʊ.vərˈɛs.tɪ.meɪt/

1. to estimate larger than the actual value.
2. to intentionally estimate too large.

oz ABBREVIATION *See ounce.*

P

p ABBREVIATION See pico-.

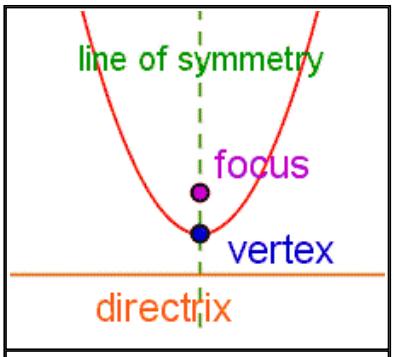
P ABBREVIATION See peta-.

pair NOUN /pɛər/ two associated objects. *Example:* ordered pair.

palindrome NOUN /ˈpæl.ɪnˌdroʊm/ a word, phrase or number that reads the same forward as backwards. *Example:* 101.

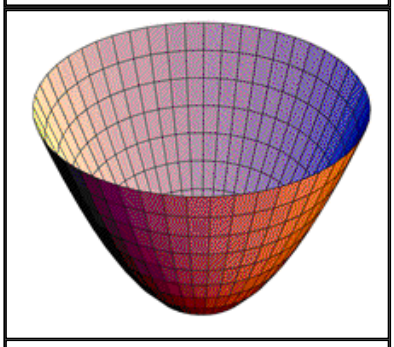
Pappus' form of a quadratic equation NOUN /ˈpæ.pəs fɔrm ʌv eɪ kwɒˈdræ.tɪk ɪˈkweɪ.ʒən/ a quadratic equation in the form $(x - h)^2 = 4p(y - k)$. *See also GeoApp!.*

parabola NOUN /pəˈræ.bə.lə/ the shape made when graphing a quadratic equation; a shape that reflects light from a source at its focus straight ahead; all points equidistant from a directrix and its focus. *See also GeoApp!.*



Parabola

paraboloid NOUN /pəˈræ.bə.lɔɪd/ a 3-dimensional geometric figure whose cross sections through its axes of symmetry are parabolas; a shape made by rotating a parabola about its axis.


Paraboloid

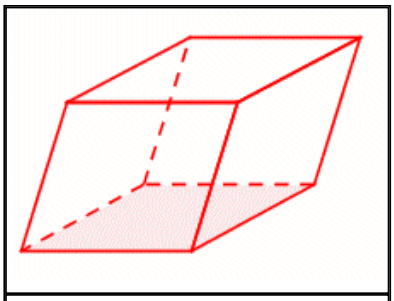
paradox NOUN /ˈpær.əˌdɔks/
1. a statement that contradicts itself. *Example:* up is down.
2. a set of statements that can *not* all be true at the same time.

Synonym: contradiction.

paragraph proof NOUN /ˈpær.əˌgræf pruf/ a proof written in paragraph form, as opposed to a two column proof or a flow proof.

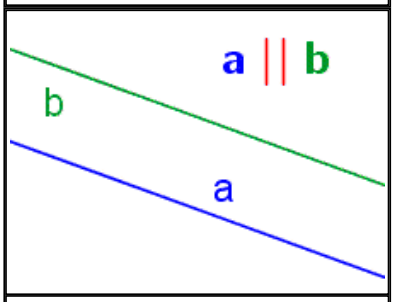
parallel ADJECTIVE /ˈpær.əˌlɛl/
1. having parallel lines.
2. having the property of all points being equidistant.

parallelepiped NOUN /ˌpær.əˈlɛl.ə.paɪ.pɪd/ a hexahedron whose faces are all parallelograms.



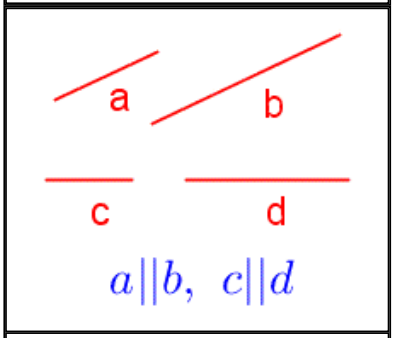
Parallelepiped

parallel lines NOUN /ˈpær.əˌlɛl laɪnz/ two distinct lines are parallel if the distance between the lines is constant. Two lines are parallel if their slopes are equal. In 2-dimensional Euclidean geometry, any two lines that do *not* intersect are parallel.



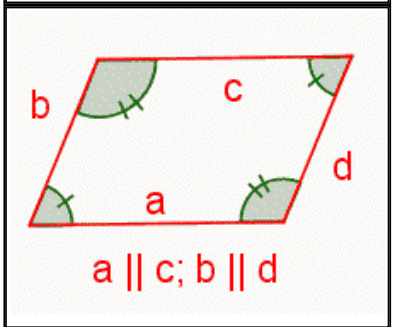
Parallel Lines

parallel line segments NOUN /ˈpær.əˌlɛl laɪn ˈsɛg.məntz/ two line segments that lie on the same line or that lie on parallel lines.



Parallel Line Segments

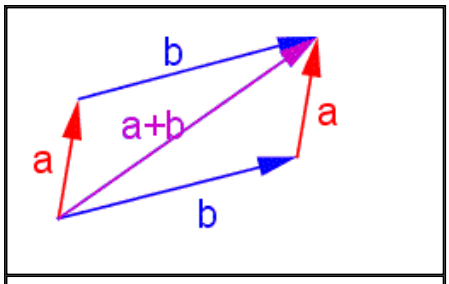
parallelogram NOUN /ˌpær.əˈlɛl.əˌgræm/ a four sided polygon whose opposite sides are parallel. *See also [GeoApp!].*



Parallelogram

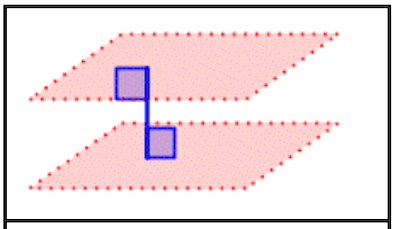
parallelogram law NOUN /ˌpær.əˈlɛl.əˌgræm lɑ/ *See [Parallelogram Property of Vectors].*

Parallelogram Property of Vectors NOUN /ˌpær.əˈlɛl.əˌgræm ˈprɒ.pər.ti ʌv ˈvɛk.tərz/ the addition of one vector to another can be visualized as placing the tail of vector b at the head of the vector a. The vector sum extends from the tail of a to the head of b. *Synonym: parallelogram law. See also GeoApp!.*

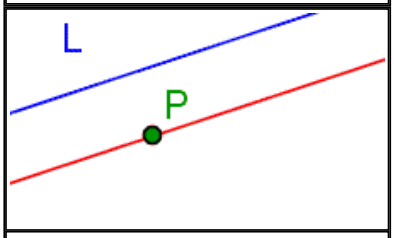


Parallelogram Property of Vectors

parallel planes NOUN /ˈpær.əˌlɛl pleɪn/ planes that are a constant distance apart. Two planes are parallel if a line segment that is perpendicular to one is also perpendicular to the other.

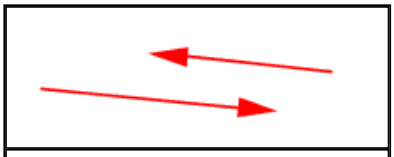

Parallel Planes

Parallel Postulate NOUN /ˈpær.əˌlɛl ˈpɒs.tʃə.lɪt/ guarantees the uniqueness of a line parallel to a given line through a point. *Math definition:* If L is a line on a plane and P is a point on the plane not on L, then there is exactly one line passing through P that is parallel to L. *See also GeoApp!.*

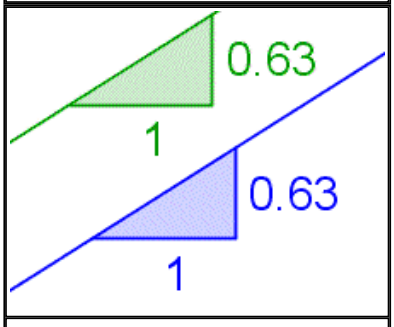


Parallel Postulate

parallel rays NOUN /ˈpær.əˌlɛl reɪz/ two rays contained by the same line or on parallel lines. *See also GeoApp!.*

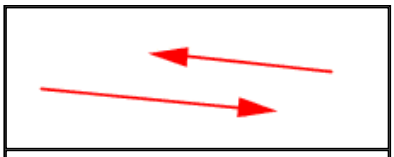

Parallel Rays

Parallel Slope Postulate NOUN /ˈpær.əˌlɛl sloʊp ˈpɒs.tʃə.lɪt/ two non-vertical lines have the same slope if and only if they are parallel.



Parallel Slope Postulate

parallel vectors NOUN /ˈpær.əˌlɛl ˈvɛk.tərz/ two vectors are parallel if one is a non-zero scalar multiple of the other. *Math definition:* u is parallel with v if and only if there exists a real, nonzero number a such that $u = av$.



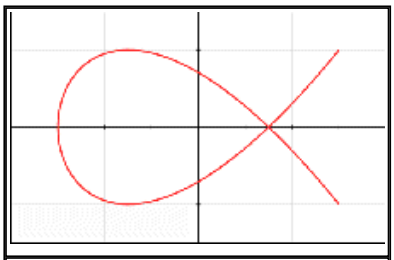
Parallel Vectors

Antonym: orthogonal vectors. See also GeoApp!.

parameter NOUN /pəˈræ.mɪ.tər/

1. a value that can be changed, usually determining the form of an equation. *Example:* in $y = ax^2 + bx + c$ the parameters are a, b, and c. *See also GeoApp!.*
2. (statistics) a value to be discovered. *Example:* The mean height of all six-year-olds.

parametric equation NOUN /ˌpær.əˈmɛ.trɪk ɪˈkweɪ.ʒən/ a set of equations that share an independent variable. *Example:* $y = 2\cos(3t)$, $x = 3\cos(2t)$. t is an independent variable, x and y are dependent variables.



Parametric Equation

parenthesis NOUN /pəˈrɛn.θə.sɪs/ a set of marks '( )' used to group operations or enclose dependent variables in a function notation. '(' is called open parenthesis. ')' is called close parenthesis. *Examples:* $(3+2)4 = 5 \cdot 4 = 20$., $f(x)$. *Plural: parentheses* /pəˈrɛn.θə.siz/. *Synonym: grouping symbol.*

parity NOUN /ˈpær.ɪ.ti/ two integers have the same parity if they are both even or if they are both odd.

part NOUN /pɑrt/ a piece of a whole.

partial ADJECTIVE /ˈpɑr.ʃəl/

1. having to do with a part of a whole. *Example:* partial product.
2. incomplete.

partial fraction decomposition NOUN /ˈpɑr.ʃəl ˈfræk.ʃən ˌdi.kɒm.pəˈzɪʃ.ən/ a method for reducing improper rational expressions to a polynomial and a proper rational expression.

partial product NOUN /ˈpɑr.ʃəl ˈprɒ.dəkt/ the product of the first n terms of an infinite product. *Example:* $\frac{1}{2} \cdot \frac{1}{4} \cdot \frac{1}{8} = \frac{1}{64}$.

partial sum NOUN /'pɑr.ʃəl sʌm/ the sum of the first n terms of a geometric sequence. *Example:* For $\frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \ldots$, the third partial sum is $\frac{1}{2} + \frac{1}{4} + \frac{1}{8} = \frac{4}{8} + \frac{2}{8} + \frac{1}{8} = \frac{7}{8}$.

partition /pɑr'tɪ.ʃən/

1. NOUN one of a set of parts that make up an entire whole.
2. VERB to split a whole into parts.

Pascal, Blaise PERSON /pɑ'skɑl bleɪz/ (1623-1662) a French mathematician who designed the first digital calculator and popularized the triangle of numbers that came to be known as Pascal's Triangle.

Blaise Pascal

Pascal's triangle NOUN /pɑ'skɑlz 'traɪˌæŋ.gəl/ a simplified version of the Binomial Theorem invented by French mathematician Blaise Pascal. *See also Binomial Theorem.*

1
1 1
1 2 1
1 3 3 1
1 4 6 4 1
1 5 10 5 1

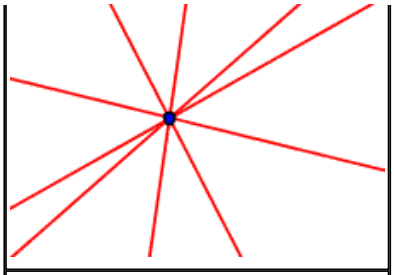
Pascal's Triangle

path NOUN /pɑθ/

1. a way to move along a linear boundary.
2. a connection between nodes of a network graph. Paths are drawn using line segments or curves. *Synonym: edge.*

pattern NOUN /'pɑt.ərn/ a repeating arrangement of objects.

pencil of lines NOUN /'pɛn.səl ʌv lainz/ a set of lines passing through a common point.



Pencil of Lines

pendulum NOUN /ˈpɛn.du.lʌm/ a weight on a string or cable that swings back and forth.

penny NOUN /ˈpɛn.i/

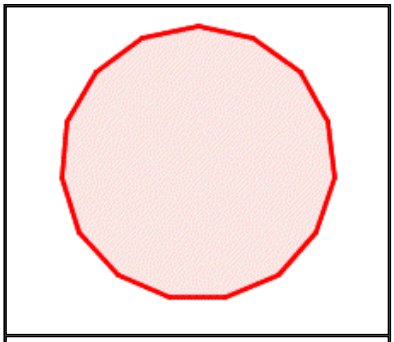
1. 1/100 of a base unit of currency for many currencies.
2. the coin valued at 1/100 of a base unit of currency.

Notations: ¢ (US), p (UK). Plural: pennies /ˈpɛn.is/*. Synonyms: pence* (British English) /pɛns/*, cent.*

penta- PREFIX /ˈpɛn.tə/ five. *Example:* pentagon.

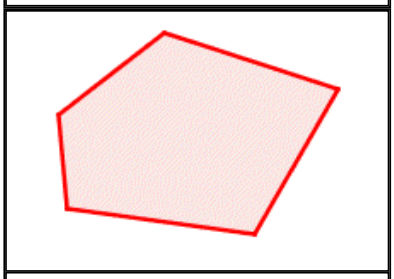
pentadeca- PREFIX /ˌpɛn.təˈdɛk.ə/ fifteen. *Example:* pentadecagon.

pentadecagon NOUN /ˌpɛn.təˈdɛk.əˌgɒn/ a polygon with fifteen sides and fifteen vertices.



Pentadecagon

pentagon NOUN /ˈpɛnt.əˌgɒn/ a polygon with five sides and five vertices.

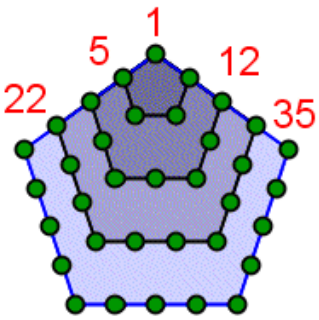


Pentagon

pentagonal ADJECTIVE /ˈpɛn.təˌgɒ.nl/

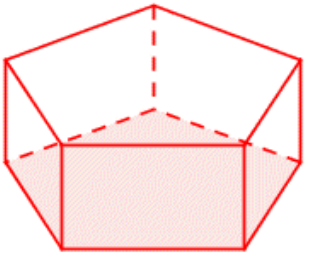
1. having to do with a pentagon.
2. including a pentagon.
3. shaped like a pentagon.

pentagonal number NOUN /ˈpɛn.təˌgɒ.nl ˈnʌm.bər/ the number of dots in the edges of pentagons starting with 1 and increasing the number dots in each side by 1. The first few pentagonal numbers are 1, 5, 12, 22 and 35.
Formula: $P(n) = \frac{1}{2}n(3n - 1)$.

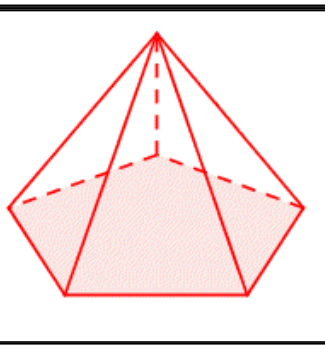


Pentagonal Numbers

pentagonal prism NOUN /ˈpɛn.təˌgɒ.nl ˈprɪz.əm/ a seven-faced polyhedron with congruent parallel pentagons for bases and rectangles for sides.

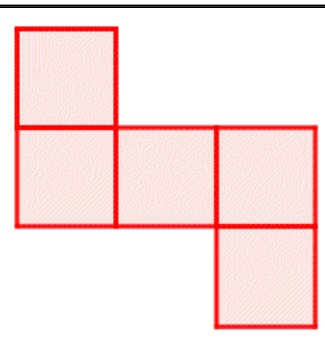

Pentagonal Prism

pentagonal pyramid NOUN /ˈpɛn.təˌgɒ.nl ˈpɪr.ə.mɪd/ a six-faced polyhedron with a pentagonal base and isosceles triangles for sides. The triangles come to a point at the apex.


Pentagonal Pyramid

pentahedron NOUN /ˌpɛn.təˈhi.drən/ a five-faced polyhedron.
Examples: square pyramid, triangular prism.

pentomino NOUN /ˌpɛn.təˈmi.noʊ/ a shape made of five connected, congruent squares that share sides.


Pentomino

per PREPOSITION /pər/

1. for every.
2. each. *Example:* per annum.

per- PREFIX /pər/
1. for every. *Example:* percent.
2. each.

per annum NOUN /pər 'æn.əm/ each year. *Example:* a 10% annual interest rate is 10% per annum.

percent ADJECTIVE, NOUN /pər'sɛnt/ a value written in parts per hundred. *Notation:* $\%$. *Formula:* $a\% = \frac{a}{100}$. *Example:*

$$25\% = \frac{25}{100} = 0.25.$$

percentage NOUN /pər'sɛnt.ɪdʒ/ portion out of 100.

percent decrease NOUN /pər'sɛnt dɪ'kris/ a decrease written as a percentage of the original amount. *Formula:* Quantity A decreased by B: $\frac{100 \cdot B}{A}\%$ decrease. *Example:* Originally $20, decreased by $5.

$$\frac{100 \cdot 5}{20}\% = \frac{500}{20}\% = 25\% \text{ decrease.}$$

percentile ADJECTIVE, NOUN /pər'sɛn.taɪl/ the n^{th} percentile of a dataset is the value of the element that is just greater than $n\%$ of all the elements of the dataset. *Synonym: percentile ranking* /pər'sɛn.taɪl 'ræŋ.kɪŋ/.

percent increase NOUN /pər'sɛnt 'ɪn.kris/ a increase written as a percentage of the original amount. *Formula:* Quantity A increased by B: $\frac{100 \cdot B}{A}\%$ increase. *Example:* Originally $20, increased by $5.

$$\frac{100 \cdot 5}{20}\% = \frac{500}{20}\% = 25\% \text{ increase.}$$

percent of change NOUN /pər'sɛnt ʌv tʃeɪndʒ/ a change given in parts per hundred. *Example:* Change from 527 to 623, percent of change is [(623-527)/527]·100 = [96/527]·100 ≈ 0.182·100 = 18.2%.

perfect ADJECTIVE /'pər.fɪkt/ exact.

perfect cube NOUN /'pər.fɪkt kyub/ an integer that is the cube of another integer. *Examples:* $1, 8, 27, 64, 125, \ldots$.

perfect number NOUN /'pər.fɪkt 'nʌm.bər/ an integer whose proper divisors add up to that number. The first three perfect numbers are: $1 + 2 + 3 = 6$, $1 + 2 + 4 + 7 + 14 = 28$, and $1 + 2 + 4 + 8 + 16 + 31 + 62 + 124 + 248 = 496$. *See also abundant number, deficient number.*

perfect square NOUN /'pər.fɪkt skwɛər/

1. an integer that is a square of another integer. *Examples:* $1, 8, 27, 64, 125, \ldots$. *Synonym: square number.*
2. *See perfect square trinomial.*

perfect square trinomial NOUN /'pər.fɪkt skwɛər 'traɪ.noʊ.mi.l/ a trinomial generated from the square of a binomial.

Formulas: $(a + b)^2 = a^2 + 2ab + b^2$, $(a - b)^2 = a^2 - 2ab + b^2$.

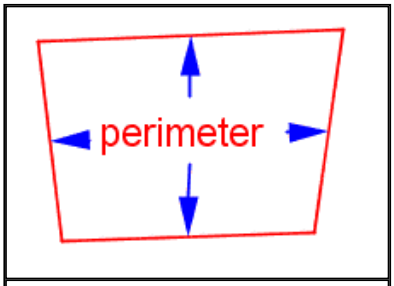
perhaps ADVERB /pər'hæps/ possibly; maybe or maybe not.

peri- PREFIX /'pɛr.ɪ/ around. *Example:* perimeter.

perimeter NOUN /pɛr'ɪ.mɪ.tər/

1. the edges of a closed 2-dimensional figure.
2. the sum of the lengths of those edges.

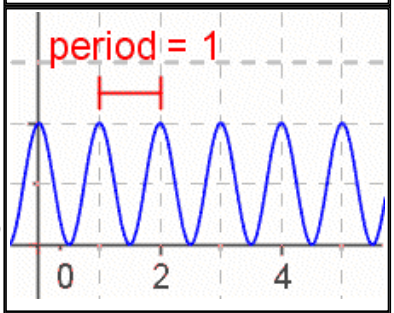
See also GeoApp!.



Perimeter

period NOUN /'pɪər.i.əd/

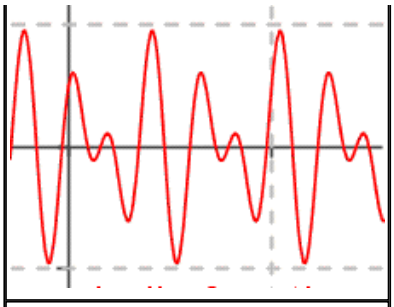
1. (function) the smallest interval over which the values of a periodic function repeat.
2. (interest) the amount of time after which interest is charged on a loan.
3. (waves) the distance from crest to crest. *See also wavelength.*
4. (time) a constant interval of time. *Example:* a period of one second. *Synonym: time interval.*



Period

periodic ADJECTIVE /ˌpɪər.i'ɒd.ɪk/ repeating at regular intervals. *Example:* periodic function.

periodic function NOUN /ˌpɪər.i'ɒd.ɪk 'fʌŋk.ʃən/ a function whose values repeat at regular intervals. *Example:* the sine function. *See also GeoApp!.*



Periodic Function

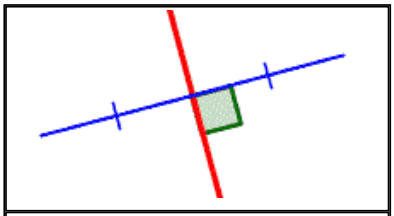
periodicity NOUN /ˌpɪər.i.ə'dɪs.ɪ.ti/ the property of repeating at regular intervals.

permutation NOUN /ˌpər.myu'teɪ.ʃən/ a selection of objects in a particular order. n objects can selected in $n!$ different orders. n objects can selected in $n!$ different orders. *Notation:* nPr where n is the number of objects from which to choose and r is the number of objects to choose. *Example:* there are $3! = 6$ permutations of $\{a,b,c\}$: abc, acb, bac, bca, cab, cba.

perpendicular /ˌpər.pən'dɪk.yə.lər/

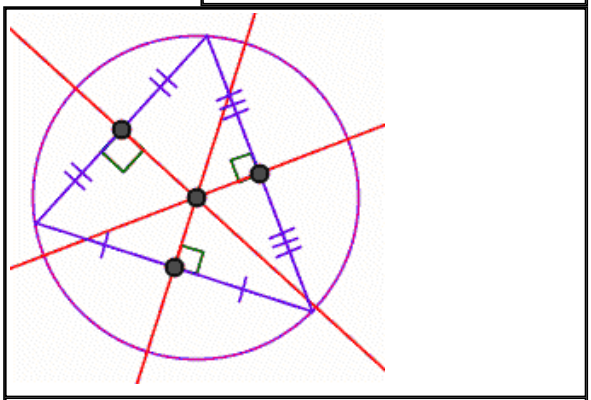
1. ADJECTIVE meeting at right angles. *Example:* perpendicular bisector.
2. NOUN a line that is at right angles to a given object.

perpendicular bisector NOUN /ˌpər.pən'dɪk.yə.lər baɪ'sɛk.tər/ an object, usually a line, that bisects a line segment and is perpendicular to that line segment.



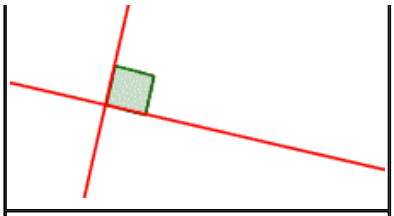
Perpendicular Bisector

Perpendicular Bisector Concurrence Theorem NOUN /ˌpər.pən'dɪk.yə.lər baɪ'sɛk.tər kən'kɜr.əns 'θɪər.əm/ the perpendicular bisectors of the sides of a triangle are concurrent.



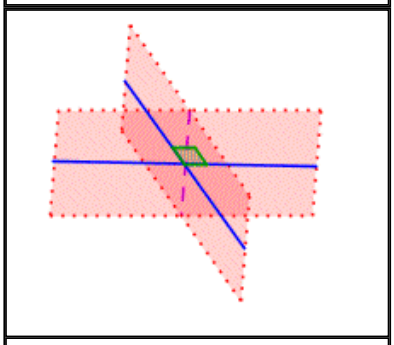
Perpendicular Bisector Congruence Theorem

perpendicular lines NOUN /ˌpər.pən'dɪk.yə.lər lainz/ lines that intersect at right angles. *See also Perpendicular Slope Postulate, GeoApp!.*



Perpendicular Lines

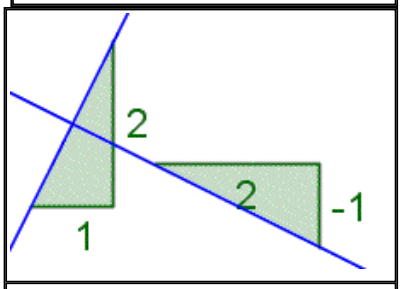
perpendicular planes NOUN /ˌpər.pən'dɪk.yə.lər pleɪn/ planes that intersect at a right angle.



Perpendicular Planes

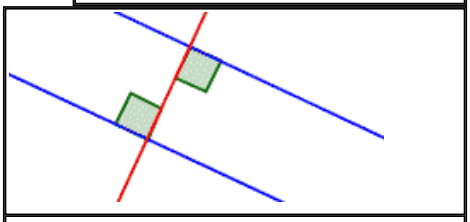
Perpendicular Slope Postulate NOUN /ˌpər.pən'dɪk.yə.lər sloʊp 'pɒs.tʃə.lɪt/ two non-vertical lines are perpendicular if and only if the product of their slopes is -1:

$$m_1 m_2 = -1 \rightarrow m_1 = -\frac{1}{m_2}.$$



Perpendicular Slope Postulate

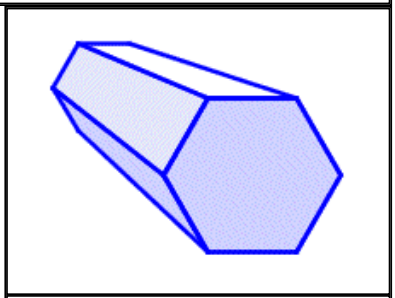
Perpendicular Transversal Theorem NOUN /ˌpər.pən'dɪk.yə.lər trænz'vɜr.səl 'θɪər.əm/ if a transversal of two parallel lines is perpendicular to one of the lines, then it is perpendicular to the other.



Perpendicular Transversal Theorem

perspective NOUN /pər'spɛk.tɪv/

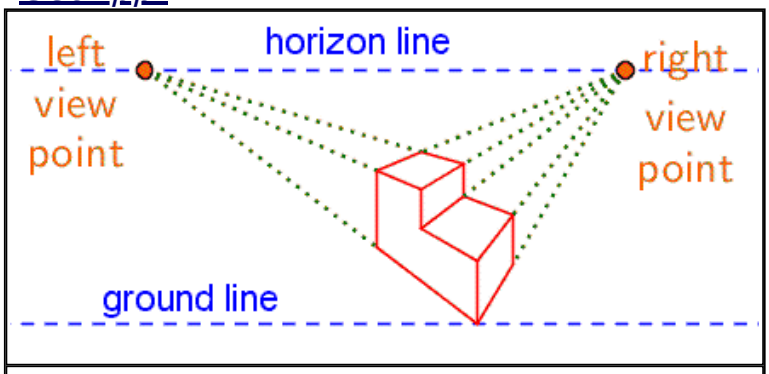
1. a technique of drawing three dimensions on a flat surface where objects gets smaller in the distance.
2. a figure using this technique.



Perspective

perspective drawing NOUN /pər'spɛk.tɪv 'drɔ.ɪŋ/ *See perspective view.*

perspective view NOUN /pər'spɛk.tɪv vyu/ the view from a corner of a figure. *Synonym: perspective drawing. See also isometric projection, GeoApp!.*



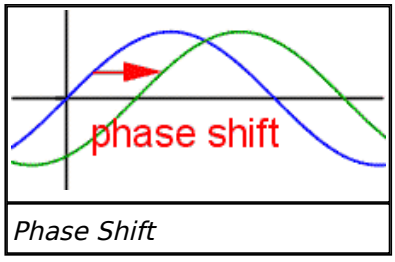
Perspective View

peta- PREFIX /'pɛ.tə/ 10^{15}. *Abbreviation: P.*

Example: 5 petameters $= 5\times10^{15}$ meters.
Synonym: quadrillion.

phase NOUN /feɪz/ a fractional part of a cycle through which a periodic function has passed.

phase shift NOUN /feɪz ʃɪft/ the horizontal movement of an entire periodic function when the angle is changed. Such a movement 'shifts' the phase. *See also GeoApp!.*



Phase Shift

phi SYMBOL /fi/ the Greek letter φ used to represent the golden ratio or a portion of an angle in three dimensions.

pi NOUN /paɪ/ the Greek letter π used for the constant ratio of the circumference of a circle to the diameter of that circle.

Formulas: $\pi \approx 3.14159$, $\pi \equiv C/D$ where C is the circumference of a circle and D is the diameter. *See also GeoApp!.*

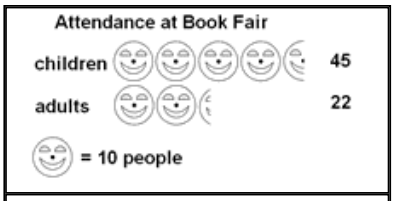
pico- PREFIX /'pi.koʊ/ 10^{-12}. *Abbreviation: p.*

Example: 7.2 picometers $= 7.2\times10^{-12}$ meters.
Synonym: trillionth.

picto- PREFIX /'pikt.oʊ/ having to do with pictures.

pictogram NOUN /'pikt,oʊ.græm/ *See pictograph.*

pictograph NOUN /'pikt,oʊ.græf/ a graph that uses pictures to show quantity. Each picture represents a particular quantity. *Synonym: pictogram.*



Pictograph

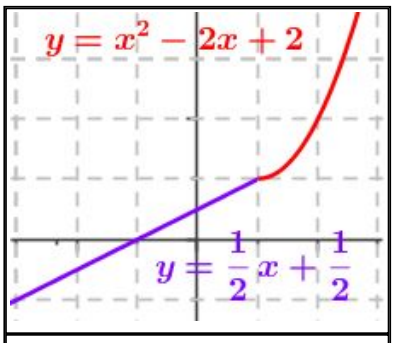
picture graph NOUN /'pɪk.tʃər græf/ *See pictograph.*

piece NOUN /pis/ a single part of a whole.

piecewise ADJECTIVE /'pis,waɪz/ having some property over a finite number of subdomains. *Example:* piecewise function.

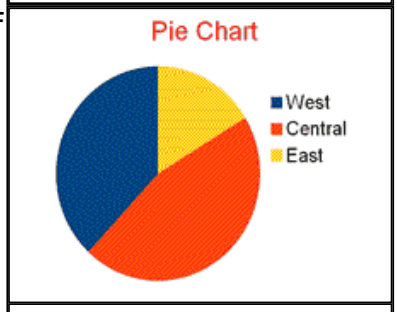
piecewise function NOUN /'pis,waɪz 'fʌŋk.ʃən/ a function that is defined differently over more than 1 subdomain. *Example:*

$$f(x) = \begin{cases} \text{if } x < 1: & \frac{1}{2}x + \frac{1}{2} \\ \text{if } x \geq 1 & x^2 - 2x + 2 \end{cases}.$$



Piecewise Function

pie chart NOUN /paɪ tʃɑrt/ a graph in the shape of a circle, divided into sectors, where each sector represents a proportion of a whole. *Synonyms: circle graph, pie graph.*



Pie Chart

pie graph NOUN /paɪ græf/ *See pie chart.*

pint NOUN /paint/ a unit of measure of volume. *Abbreviation: pt.*

Formulas: 1 pint = 2 cups, 2 pints = 1 quart, 1 pint ≈ .473 liters.

Pisano, Leonardo PERSON /ˌpi'zɑ.noʊ 'li.oʊˌnɒr.doʊ/ (1170-1250) an Italian mathematician nicknamed Fibonacci known for the Fibonacci numbers.

place NOUN /pleɪs/ a relative position.

placebo NOUN /plʌ'si.boʊ/ a non-active pill used to test the validity of the results of a study. *Synonym: sugar pill.*

placeholder NOUN /'pleɪsˌhoʊl.dər/ something that 'reserves' a place. *Example:* Zero is a placeholder in numerals. It adds no value to a numeral, but is important in telling the difference between numerals such as 204 and 24.

place value NOUN /pleɪs 'væl.yu/ a value by which a digit in a particular place in a numeral is multiplied to find the value of the numeral. *Example:* $12.7 = 1\times10 + 2\times1 + 7\times\frac{1}{10}$.

Place Value

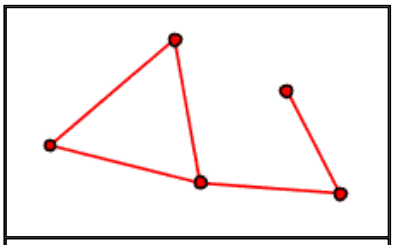
plain text NOUN /pleɪn tɛkst/ text that can be read without decrypting or deciphering. *Synonym: human readable text. Antonyms: encrypted text, encyphered text.*

plan NOUN /plæn/ a diagram showing a view from above; a scale drawing of a structure.

planar ADJECTIVE /'pleɪ.nər/
1. contained within a single plane. *Example:* planar curve.
2. involving two dimensions.

Antonym: nonplanar.

planar graph NOUN /'pleɪ.nər græf/ a network graph whose paths do *not* cross. *Antonym: nonplanar graph.*


Planar Graph

plane NOUN /pleɪn/ a flat, two dimensional space with infinite length and width and no thickness.

plane figure NOUN /pleɪn 'fɪg.yər/ a geometric figure than can exist within a single plane. *See also planar.*

plane geometry NOUN /pleɪn dʒi'ɒ.mɪ.tri/ the study of objects in a flat, 2-dimensional space.

plane shape NOUN /pleɪn ʃeɪp/ *See plane figure.*

plane trigonometry NOUN /pleɪn ˌtrɪ.gə'nɒ.mɪ.tri/ the branch of mathematics that deals with planar right triangles, unit circles and the calculations and relationships between the sides and angles of right triangles.

Plato PERSON /'pleɪ.toʊ/ (427 BCE-347 BCE) a Greek philosopher and mathematician who made important contributions to geometry and to the science of logic.

Plato

Platonic ADJECTIVE /plə'tɒn.ɪk/ credited to or named after Plato.

Platonic solid NOUN /plə'tɒn.ɪk 'sɒl.ɪd/ *See regular polyhedron.*

Please Excuse My Dear Aunt Sally MNEMONIC a mnemonic for remembering the order of operations: parentheses, exponents, multiplication and division (left to right), addition and subtraction (left to right).

plot VERB /plɒt/

1. to mark on a graph.
2. to draw a figure by marking points in a coordinate plane.

plus PREPOSITION /plʌs/

1. added to; increased by. Keyword for addition.
2. in addition to.

Notation: $+$.

plus or minus PREPOSITION /plʌs ɔr 'maɪ.nəs/ an operator than can be either plus or can be minus. *Notation:* $\pm$. *Example:* $3 \pm 4 = 7$ or -1. *See also minus or plus.*

plus sign NOUN /plʌs saɪn/ the symbol '+' used to show addition or positive.

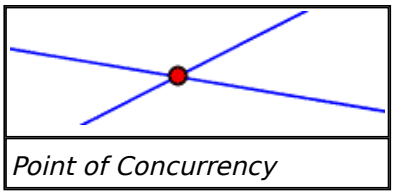
pm ABBREVIATION post meridiem, which means after noon. *Example:* 3:00 pm is 3 hours after noon.

point NOUN /pɔɪnt/

1. a point has a location but no width, length or height. A point is drawn as a dot and/or written as a coordinate.
2. a dot in a drawing.

Point

point of concurrency NOUN /pɔɪnt ʌv kən'kɜr.ən.si/ a point where two or more geometric objects intersect. *Synonym: point of intersection.*

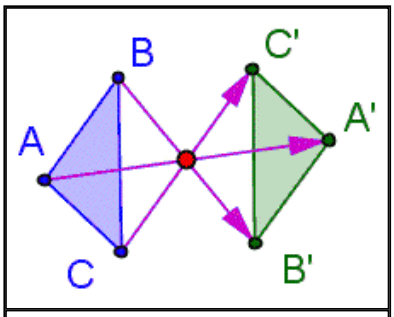


Point of Concurrency

point of contact NOUN /pɔɪnt ʌv 'kɒn.tækt/ where one object touches another without crossing. *See also point of concurrency.*

point of intersection NOUN /pɔɪnt ʌv ˌɪn.tər'sɛk.ʃən/ *See point of concurrency.*

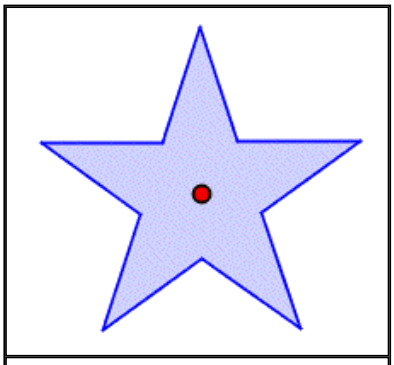
point of reflection NOUN /pɔɪnt ʌv rɪ'flɛk.ʃən/ a point about which a reflection is performed. *Math definition:* Given point P and a reflection point Q, point R is the reflection of P about Q if Q is the midpoint of $\overline{PR}$. *See also GeoApp!.*



Point of Reflection

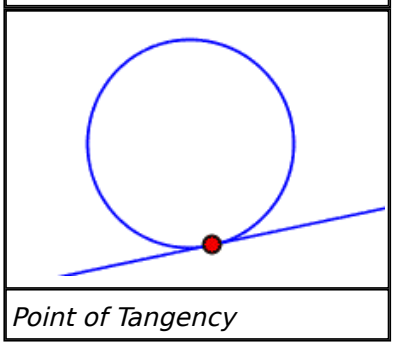
point of rotation NOUN /pɔɪnt ʌv roʊ'teɪ.ʃən/ *See center of rotation.*

point of symmetry NOUN /pɔɪnt ʌv 'sɪm.ɪ.tri/ a point about which an object has radial or reflective symmetry.



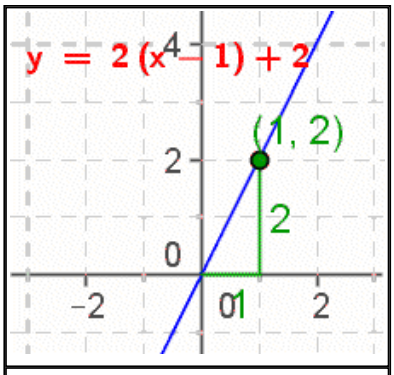
Point of Symmetry

point of tangency NOUN /pɔɪnt ʌv 'tæn.dʒən.si/ a point where a tangent line touches a circle or a curve without crossing it. *See also GeoApp!.*



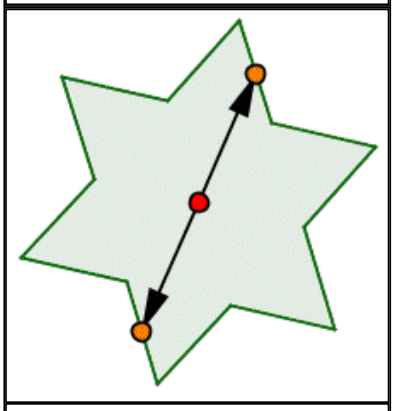
Point of Tangency

point-slope form NOUN /pɔɪnt sloʊp fɔrm/ a way to write a linear equation given the coordinates of a point on a line and the slope of the line. *Formula:* $y = m(x - x_0) + y_0$ where m is the slope and (x_0, y_0) is the coordinate of any point on the line. *See also GeoApp!.*



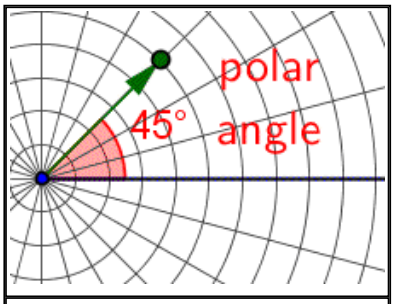
Point Slope Form

point symmetry NOUN /pɔɪnt 'sɪm.ɪ.tri/ an image that, when reflected across a point, is identical to the pre-image has point symmetry about that point. *See also GeoApp!.*


Point Symmetry

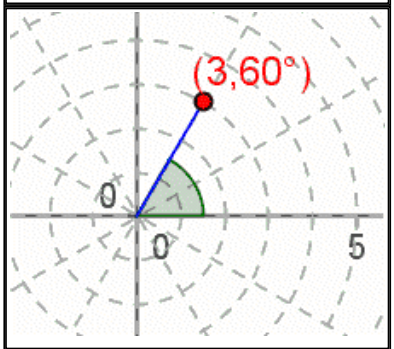
polar ADJECTIVE /'poʊ.lər/ where location in a plane is determined by an angle and a distance from the endpoint of a fixed ray.

polar angle NOUN /'poʊ.lər 'æŋ.gəl/ one of two coordinates in a 2-dimensional polar coordinate system: (r,θ). A polar angle is measured from a horizontal ray extending to the right of the origin.



Polar Angle

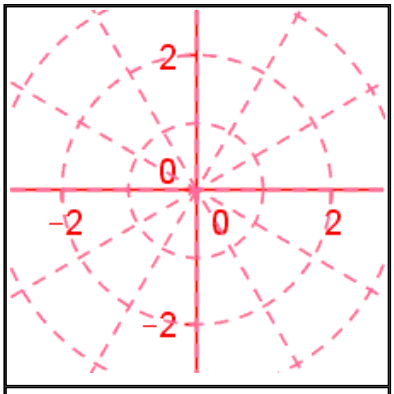
polar coordinate NOUN /'poʊ.lər koʊ'ɔr.dnɪt/ for 2-dimensional systems, a distance from the origin and an angle from the positive x-axis, written (r,θ). For 3-dimensional systems, a distance and two angles, written (r,θ,φ).



Polar Coordinate

polar coordinate plane NOUN /ˈpoʊ.lər koʊˈɔr.dnɪt pleɪn/ a plane containing a polar coordinate system.

polar coordinate system NOUN /ˈpoʊ.lər koʊˈɔr.dnɪt ˈsɪs.təm/ a coordinate system that uses an angle and a distance to determine the location of a point. A 3-dimensional polar coordinate system uses two angles at right angles to each other and a distance to determine the location of a point.



Polar Coordinate System

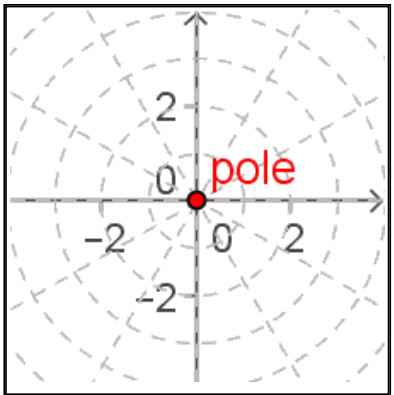
polar form NOUN /ˈpoʊ.lər fɔrm/

1. (complex numbers) a complex number in the form (r,θ) where r is the magnitude and θ is the rotation from the positive real axis. *Formula:* the polar form of the complex number $a+bi$ is $\left(\sqrt{a^2+b^2}, \arctan\frac{b}{a}\right)$.
2. (vectors) a vector in the form (r,θ) where r is the magnitude and θ is the rotation from the positive x-axis. *Formula:* the polar form of vector $<x, y>$ is $\left(\sqrt{x^2+y^2}, \arctan\frac{y}{x}\right)$.
3. (equation) an equation written for polar coordinates, often in the form $r = f(\theta)$. *Example:* $r = \cos(\theta)$.

polar origin NOUN /ˈpoʊ.lər ˈɔr.ɪ.dʒɪn/ *See pole.*

pole NOUN /ˈpoʊl/

1. the origin in a polar coordinate system. An arbitrary point from which location in a polar coordinate system is determined. *Synonym: polar origin.*
2. an imaginary line about which a sphere rotates.
3. one of two points at which a pole intersects the surface of a sphere. *Example:* north pole.



Pole

poly- PREFIX /ˈpɒl.i/

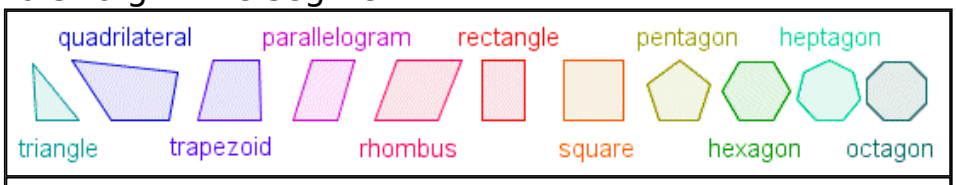
1. many. *Example:* polygon.
2. more than one.

Pólya, George PERSON /ˈpɔl.yəz dʒɔrdʒ/ (1887-1985) a Hungarian mathematician noted for characterizing how people solve problems.

Polya's Four Step Approach NOUN /ˈpɔl.yəz fɔr stɛp əˈproʊtʃ/ a method of solving problems:

1. Read and understand the problem.
2. Plan how to solve the problem.
3. Solve the problem.
4. Look back.

polygon NOUN /ˈpɒl.iˌgɒn/ a closed n-sided figure in a plane. Each side is a straight line segment.



Polygons

polyhedron NOUN /ˌpɒ.liˈhi.drən/ a 3-dimensional shape with faces made of polygons. *Plural: polyhedra* /ˌpɒ.liˈhi.drə/. *See also GeoApp!.*

polynomial NOUN /ˌpɒl.əˈnoʊ.mi.əl/ an expression where each term has a coefficient and zero or more variables raised to an integer power.

Example: $-3x^5 + 4x^4 - 2x^2 + 0.5x + 2$.

polynomial equation NOUN /ˌpɒl.əˈnoʊ.mi.əl ɪˈkweɪ.ʒən/ an equation containing a polynomial on one side of the equal sign and a zero or a single variable on the other.

Example: $2x^4 - 3x^2 + 5x + 2 = 0$.

polynomial function NOUN /ˌpɒl.əˈnoʊ.mi.əl ˈfʌŋk.ʃən/ a function whose transformation rule is a polynomial.

Example: $f(x) = -x^4 + 2x^2 + 3x$.

polyomino NOUN /ˌpɒl.i.oʊˈmi.noʊ/ a plane figure made of two or more identical squares.

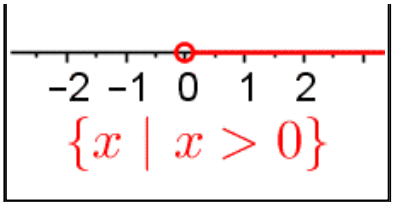
population NOUN /ˌpɒp.yuˈleɪ.ʃən/ all of a group of objects about which statistical data is collected and analyzed. *Example:* all frogs in an ecosystem.

portion NOUN /ˈpɔr.ʃən/ a part of a whole.

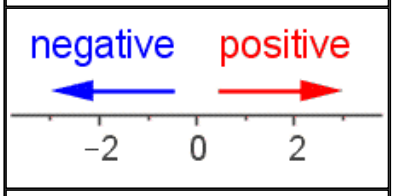
position NOUN /ˌpoʊˈsɪ.ʃən/ *See location.*

positive ADJECTIVE, NOUN /ˈpɒz.ɪ.tɪv/

1. greater than zero. Not zero or negative. *Antonym: nonpositive.*
2. in a positive direction. *Antonym: negative.*

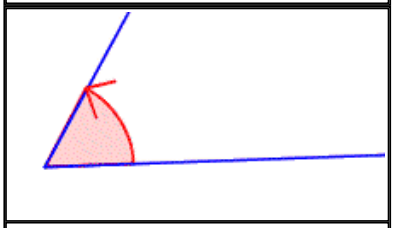


Positive Number



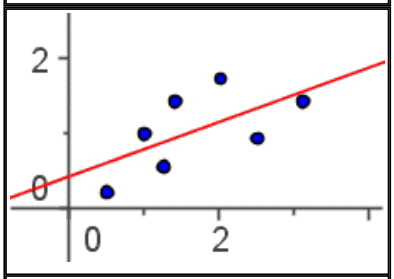
Positive

positive angle NOUN /ˈpɒz.ɪ.tɪv ˈæŋ.gəl/ an angle going in a counterclockwise direction. *Antonym: negative angle.*



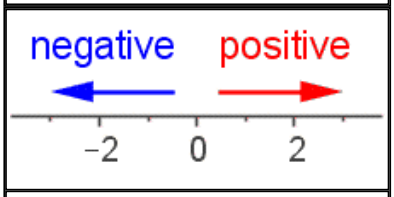
Positive Angle

positive correlation NOUN /ˈpɒz.ɪ.tɪv ˌkɒr.əˈleɪ.ʃən/ a correlation between variables such that as one goes up, the other tends to go up. *Antonym: negative correlation.*



Positive Correlation

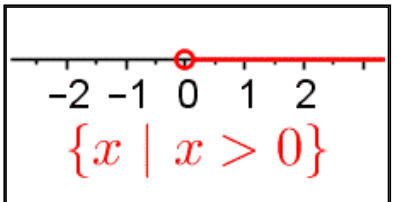
positive direction NOUN /ˈpɒz.ɪ.tɪv dɪˈrɛk.ʃən/ an arbitrary direction in which values increase. *Antonym: negative direction.*



Positive

positive integer NOUN /ˈpɒz.ɪ.tɪv ˈɪn.tɪ.dʒər/ a whole number that is greater than zero; a natural number. *Notations:* $\mathbb{N}$, $\mathbb{Z}+$. *Math definition:* $\mathbb{N} = \{1, 2, 3, 4, ...\}$. *Synonyms: natural number, counting number.*

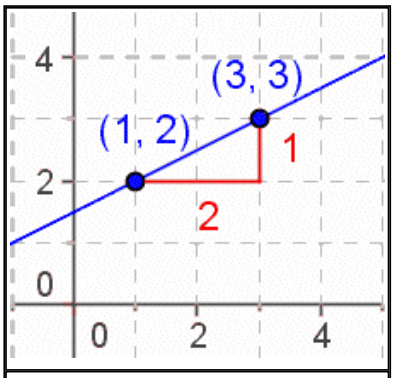
positive number NOUN /ˈpɒz.ɪ.tɪv ˈnʌm.bər/ a number greater than zero. *Math definition:* $\{x : x > 0\}$. *Antonym: nonpositive number.*



Positive Number

positive sign NOUN /ˈpɒz.ɪ.tɪv saɪn/ the symbol '+' meaning that a number is positive. *Example:* $+5$. *Synonym:* *plus sign*.

positive slope NOUN /ˈpɒz.ɪ.tɪv sloʊp/ a slope that slants upwards from left to right; a slope that can be written as a positive number. *Antonym:* *negative slope*.



Positive Slope

possibility NOUN /ˌpɒ.sɪˈbɪl.ɪ.ti/
1. one of several things that can happen.
2. the state of being possible or impossible.

possible ADJECTIVE /ˈpɑs.ɪ.bəl/
1. can happen.
2. can be true.

Antonym: *impossible*.

postulate NOUN /ˈpɒs.tʃə.lɪt/ *See* *axiom*.

pound NOUN /paʊnd/
1. a unit of measure of weight. *Abbreviation: lb.*
   Formulas: $16 \text{ ounces} = 1 \text{ pound}$, $2000 \text{ pounds} = 1 \text{ ton}$, $1 \text{ pound} \approx 0.454 \text{ kg}$ on the Earth's surface.
2. *See* *pound sterling*.

pound sterling NOUN /paʊnd ˈstɜr.lɪŋ/ the base currency in the United Kingdom. *Notations:* *£*, *GBP*. *Formula:* $100 \text{ pence} = 1 \text{ GBP}$.

power NOUN /ˈpaʊ.ər/ *See* *exponent*.

power function NOUN /ˈpaʊ.ər ˈfʌŋk.ʃən/ *See* *exponential function*.

power of a power NOUN /ˈpaʊ.ər ʌv ə ˈpaʊ.ər/ a base raised to a power, the whole of which is raised to another power.
Formula: $(b^m)^n = b^{m \cdot n}$.

Power Property of Logarithms NOUN /ˈpaʊ.ər ˈprɒ.pər.ti ʌv ˈlɔ.gəˌrɪð.əmz/ the logarithm of a base to a power is equal to the power times the logarithm of the base: $\log_b M^k = k \log_b M$.

power rule NOUN /'paʊ.ər rul/ a property of exponents such that $(b^m)^n = b^{m \cdot n}$. *Important:* $b^{(m^n)} \neq b^{m \cdot n}$.

power series NOUN /'paʊ.ər 'sɪər.iz/ an infinite series containing one or more variables in the form $f(x) = a_0 + a_1(x - c) + a_2(x - c)^2 + a_3(x - c)^3 + \ldots$.

power set NOUN /'paʊ.ər sɛt/ the set of all subsets of a set. *Notation:* $\wp(A)$ is read 'power set of A'.. *Example:* If $A = \{a,b,d\}$ then $\wp(A) = \{\emptyset, \{a\}, \{b\}, \{d\}, \{a,b\}, \{a,d\}, \{b,d\}, \{a,b,d\}\}$.

powers of 10 NOUN /'paʊ.ərz ʌv tɛn/ $1=10^0$, $10=10^1$, $100=10^2$, ...

powers of i NOUN /'paʊ.ərz ʌv aɪ/

Powers of i		
$i^1 = i$	$i^5 = i$	$i^{4k+1} = i,\ k \in Z$
$i^2 = -1$	$i^6 = -1$	$i^{4k+2} = -1,\ k \in Z$
$i^3 = -i$	$i^7 = -i$	$i^{4k+3} = -i,\ k \in Z$
$i^4 = 1$	$i^8 = 1$	$i^{4k+4} = 1,\ k \in Z$

practical situation NOUN /'præk.tɪ.kəl 'sɪt.u.eɪ.ʃən/ a mathematical problem in a real-world context. *Example:* Jeremy has five fewer pencils than Jen. Jen has ten pencils. How many pencils does Jeremy have?

pre- PREFIX /pri/
1. before. *Example:* predict.
2. in front of. *Example:* precedence.

precedence NOUN /'prɛs.ɪ.dəns/ *See order of operations.*

precise NOUN /prɪ'saɪs/ being exact; no more and no less.

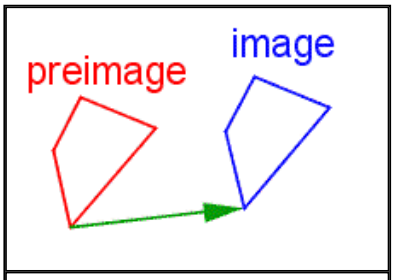
precision NOUN /prɪ'sɪ.ʒən/
1. how accurate something is. *Synonym: accuracy, definition 1.*
2. degree of accuracy or correctness.

predict VERB /prɪ'dɪkt/
1. to tell or estimate before it happens.

2. to model. *Example:* The equation $y = a_0t^2 + v_0t + h_0$ predicts the vertical height of a projectile at time t.

prediction NOUN /prɪ'dɪk.ʃən/
1. a description of possible future events made in advance.
2. an estimate of a result.

preimage NOUN /'pri.ɪm.ɪdʒ/ a geometric figure before a transformation.



Preimage

premise NOUN /'prɛm.ɪs/ one or more sentences upon which an argument is based. *Example:*
- Socrates is a man. (premise)
- All men are mortal. (premise)
- So Socrates is mortal. (conclusion)

present NOUN /'prɛs.ənt/ at this time.

present value NOUN /'prɛs.ənt 'væl.yu/ the current value of a future payment or payments discounted to reflect the time value of money.

price NOUN /praɪs/ the amount of money paid for something.

prime ADJECTIVE /praɪm/ can not be factored. *Example:* prime number. *Antonym: composite.*

prime factor NOUN /praɪm 'fæk.tər/ a factor that is either a prime number or an irreducible expression. *Examples:* 7, 19, $(x–2)$.

prime factorization NOUN /praɪm fæk,toʊr.i'zeɪ.ʃən/ a set of factors that are all prime and, when multiplied together, give a specific number or expression. *Example:* $12 = 2^2 \cdot 3$. *See also factor tree.*

prime notation NOUN /praɪm noʊ'teɪ.ʃən/ to show that an object is created from another object, label the new object with the old label plus a prime mark ('). *Example:* if a is used to create a new object, label the new object a'.

prime number NOUN /praɪm 'nʌm.bər/ an integer greater than 1 that is evenly divisible only by 1 and itself. *Examples:* 2, 3, 5, 7, 11, 13, 17, ... *Antonym: composite number.*

primitive NOUN /ˈprɪm.ə.tɪv/ an object that is defined implicitly by the axioms of a axiomatic system. *Example:* points and lines are primitives of modern geometry. *Synonym: undefined term.*

principal /ˈprɪn.sə.pəl/

1. NOUN the amount of a loan on which interest is calculated. *Formula:* principal + interest = total payment.
2. ADJECTIVE major. *Example:* principle axis.
3. ADJECTIVE most important. *Example:* principal root.

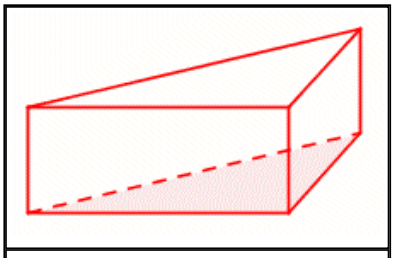
principal diagonal NOUN /ˈprɪn.sə.pəl daɪˈæg.ə.nl/ *See main diagonal.*

principal root NOUN /ˈprɪn.sə.pəl rut/ the positive square root. *Example:* The principal root of 25 is 5, *not* -5.

principal value NOUN /ˈprɪn.sə.pəl ˈvæl.yu/ (trigonometry) the output of an arcsine or arccosine function that lies in a range, usually $\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$, or the output of an arctangent function that lies in a range, usually $[0, \pi]$.

prior ADJECTIVE /ˈpraɪ.ər/ coming before in order or time.

prism NOUN /ˈprɪz.əm/ a geometric solid whose bases are parallel and congruent polygons, and whose sides are parallelograms. *See also Net!.*



Prism

prisoner NOUN /ˈprɪz.ə.nər/ in a Mandelbrot set or a Julia set, a value that tends to zero. *Antonym: escapee.*

probability NOUN /ˌprɒb.əˈbɪl.ɪ.ti/

1. the likelihood, chance, or odds of an event happening.
2. the study of chance occurrences.

probable ADJECTIVE /ˈprɒb.ə.bəl/

1. likely to happen.
2. likely to be true.

problem NOUN /ˈprɒ.bləm/ a situation or equation to solve.

problem solving NOUN /ˈprɒ.bləm ˈsɒl.vɪŋ/ finding a solution to a problem.

process /ˈprɒ.ses/

1. NOUN the act of doing something in a systematic manner to bring about a particular result.
2. VERB to do something in a systematic manner to bring about a particular result.

product NOUN /'prɒ.dəkt/

1. the result of multiplication. *Formula:* $\text{multiplicand} \times \text{multiplier} = \text{product}$. *Example:* $5 \times 3 = 15$.
2. one or more numbers or expressions multiplied by each other.

Product Property of Exponents NOUN /'prɒ.dəkt 'prɒ.pər.ti ʌv 'ɛk.spoʊ.nəntz/ the product of two terms with the same base is the base raised to the sum of the exponents. *Math definition:* $b^m b^n = b^{m+n}$..

Product Property of Logarithms NOUN /'prɒ.dəkt 'prɒ.pər.ti ʌv 'lɔ.gəˌrɪð.əmz/ the log of a product is equal to the sum of logs of the multiplicands. *Math definition:* $\log_b M \cdot N = \log_b M + \log_b N$.

Product Property of Proportions NOUN /'prɒ.dəkt 'prɒ.pər.ti ʌv prə'poʊr.ʃənz/ if $\frac{a}{c} = \frac{c}{d}$, then $ad = bc$. Conversely, if $ad = bc \neq 0$, then $\frac{a}{c} = \frac{c}{d}$ and $\frac{b}{a} = \frac{d}{c}$.

product to sum identities NOUN /'prɒ.dəkt tu sʌm aɪ'dɛnˌtɪ.tiz/ trigonometric identities involving the product of two trigonometric functions. *See also Trigonometric Identities.*

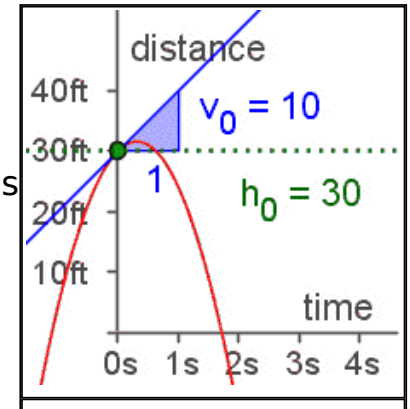
profit /'prɑf.ɪt/

1. NOUN an amount of money gained on on one or more transactions or in a certain period of time.
2. VERB to gain money on one or more transactions.

progression NOUN /proʊ'grɛ.ʃən/ *See sequence.*

projectile NOUN /prə'dʒɛk.taɪl/ a free falling body that has been projected forward. *Example:* a ball thrown off a roof, until it hits the ground.

projectile motion NOUN /prə'dʒɛk.taɪl 'moʊ.ʃən/ the vertical motion of a free falling object with respect to time. *Formula:* $y = ½at^2 + v_0t + h_0$ where y is the height at time t, a is the vertical acceleration due to gravity, v_0 is the initial vertical velocity and h_0 is the initial height. *See also GeoApp!.*



Projectile Motion

projection NOUN /proʊ'dʒɛk.ʃən/ a 2-dimensional drawing of a 3-dimensional object.

prolate spheroid NOUN /'proʊ.leɪt 'sfɪər.ɔɪd/ an ellipsoid made by rotating an ellipse around its major axis. *For contrast, see oblate spheroid.*

pronumeral NOUN /'proʊ.num.ər.əl/ *See variable.*

proof NOUN /pruf/ a series of statements that show a claim is true.

proof by construction NOUN /pruf baɪ kən'strʌk.ʃən/ construction of a concrete example with a particular property that shows that property exists. *Synonym: proof by example.*

proof by contradiction NOUN /pruf baɪ ˌkɒn.trə'dɪk.ʃən/ a proof that shows a proposition is true by showing that, if the proposition were false, then there would be a contradiction. *Synonym: indirect proof. Antonym: direct proof.*

proof by example NOUN /pruf baɪ ɪg'zæm.pl/ *See proof by construction.*

proof by exhaustion NOUN /pruf baɪ ɪg'zɒs.tʃən/ a proof where a proposition is divided into a number of cases, and each of the cases is individually proved.

proof by induction NOUN /pruf baɪ ɪn'dʌk.ʃən/ a proof that shows that, if a proposition is true for the first case and for an arbitrary case, it is always true for the next case after the arbitrary case. Proof by induction is *not* logical induction.

proof by transposition NOUN /pruf baɪ ˌtræns.pə'zɪ.ʃən/ a proof that shows that the contrapositive of a statement is true. If the contrapositive of a statement is true, then the statement is true. *See also contrapositive.*

proper ADJECTIVE /'prɒ.pər/ one of a select group. *Example:* proper fraction. *Antonym: improper.*

proper divisor NOUN /'prɒ.pər dɪ'vaɪ.zər/ a divisor that is *not* the integer itself. *Example:* the proper divisors of 12 are 1, 2, 3, 4 and 6.

proper factor NOUN /'prɒ.pər 'fæk.tər/ *See proper divisor.*

proper fraction NOUN /'prɒ.pər 'fræk.ʃən/

1. a numeric fraction where the absolute value of the numerator is less than the absolute value of the denominator. *Math definition:* $\frac{a}{b}$ where $|a| < |b|$. *Examples:* $\frac{3}{4}$, $\frac{-7}{16}$.

2. a rational polynomial such that the degree of the numerator is less than the degree of the denominator: $\frac{p}{q}$ such that $\deg(p) < \deg(q)$. *Example:* $\frac{x-3}{x^2+2}$.

Antonym: improper fraction.

proper subset NOUN /ˈprɒ.pər ˈsʌbˌsɛt/ a subset that is *not* equal to the original set. *Math definition:* A is a proper subset of B if and only if $A \subset B$ and $A \neq B$.

property NOUN /ˈprɒ.pər.ti/ an attribute or characteristic shared by a class of objects. *Example:* length is a property of line segments. *Synonym: attribute.*

Property of Addition by 0 NOUN /ˈprɒ.pər.ti ʌv əˈdɪ.ʃən baɪ ˈzɪər.oʊ/ *See 0, Property of Addition by.*

Property of Division by 1 NOUN /ˈprɒ.pər.ti ʌv dɪˈvɪ.ʒən baɪ wʌn/ *See 1, Property of Division by.*

Property of Multiplication by 0 NOUN /ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən baɪ ˈzɪər.oʊ/ *See 0, Property of Multiplication by.*

Property of Multiplication by 1 NOUN /ˈprɒ.pər.ti ʌv ˌmʌl.tə.plɪˈkeɪ.ʃən baɪ wʌn/ *See 1, Property of Multiplication by.*

proportion NOUN /prəˈpoʊr.ʃən/

1. a part compared to a whole.
2. an equation of two ratios in the form $\frac{a}{c} = \frac{c}{d}$.

proportional ADJECTIVE /prəˈpoʊr.ʃən.l/ having a common ratio. *Notation:* $\propto$. *Formula:* $y = ax$ where a is the common ratio. *Example:* $x \propto y$ (x is proportional to y).

proportional reasoning NOUN /prəˈpoʊr.ʃən.l ˈriz.nɪŋ/ an understanding of co-variation and multiple comparisons. The ability to mentally store and process several pieces of mathematical information.

proposition NOUN /ˌprɒp.əˈzɪ.ʃən/

1. a true statement used to support a conclusion.
2. a statement to be proved. *Synonym: claim.*

protractor NOUN /proʊˈtræk.tər/ a tool used to measure or draw angles.

Protractor

Protractor Postulate NOUN /proʊˈtræk.tər ˈpɒs.tʃə.lɪt/ any angle can be paired with a real number.

prove VERB /pruv/ use a logical argument to show that a proposition is true.

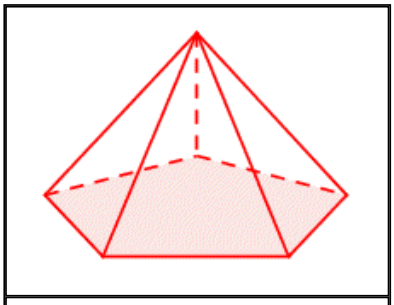
pseudo-random number NOUN /ˈsu.doʊ ˈræn.dəm ˈnʌm.bər/ a number from a list of numbers that is *not* truly random, but is used as if the list is random.

pt. ABBREVIATION *See pint.*

pure imaginary number NOUN /pyʊər ɪˈmædʒ.əˌnɛr.i ˈnʌm.bər/ *See imaginary number.*

pure mathematics NOUN /pyʊər ˌmæθ.əˈmæ.tɪks/ mathematics that is *not* related to a real-world application; mathematics for the sake of mathematics. *Antonym: applied mathematics.*

pyramid NOUN /ˈpɪr.ə.mɪd/ a geometric solid with a polygon for a base and triangular sides that meet at a point.



Pyramid

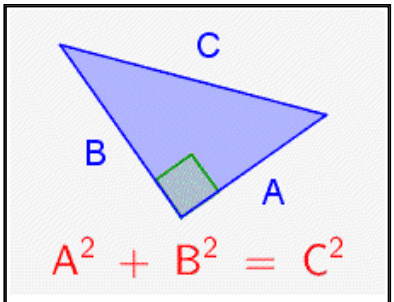
Pythagoras PERSON /pɪˈθæg.ər.əs/ (ca 575 B.C.E.-ca. 495 B.C.E.) a Greek mathematician, philosopher, musician and religious leader for whom the Pythagorean Theorem is named.

Pythagorean identities NOUN /pɪˌθæg.əˈri.ən aɪˈdɛnˌtɪ.tiz/ trigonometric identities based on the Pythagorean Theorem. *See also Trigonometric Identities.*

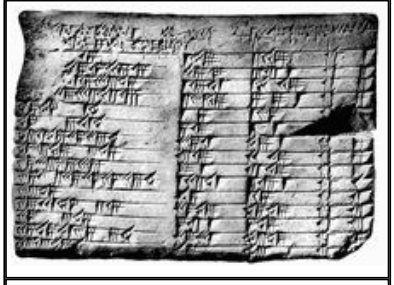
Pythagorean Theorem NOUN /pɪˌθæg.əˈri.ən ˈθɪər.əm/ a theorem relating the lengths of the sides of right triangles.

Formula: $A^2 + B^2 = C^2$ where A and B represent the lengths of the legs of the right triangle and C represents the length of the hypotenuse.

Pythagorean triple NOUN /pɪˌθæg.əˈri.ən ˈtrɪ.pəl/ a set of three positive integers which satisfy the Pythagorean Theorem: $A^2 + B^2 = C^2$. *Example:* $(3, 4, 5)$. *See Pythagorean Triples.*



Pythagorean Theorem



Pythagorean Triple

Q

QED ABBREVIATION /kyu i di/ abbreviation for the Latin phrase *quod erat demonstrundum* meaning 'that which was to be shown'; an abbreviation placed at the end of a proof.

Notation: ■.

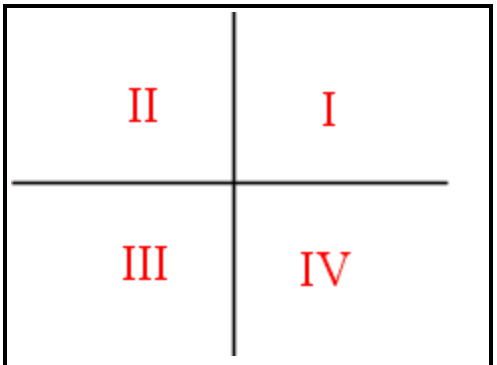
qt. ABBREVIATION *See quart.*

quad- PREFIX /kwɒd/ four. *Example:* quadrant.

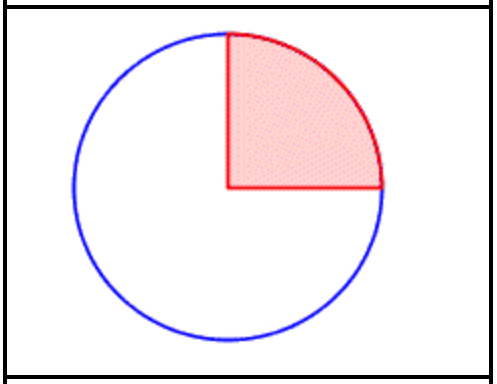
quadrangle NOUN /'kwɒdˌræŋ.gəl/ *See quadrilateral.*

quadrant NOUN /'kwɒd.rənt/

1. one of four regions into which the rectangular coordinate plane is divided by the axes. *See also GeoApp!.*
2. one quarter of a circle.



Quadrant of a Coordinate Plane



Quadrant of a Circle

quadrantal angle NOUN /kwɒd'rən.tl 'æŋ.gəl/ any angle that is a multiple of $90º$. *Examples:* $0º$, $90º$, $180º$, $270º$.

quadratic ADJECTIVE /kwɒ'dræ.tɪk/ involving a 2^{nd} degree polynomial. *Example:* quadratic formula.

quadratic equation NOUN /kwɒ'dræ.tɪk ɪ'kweɪ.ʒən/ an equation of a single variable polynomial of degree 2.

Formula: $y = ax^2 + bx + c$.

Example: $y = -3x^2 + 2x - 4$.

quadratic factor NOUN /kwɒ'dræ.tɪk 'fæk.tər/ a factor of a polynomial where the factor is degree 2.

Example: $x^2 + x - 2$. *See also linear factor.*

quadratic formula NOUN /kwɒ'dræ.tɪk 'fɔr.myə.lə/ a formula used to solve and find the roots of quadratic equations.

Formula: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ where

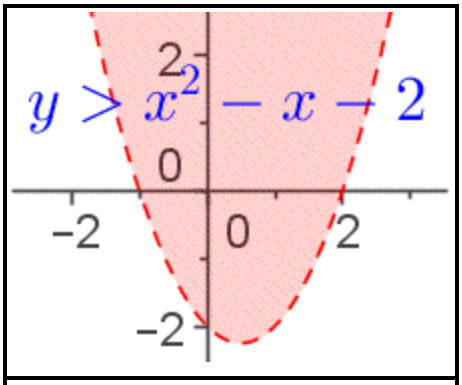
$0 = ax^2 + bx + c$.

quadratic function NOUN /kwɒ'dræ.tɪk 'fʌŋk.ʃən/ a function of a quadratic polynomial.

Formula: $f(x) = ax^2 + bx + c$.

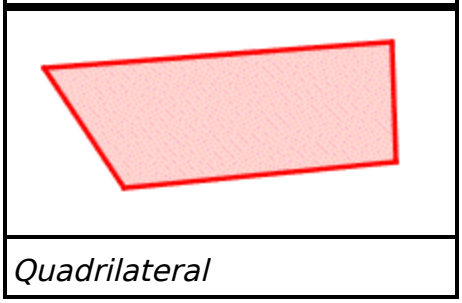
quadratic inequality NOUN /kwɒ'dræ.tɪk ˌɪn.ɪ'kwɒl.ɪ.ti/ an inequality with a quadratic polynomial on one side of the inequality and zero or a dependent variable on the other side.

Example: $y > x^2 - x - 2$.



Quadratic Inequality

quadrilateral NOUN /ˌkwɒd.rə'læ.tər.əl/ a four sided polygon. Some common quadrilaterals are: square, rectangle, rhombus and trapezoid (trapezium in British English). *See also Types of Quadrilaterals!.*



Quadrilateral

quadrillion ADJECTIVE, NOUN /kwɒ'drɪl.yən/ 10^{15} = 1,000,000,000,000,000. *Synonym: peta-.*

quadrillionth ADJECTIVE, NOUN /kwɒ'drɪl.yənθ/ 10^{-15} = 0.000000000000001. *Synonym: femto-.*

quadruple NOUN /ˌkwɒd'ru.pl/ multiply by four.

qualitative data NOUN /ˌkwɒl.ɪ'teɪ.tɪv 'deɪ.tə/ data that is *not* numerical data. *Examples:* gender, color preference. *Synonym: categorical data. Antonym: quantitative data.*

quantitative data NOUN /'kwɒn.tɪ.teɪ.tɪv 'deɪ.tə/ numeric data. *Examples:* age, height. *Antonym: qualitative data.*

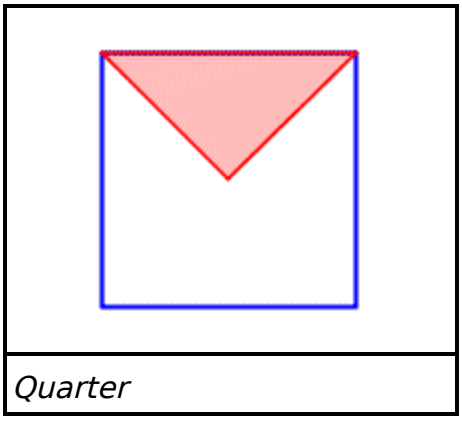
quantity NOUN /'kwɒn.tɪ.ti/ how many or how much of something there is.

quar- PREFIX /kwɔr/ four or fourth. *Example:* quarter.

quart NOUN /'kwɔrt/ a unit of measure of volume. *Abbreviation: qt.. Formulas:* $1 \text{ quart} = 4 \text{ cups}$, $1 \text{ quart} = 32 \text{ fluid ounces}$, $1 \text{ quart} \approx 0.946 \text{ liters}$.

quarter NOUN /'kwɔr.tər/

1. one of four equal parts; ¼ or 25%.
2. a coin valued at ¼ of a dollar or 25 cents.
3. a period of three months.



Quarter

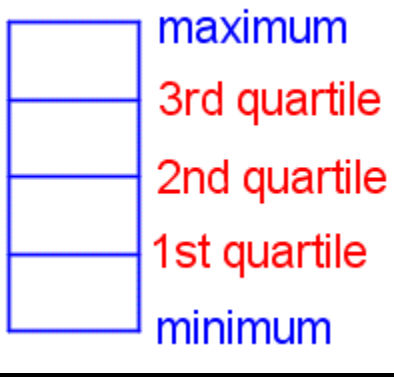
quarterly NOUN /'kwɔr.tər.li/

1. once every three months. *Example:* quarterly meeting.
2. for a three month period. *Example:* quarterly profit.

quartic /'kwɔr.tɪk/

1. NOUN a 4th degree polynomial. *Example:* $x^4 - 3x^2$.
2. ADJECTIVE having to do with a 4th degree polynomial.

quartile NOUN /ˈkwɔr.taɪl/ one of three values that divide a dataset into four equal parts.



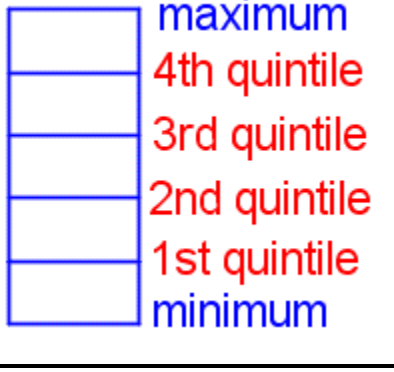
Quartile

quin- PREFIX /kwɪn/ five or fifth. *Example:* quintic.

quintic /ˈkwɪn.tɪk/

1. NOUN a 5th degree polynomial. *Example:* $x^5 - 4x^2$.
2. ADJECTIVE having to do with a 5th degree polynomial.

quintile NOUN /ˈkwɪn.taɪl/ one of four values that divide a dataset into five equal parts.



Quintile

quintillion ADJECTIVE, NOUN /kwɪnˈtɪl.yən/ 10^{18} = 1,000,000,000,000,000,000. *Synonym: exa-.*

quintillionth ADJECTIVE, NOUN /kwɪnˈtɪl.yənθ/ 10^{-18} = 0.000000000000000001. *Synonym: atto-.*

quotient NOUN /ˈkwoʊ.ʃənt/ the result of a division problem. *Formulas:* $\text{dividend} \div \text{divisor} = \text{quotient}$, $\text{dividend} \div \text{divisor} = \text{quotient R remainder}$ (integer division), $\begin{array}{r} \text{quotient} \\ \text{divisor}\overline{)\text{dividend}} \end{array}$.

Quotient Property of Exponents NOUN /ˈkwoʊ.ʃənt ˈprɒ.pər.ti ʌv ˈɛk.spoʊ.nənts/ the quotient of two values with exponents that have the same base is equal to the base raised to the difference of the exponents. *Formula:* $\frac{b^m}{b^n} = b^{m-n}, b \neq 0.$

Quotient Property of Logarithms NOUN /ˈkwoʊ.ʃənt ˈprɒ.pər.ti ʌv ˈlɔ.gəˌrɪð.əmz/ the logarithm of one value divided by another is equal to the logarithm of the numerator minus the logarithm of the denominator. *Formula:* $\log_b \frac{M}{N} = \log_b M - \log_b N, \ N \neq 0.$

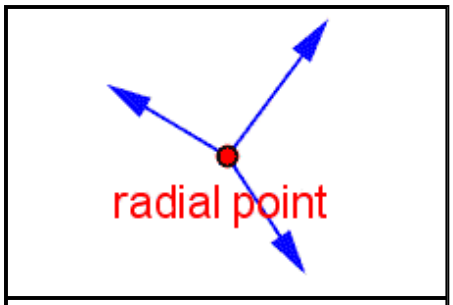
R

R ABBREVIATION *remainder*. *Example:* $5\mathrm{R}2$ (5 remainder 2).

rad. ABBREVIATION *radian*.

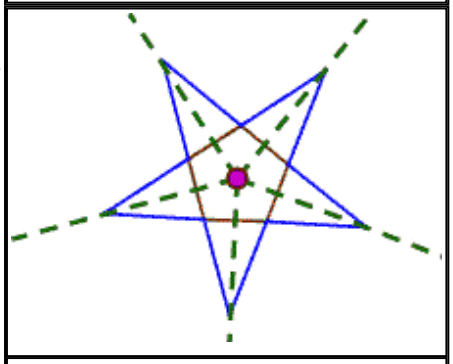
radial ADJECTIVE /'reɪ.di.əl/ having to do with radii from a central point. *Example:* radial symmetry.

radial point NOUN /'reɪ.di.əl pɔɪnt/ a point from which rays start.



Radial Point

radial symmetry NOUN /'reɪ.di.əl 'sɪm.ɪ.tri/ a figure has radial symmetry if, when rotated about a center point by a certain angle, the image of the figure lies exactly on top of the preimage. *See also GeoApp!.*



Radial Symmetry

radian NOUN /'reɪ.diən/ a unit of measure of angles. A full circle equals 2π radians. *Abbreviation: rad.*.

Formulas: $\pi \text{ radians} = 180°$,

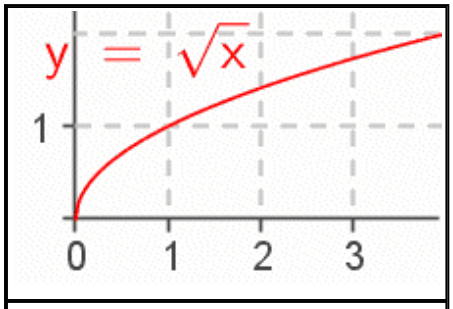
$1 \text{ radian} \approx 57.2958°$.

radical /'ræd.ɪ.kəl/

1. NOUN the root of a quantity. *Examples:* $\sqrt{5}$, $\sqrt[3]{x+2}$.
2. NOUN the symbol used to indicate root.. *Notation:* $\sqrt{}$.
3. ADJECTIVE having to do with or containing roots. *Example:* radical expression.

radical expression NOUN /'ræd.ɪ.kəl ɪk'sprɛ.ʃən/ an expression with one or more variables inside a radical. *Example:* $3 + \sqrt{x}$.

radical function NOUN /'ræd.ɪ.kəl 'fʌŋk.ʃən/ a function with one or more variables inside a radical. *Example:* $f(x) = 2 - \sqrt{x}$.



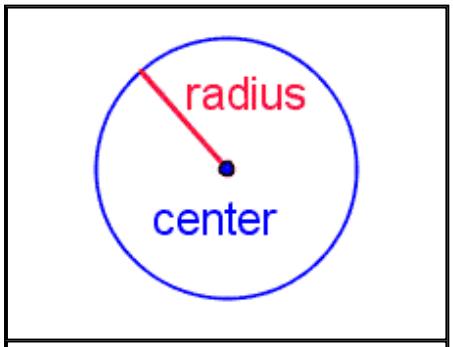
Radical Function

radicand NOUN /ˌræ.dɪ'kænd/ the value that appears under a radical sign; the value of which a root is to be taken. *Notation:* $\sqrt{\text{radicand}}$.

radius NOUN /'reɪ.di.əs/

1. a line segment extending from the center of a circle to the edge of the circle. *See also Parts of a Circle!.*
2. the length of a radius of a circle.
3. a ray that extends from a central point.

Plural: radii /'reɪ.diˌaɪ/.



Radius

radix NOUN /'reɪ.dɪks/ *See base, definition 2.*

raise to a power VERB /reɪz tu eɪ 'paʊ.ər/ to evaluate an exponent. *Example:* raise 2 to the third power: $2^3 = 8$. *See also exponent.*

random ADJECTIVE /'ræn.dəm/ without pattern, nonrepeating. *Example:* random number.

random event NOUN /'ræn.dəm ɪ'vɛnt/ an event that happens without outside influence on its outcome.

random number NOUN /'ræn.dəm 'nʌm.bər/ a number from a list of numbers where the list of numbers is nonrepeating and satisfies no algorithm.

random number generator NOUN /ˈræn.dəm ˈnʌm.bər ˈdʒɛn.ər.eɪˌtər/ a program that produces random or pseudo-random numbers.

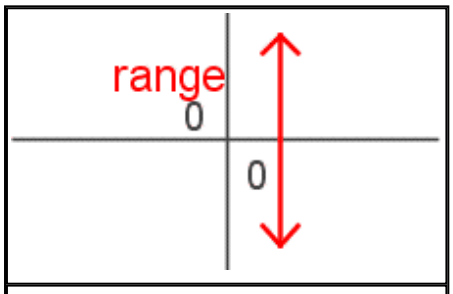
random sample NOUN /ˈræn.dəm ˈsɑm.pəl/ a sampling taken from a population using a random method to choose the sample.

random selection NOUN /ˈræn.dəm ˈsɪl.ɛk.ʃən/ selection from a population using a random selection process.

random variable NOUN /ˈræn.dəm ˈvɛər.i.ə.bəl/ a variable that takes on any value in a column of a dataset.

range NOUN /reɪndʒ/

1. (of a function) all values that a dependent variable can take; all output values of a function. *See also domain.*
2. (of a dataset) the lowest and highest values of the dataset.



Range

rate NOUN /ˈreɪt/

1. an amount per base unit; a ratio. *Example:* Prices are increasing at a rate of 3%.
2. a ratio that compares values in different units of measure. *Example:* dollars per gallon; $/gal..

rate of change NOUN /ˈreɪt ʌv tʃeɪndʒ/

1. (linear) the ratio of change of two variables. *Synonym: slope.*
2. (nonlinear) the limit of rates of change between two points on a curve as one approaches the other.

rate of interest NOUN /ˈreɪt ʌv ˈɪn.trɪst/ *See interest rate.*

ratio NOUN /ˈreɪ.ʃoʊ/

1. a comparison of two quantities by division.
2. a relative quantity; a proportion. *Example:* 1 out of 4 people in the United States are obese. $1:4$ or ¼.

Notations: $a:b$, a/b.

rational ADJECTIVE /ˈræʃ.nl/

1. can be written as a ratio. *Example:* rational number.

2. is written as a ratio. *Example:* rational expression.

rational equation NOUN /ˈræʃ.nl ɪˈkweɪ.ʒən/ an equation that contains one or more ratios of polynomials. *Example:*

$$y = \frac{x+3}{x^2-2x}.$$

rational expression NOUN /ˈræʃ.nl ɪkˈsprɛ.ʃən/ an expression that contains at least one ratio of polynomial. *Example:*

$$3 - \frac{x+3}{x^2-2x}.$$

rational function NOUN /ˈræʃ.nl ˈfʌŋk.ʃən/ a function containing a rational expression. *Example:*

$$f(x) = \frac{3x-2}{x^2}.$$

rationalize VERB /ˈræʃ.nlˌaɪz/ to remove radicals from the denominator of an expression. *Formulas:*

$$\frac{1}{\sqrt{a}} = \frac{1}{\sqrt{a}} \cdot \frac{\sqrt{a}}{\sqrt{a}} = \frac{\sqrt{a}}{a}, \frac{1}{\sqrt{a}+\sqrt{b}} = \frac{\sqrt{a}-\sqrt{b}}{a-b}.$$

Example: $\frac{1}{\sqrt{2}} = \frac{\sqrt{2}}{2}$.

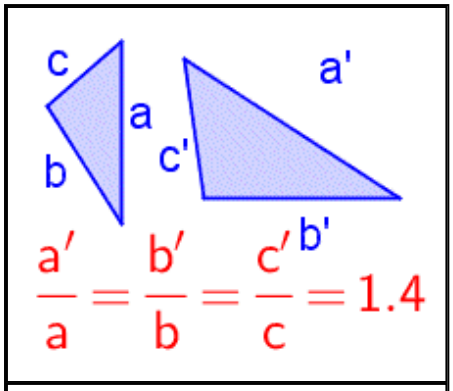
rational number NOUN /ˈræʃ.nl ˈnʌm.bər/ a real number that can be written as the ratio of two integers. *Example:* $\frac{2}{3}$.

Antonym: irrational number.

rational root NOUN /ˈræʃ.nl rut/ a root that is a rational number.

Rational Roots Theorem NOUN /ˈræʃ.nl rutz ˈθɪər.əm/ given a polynomial $a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x + a_0$ with integer coefficients, any rational roots of the polynomial have a numerator which is a factor of a_n and a denominator which is a factor of a_0. *Example:* If $a_n = 6$ and $a_0 = 5$, any rational root of the polynomial will be one of $\frac{1}{1}, \frac{2}{1}, \frac{3}{1}, \frac{6}{1}, \frac{1}{4}, \frac{2}{5}, \frac{3}{5}, \frac{6}{5}$.

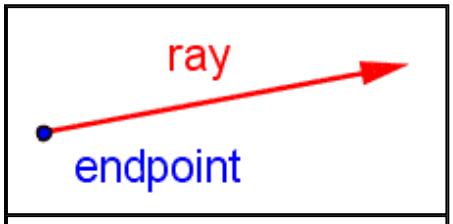
Ratio of Sides Similarity NOUN /ˈreɪ.ʃoʊ ʌv saɪdz ˌsɪm.əˈlær.ɪ.ti/ if the ratios of all three corresponding sides of two triangles are equal, then the triangles are similar. *Math definition:* given ΔABC and ΔDEF, if $\frac{a}{d} = \frac{b}{e} = \frac{c}{f}$ then $\Delta ABC \sim \Delta DEF$.



Ratio of Sides Similarity

ratio test NOUN /ˈreɪ.ʃoʊ tɛst/ a test for convergence used when terms of a series contain factorials and/or an integer exponent. The ratio test makes use of the number $L = \lim_{n \to \infty} \left| \frac{a_{n-1}}{a_n} \right|$. If $L < 1$, the series converges. If $L > 1$, the series diverges. If $L = 1$, or the limit does *not* exist, the test is inconclusive.

ray NOUN /reɪ/ a half-line starting at an endpoint and going on forever in one direction. *Notation:* $\overrightarrow{ab}$ (ray ab). a is the endpoint and b is any point on the ray. *Synonym: half-line.*

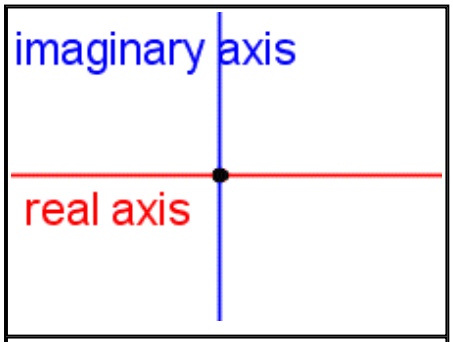


Ray

re- PREFIX /rɪ/ again. *Example:* recur.

real ADJECTIVE /'riəl/ having to do with real numbers.

real axis NOUN /'riəl 'æk.sɪs/ the horizontal axis in the complex plane which represents the real part of a complex number.



Real Axis

real line NOUN /'riəl laɪn/ *See number line.*

real number NOUN /'riəl 'nʌm.bər/ a number that can be found on the real number line. *Examples:* 14, -3.7, $6/5$, π.

real part NOUN /'riəl pɑrt/ the part of a complex number that is *not* multiplied by the square root of -1: a in $a+bi$. *Notations:* $\Re$, RE. *Examples:* $\Re(3+2\mathrm{i}) = 3$, $\mathrm{RE}(3+2\mathrm{i}) = 3$.

real valued ADJECTIVE /'riəl 'væl.yud/ having variables that represent real numbers and *not* complex numbers. *For contrast, see complex valued.*

real variable NOUN /'riəl 'vɛər.i.ə.bəl/ a variable that represents a real number and *not* a complex number.

reason /'ri.zən/

1. VERB to form conclusions based on fact or evidence.
2. NOUN why something is true; a justification.
3. NOUN an explanation of why something is.

reasonable ADJECTIVE /'riz.nə.bəl/

1. showing reason. *Antonym: unreasonable.*
2. justified.

reasonableness NOUN /'riz.nə.bəl.nəs/ whether or not something is reasonable. *Example:* reasonableness test.

reasonableness test NOUN /ˈriz.nə.bəl.nəs tɛst/ an algorithm for checking reasonableness of a result.

reasoning NOUN /ˈriz.nɪŋ/

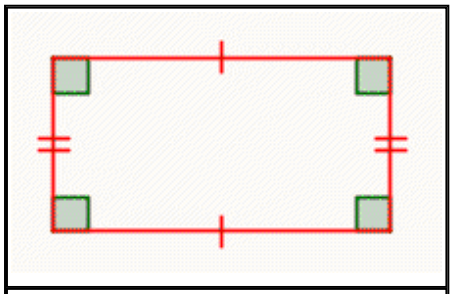
1. the act of forming conclusions based on fact or evidence.
2. the result of forming conclusions based on fact or evidence.

reciprocal NOUN /rɪˈsɪp.rə.kəl/ the reciprocal of a is $1/a$.

Example: the reciprocal of $3/4$ is $4/3$.

Synonym: multiplicative inverse.

rectangle NOUN /ˈrɛkˌtæŋ.gəl/ a four sided polygon whose sides meet at right angles.

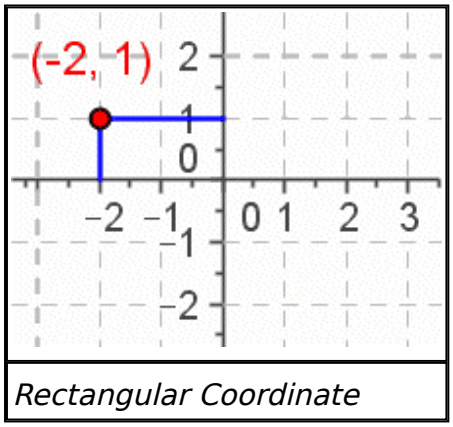


Rectangle

rectangular ADJECTIVE /rɛkˈtæŋ.gyə.lər/

1. having to do with a rectangle. *Example:* rectangular number.
2. shaped like a rectangle.
3. having perpendicular axes. *Example:* rectangular coordinate.
4. including a rectangle. *Example:* rectangular prism.

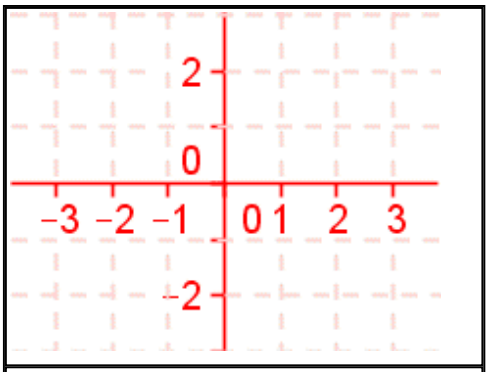
rectangular coordinate NOUN /rɛkˈtæŋ.gyə.lər koʊˈɔr.dnɪt/ an ordered pair, ordered triple, etc. that represents a location in a rectangular coordinate system. *Notations:* (x,y) (two dimensional), (x,y,z) (three dimensional). *Synonym: Cartesian coordinate. See also GeoApp!.*



Rectangular Coordinate

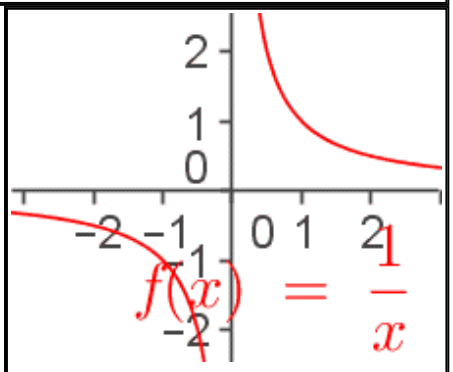
rectangular coordinate plane NOUN /rɛkˈtæŋ.gyə.lər koʊˈɔr.dnɪt pleɪn/ a metric plane containing a rectangular coordinate system. *See also GeoApp!.*

rectangular coordinate system NOUN /rɛk'tæŋ.gyə.lər koʊ'ɔr.dnɪt 'sɪs.təm/ a metric n-space with perpendicular axes meeting at an origin. *Synonym: Cartesian coordinate system. See also GeoApp!.*



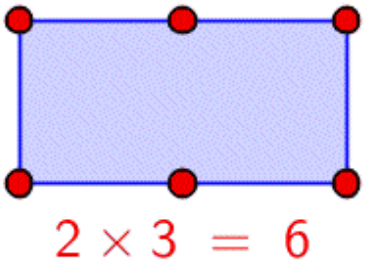
Rectangular Coordinate System

rectangular hyperbola NOUN /rɛk'tæŋ.gyə.lər haɪ'pɜr.bə.lə/ a hyperbola with horizontal and vertical asymptotes. *Equation:* $y = \frac{a}{x-h} + k$ where $x = h$ is the vertical asymptote and $y = k$ is the horizontal asymptote.



Rectangular Hyperbola

rectangular number NOUN /rɛk'tæŋ.gyə.lər 'nʌm.bər/ a natural number that can be drawn in the shape of a rectangle. *Synonym: composite number. Antonym: prime number.*

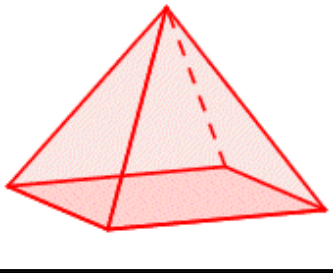


Rectangular Number

rectangular parallelepiped NOUN /rɛk'tæŋ.gyə.lər ˌpær.ə'lɛl.ə.paɪ.pɪd/ *See rectangular solid.*

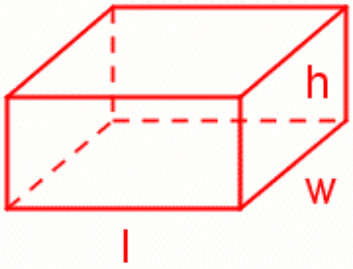
rectangular prism NOUN /rɛk'tæŋ.gyə.lər 'prɪz.əm/ *See rectangular solid.*

rectangular pyramid NOUN /rɛk'tæŋ.gyə.lər 'pɪr.ə.mɪd/ a pyramid whose base is a rectangle.



Rectangular Pyramid

rectangular solid NOUN /rɛk'tæŋ.gyə.lər 'sɒl.ɪd/ a geometric solid whose faces are rectangles. *Synonym: cuboid.*



Rectangular Solid

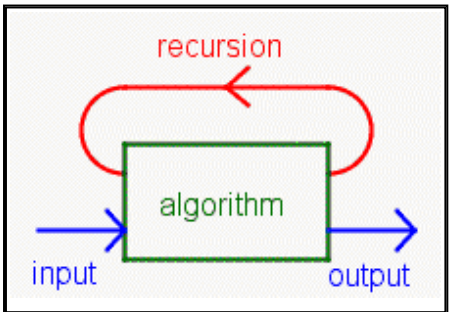
recur VERB /rɪ'kɜr/
1. to happen again.
2. to repeat.

recurring decimal NOUN /rɪ'kɜr.ɪŋ 'dɛs.ə.məl/ *See repeating decimal.*

recursion NOUN /rɪ'kɜr.ʃən/
1. the process of making repeated use of an algorithm.
2. one step in a repeating algorithm.

Synonym: iteration.

recursive ADJECTIVE /rɪ'kɜr.sɪv/ makes repeated use of an algorithm. *Synonym: iterative.*



Recursive

reduce VERB /rɪ'dus/
1. to change to a simpler form. *Example:* reduce a fraction.
2. to find prime factors of.

3. to make smaller.

reduce a fraction VERB /rɪ'dus eɪ 'fræk.ʃən/ to cancel common factors in a fraction. *Formula:* $\frac{a}{b} = \frac{a \div \gcf(a,b)}{b \div \gcf(a,b)}$

Example: $\frac{10}{30} = \frac{\cancel{2} \cdot \cancel{5}}{\cancel{2} \cdot 3 \cdot \cancel{5}} = \frac{1}{3}$.

reduced fraction NOUN /rɪ'dusd 'fræk.ʃən/ a fraction whose numerator and denominator have no common factors. *See also simplest form.*

reduced row echelon form NOUN /rɪ'dusd roʊ 'ɛʃ.əˌlɒn fɔrm/ an augmented square matrix with zeros in all entries except the main diagonal and possibly the augmented column, and ones in the main diagonal.

$$\left[\begin{array}{ccc|c} 1 & 0 & 0 & 3 \\ 0 & 1 & 0 & -2 \\ 0 & 0 & 1 & 1 \end{array}\right]$$

Reduced Row Echelon Form

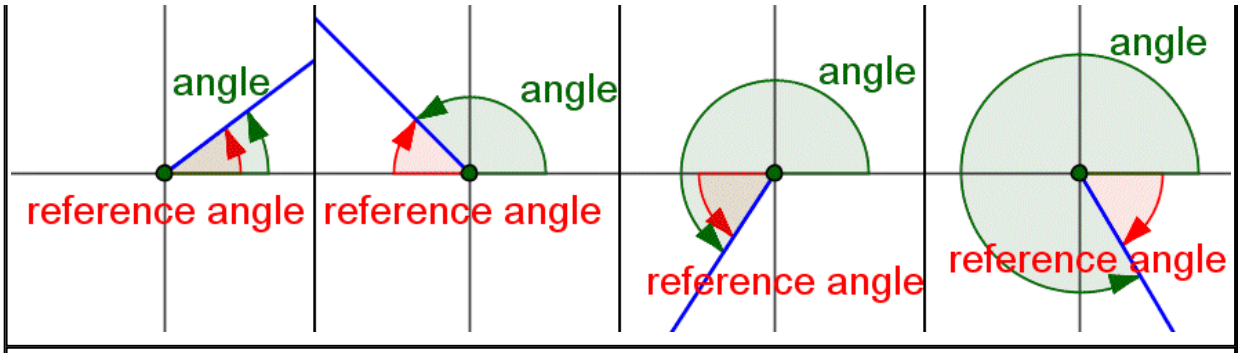
reducible ADJECTIVE /rɪ'dus.ə.bl/ can be reduced to a simpler form. *Example:* $2/4$ can be reduced to $1/2$. *Antonym: irreducible.*

reducible expression NOUN /rɪ'dus.ə.bl ɪk'sprɛ.ʃən/ an expression that has at least one factor other than 1 and itself. *Antonym: irreducible expression.*

reducible polynomial NOUN /rɪ'dus.ə.bl ˌpɒl.ə'noʊ.mi.əl/ a polynomial that has at least one factor other than 1 and itself. *Antonym: reducible polynomial. See also factor completely.*

reference ADJECTIVE /'rɛf.rəns/ used for comparison. *Example:* reference line.

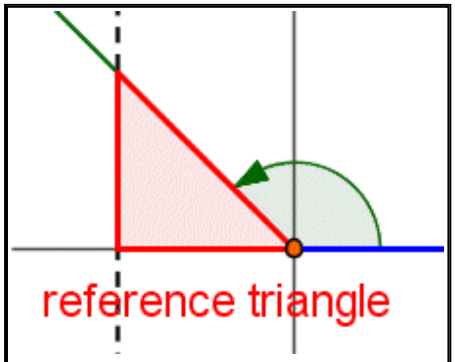
reference angle NOUN /'rɛf.rəns 'æŋ.gəl/ an angle between the closest half of the x-axis and the terminal line of another angle. *Example:* the reference angle for $327°$ is $360° - 327° = 33°$.



Reference Angle

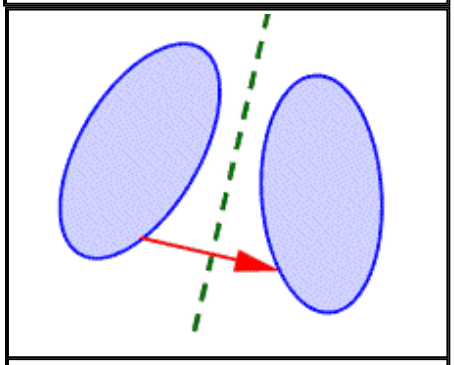
reference plane NOUN /ˈrɛf.rəns pleɪn/ a plane, usually horizontal, to which other planes are compared.

reference triangle NOUN /ˈrɛf.rəns ˈtraɪˌæŋ.gəl/ a triangle formed by the origin point, a point on a terminal side, and a point on the x-axis formed by the intersection of the x-axis and a vertical line passing through the point on the terminal side. *See also GeoApp!.*



Reference Triangle

reflect VERB /rɪˈflɛkt/ to 'flip' an object across a line or a point.
Synonym: mirror.



Reflect

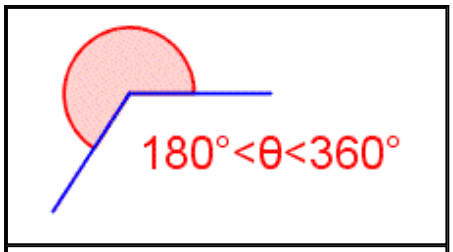
reflection NOUN /rɪˈflɛk.ʃən/

1. a geometric transformation of 'flipping' an object across a line or a point.
2. the result of reflecting an object.

See also GeoApp!, GeoApp!.

reflective symmetry NOUN /rɪˈflɛk.tɪv ˈsɪm.ɪ.tri/ whether or not the preimage is congruent with the image after a reflection. *Synonyms: line symmetry, mirror symmetry.*

reflex angle NOUN /'ri.flɛks 'æŋ.gəl/ an angle that measures more than 180 degrees and less than 360 degrees. *See also Angle Classes!.*



Reflex Angle

reflexive ADJECTIVE /ri'flɛk.sɪv/ if, for a relation R, aRa is always true, then relation R is reflexive. *Example:* $5 = 5$.

Reflexive Property of Equality NOUN /ri'flɛk.sɪv 'prɒ.pər.ti ʌv ɪ'kwɒl.ɪ.ti/ a number is always equal to itself. *Formula:* $a = a$. *Example:* $-3 = -3$.

region NOUN /'ri.dʒən/ all points that are part of a shape including boundary points and interior points.

regroup VERB /ri'grup/ to rearrange groups of digits in a numeration system especially in arithmetic operations. *Synonyms: carry* (obsolete) /'kɛər.i/, *borrow* (obsolete) /'bɒ.roʊ/.

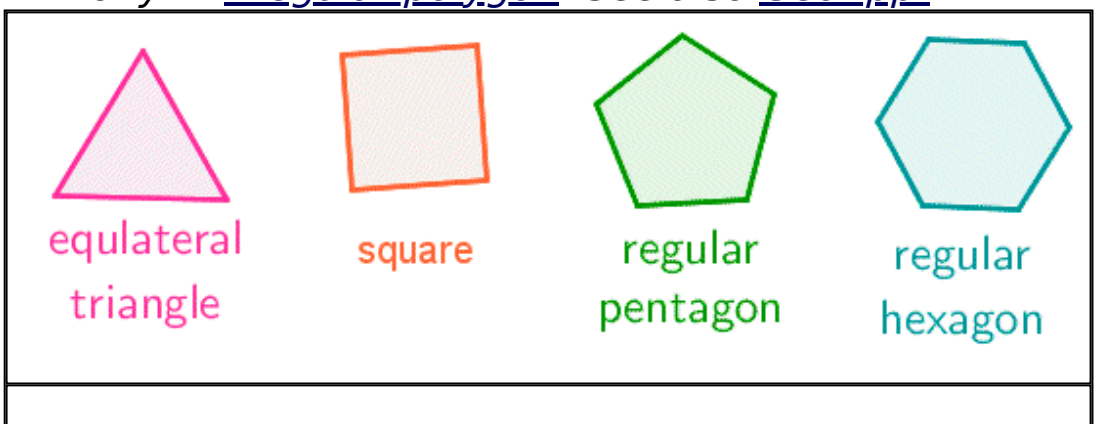
regular ADJECTIVE /'rɛg.yə.lər/

1. uniform; conforming to a standard or a pattern. *Example:* regular tessellation.
2. symmetric.

Antonym: irregular.

regular interval NOUN /'rɛg.yə.lər 'ɪn.tər.vəl/ one of a group of intervals where the length of each interval is the same.

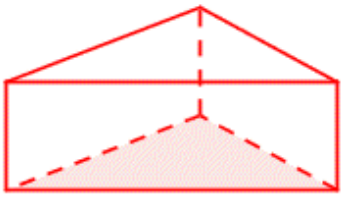
regular polygon NOUN /'rɛg.yə.lər 'pɒl.iˌgɒn/ a convex polygon whose sides are all the same length. *Antonym: irregular polygon. See also GeoApp!.*



Regular Polygons

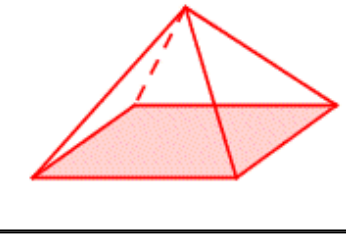
regular polyhedron NOUN /ˈrɛg.yə.lər ˌpɒ.liˈhi.drən/ any one of five solids whose faces are congruent regular polygons and where the angles between the faces are all congruent. *Examples:* regular tetrahedron, regular hexahedron, regular octahedron, regular dodecahedron, regular icosahedron.

regular prism NOUN /ˈrɛg.yə.lər ˈprɪz.əm/ a right prism whose base is a regular polygon.



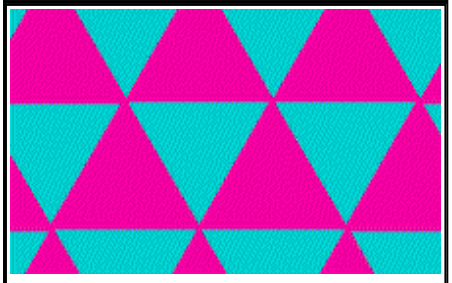
Regular Prism

regular pyramid NOUN /ˈrɛg.yə.lər ˈpɪr.ə.mɪd/ a pyramid whose base is a regular polygon, and whose altitude intersects the center of the base.



Regular Pyramid

regular tessellation NOUN /ˈrɛg.yə.lər ˌtɛs.əˈleɪ.ʃən/ a tessellation made up entirely of regular polygons.

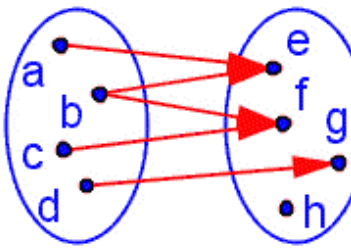


Regular Tessellation

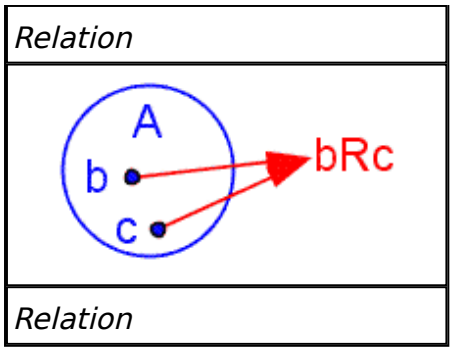
relate VERB /rɪˈleɪt/ to compare using a relationship operator. *Example:* relate x and y: $x = y + 2$.

relation NOUN /rɪˈleɪ.ʃən/

1. a property of sets that associates two or more variables, input and output. *Synonym: mapping. See also function.*



2. a property of sets such that, for any two members of the set a and b, $a\mathrm{R}b$ is either true or false. *Example:* equality.



relationship NOUN /rɪ'leɪ.ʃən.ʃɪp/ how two or more objects relate to each other.

relationship operator NOUN /rɪ'leɪ.ʃən.ʃɪp 'ɒ.pəˌreɪ.tər/ a symbol used to describe a particular relationship between two objects. *Examples:* $<$, $\leq$, $\neq$, $=$, $\geq$, $>$, $\equiv$, $\approx$.

relative ADJECTIVE /'rɛl.ə.tɪv/

1. compared to. *Example:* relative frequency.
2. in relation to.
3. over a local subdomain. *Synonym: local.*

relative error NOUN /'rɛl.ə.tɪv 'ɛr.ər/

1. ratio of an absolute error to the actual or theoretical value.
2. the error in proportion to the measurement. *Example:* if a length measures $2\ \mathrm{cm}$ and the error is $\pm 0.5\ \mathrm{cm}$, the relative error is $0.5 \div 2 = 0.25 = 25\%$.

relative frequency NOUN /'rɛl.ə.tɪv 'fri.kwən.si/

1. (probability) the number of times a particular outcome happened during a set of experiments as a proportion to the total number of trials.
2. (statistics) the number of observations in a particular category divided by the total number of observations.

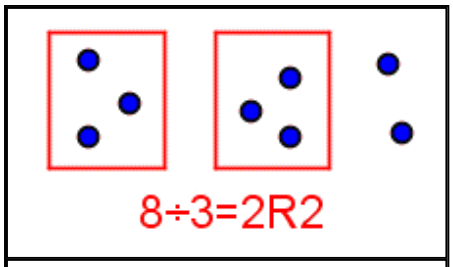
See also absolute frequency.

relatively prime ADJECTIVE /'rɛl.ə.tɪv.li praɪm/ *See coprime.*

relative maximum NOUN /'rɛl.ə.tɪv 'mæk.sə.məm/ *See local maximum.*

relative minimum NOUN /'rɛl.ə.tɪv 'mɪn.ə.məm/ *See local minimum.*

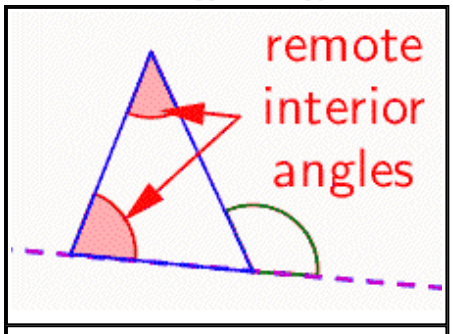
remainder NOUN /rɪ'meɪn.dər/ the amount left over after division. *Abbreviation:* R. *Math definition:* $a \div b = c\mathrm{R}d$ if and only if $a = bc + d$, $|d|<|b|$. *Example:* $10 \div 3 = 3\ \mathrm{R}\ 1$. The remainder is 1. *Synonym:* modulo n.



Remainder

Remainder Theorem NOUN /rɪ'meɪn.dər 'θɪər.əm/ if a is a root of $P(x)$ then the remainder of the division of $P(x)$ by $x - a$ is $P(a)$. *Formula:* $\frac{P(x)}{x-a} = P'(x) + \frac{P(a)}{x-a}$.

remote interior angles NOUN /rɪ'moʊt ɪn'tɪər.i.ər 'æŋ.gəlz/ angles of a triangle that are *not* adjacent to a particular exterior angle.



Remote Interior Angles

repeat VERB /rɪ'pit/
1. to appear or happened again.
2. to make appear or happen again.

repeating ADJECTIVE /rɪ'pit.iŋ/ appearing or happening again. *Example:* repeating decimal.

repeating decimal NOUN /rɪ'pit.iŋ 'dɛs.ə.məl/ a real number where one or more digits repeat forever. *Notation:* $5.325 = 5.325252525\ldots$. *Antonym:* nonrepeating decimal.

replace VERB /ri'pleɪs/
1. (algebra) to substitute objects from one set with objects from another set. *Synonym:* substitute.
2. (probability) to put back; to allow to be selected again.

replacement NOUN /riˈpleɪs.mənt/
1. the property of being used to replace something else. *Example:* Replace y with 4 in the equation..
2. (probability) the property of whether an event can happen a second time. *Example:* select two balls with replacement: select one ball, put it back then select another.

replacement set NOUN /riˈpleɪs.mənt sɛt/ a set of possible values that can be used in place of a unknown in an open mathematical sentence.

represent VERB /ˌrɛp.rɪˈzɛnt/ use something to stand for or illustrate something else. *Example:* a variable represents a value that can change.

representation NOUN /ˌrɛp.rɪ.zɛnˈteɪ.ʃən/ something used to represent something else. *Example:* a bar chart is a representation of data.

representative ADJECTIVE /ˌrɛp.rɪˈzɛn.tə.tɪv/ serving to represent. *Example:* representative sample.

representative fraction NOUN /ˌrɛp.rɪˈzɛn.tə.tɪv ˈfræk.ʃən/ a fraction that is used as a scale on a map. *See also map scale.*

representative sample NOUN /ˌrɛp.rɪˈzɛn.tə.tɪv ˈsɑm.pəl/ a data sample believed to represent an entire population.

research /riˈsɜrtʃ/
1. VERB to investigate methodically.
2. NOUN the result of a methodical investigation.

residual NOUN /rɪˈzɪdʒ.u.əl/ the difference between an observation and the mean of the sample from which the observation was taken. *Formula:* $R = d_n - M_x$ where d_n is data item number n and M_x is a mean of data set x.

residue NOUN /rɪˈzɪ.dyu/ the result of a modulo operation. *Formula:* $\text{dividend mod. divisor} = \text{residue}$. *Example:* $14 \text{ mod. } 5 = 4$. *Synonym: remainder.*

respect NOUN /rɪ'spɛkt/ *See with respect to.*

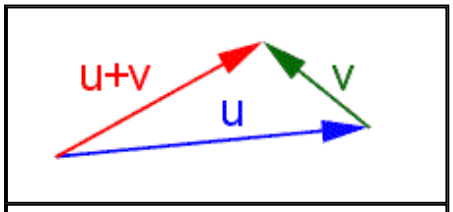
respectively ADVERB /rɪ'spɛk.tɪv.li/ taken in the same order as the previous list. *Example:* 'The values of a, b and c are 1, 2 and 3, respectively,' means $a = 1$, $b = 2$ and $c = 3$.

restricted domain NOUN /rɪ'strɪk.tɪd doʊ'meɪn/ a domain where a restriction has been placed on the domain. *Example:* $x > 2$.

result NOUN /rɪ'zʌlt/

1. the final answer to a computation. *Example:* the result of $(5 \times 6) \div 3$ is 10.
2. the outcome of a proof.

resultant NOUN /rɪ'zʌl.tnt/ a vector that is the sum of two or more vectors. *Example:* the resultant of $\langle 3,-1 \rangle + \langle -2,2 \rangle$ is $\langle 3–2, -1+2 \rangle = \langle 1,1 \rangle$.



Resultant

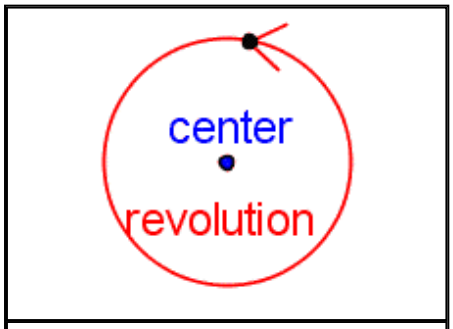
retail price NOUN /'ri.teɪl praɪs/ a price charged retail customers; the price after markup. *Formula:* cost + markup = retail price.

revise VERB /rɪ'vaɪz/

1. to change
2. to correct or improve.

revolution NOUN /ˌrɛv.ə'lu.ʃən/

1. one complete turn around a circle.
2. one complete orbit around a sphere.



Revolution

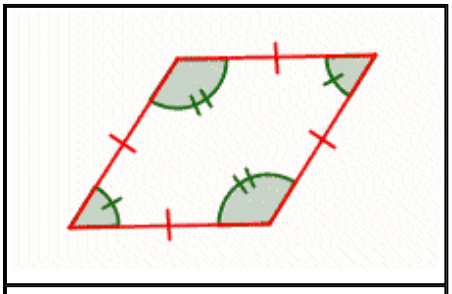
revolutions per second NOUN /ˌrɛv.ə'lu.ʃənz pər 'sɛ.kənd/ a measure of rotational speed; the number of times an object rotates a full 360º in one second.

revolve VERB /riˈvɒlv/ *See rotate.*

rewrite VERB /riˈraɪt/ to write in a different form.

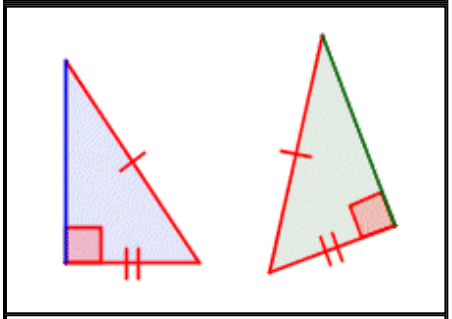
Rhind papyrus NOUN /raɪnd pəˈpaɪ.rəs/ an Egyptian mathematical text dating from about 1650 B.C.E. Like a modern textbook, the Rhind papyrus contains a set of math problems and their answers.

rhombus NOUN /ˈrɒm.bəs/ a quadrilateral with four equal sides. *Plural: rhombi* /ˈrɒm.baɪ/.



Rhombus

RHS congruence NOUN /ɑr eɪtʃ es kənˈgru.əns/ (right angle-hypotenuse-side) two right triangles are congruent if their hypotenuses and one side are congruent.



RHS Congruence

rhythmic counting NOUN /ˈrɪð.mɪk ˈkaʊnt.iŋ/ counting while emphasizing certain multiples.

Example: 1, 2, 3, 4, 5, 6, ...

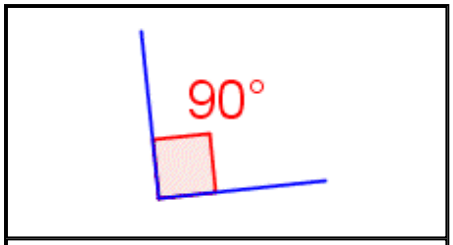
Riemann, Georg Friedrich Bernhard PERSON /ˈriˌmɑn dʒɔrdʒ ˈfri.drɪk bɜrnˈɑrd/ (1826-1866) a German mathematician known for his work with the Dirichlet Principle and the Riemann zeta function.

Bernhard Riemann

Riemannian geometry NOUN /riˈmɑ.ni.ən dʒiˈɒ.mɪ.tri/ a non-Euclidean geometry that can be visualized as taking place on the surface of a sphere, where a line is a great circle. *See also GeoApp!.*

right ADJECTIVE /raɪt/ having to do with perpendicular lines. *Example:* right angle. *Antonym: oblique.*

right angle NOUN /raɪt ˈæŋ.gəl/ an angle that measures ¼ of a full circle. A right angle measures $90º$ or $\pi/2$ radians. Perpendicular lines form right angles. *Antonym: oblique angle. See also Angle Classes!.*



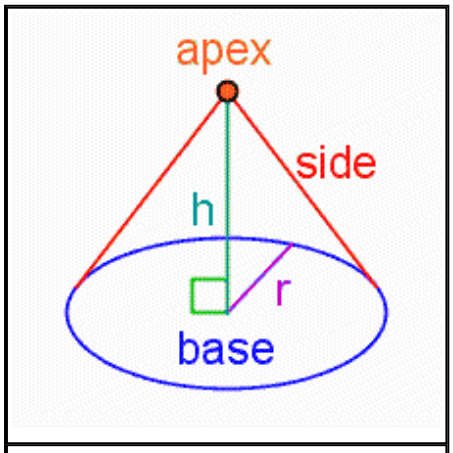
Right Angle

Right Angle Congruence Theorem NOUN /raɪt ˈæŋ.gəl kənˈgru.əns ˈθɪər.əm/ all right angles are congruent.

right-angled triangle NOUN /raɪt ˈæŋ.gəld ˈtraɪˌæŋ.gəl/ *See right triangle.*

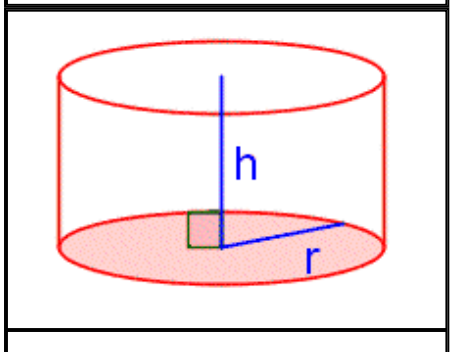
right angle-hypotenuse-side congruence NOUN *See RHS congruence.*

right cone NOUN /raɪt koʊn/ a cone whose axis is perpendicular to the base. *Antonym: oblique cone.*



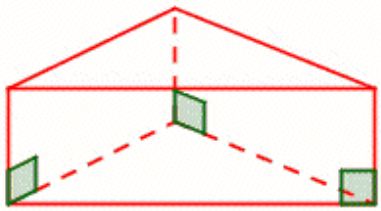
Cone

right cylinder NOUN /raɪt ˈsɪl.ɪn.dər/ a cylinder whose axis forms a right angle with the bases. *Antonym: oblique cylinder.*



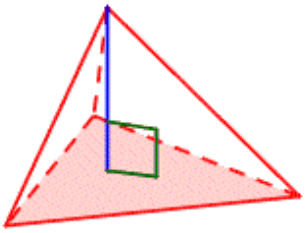
right prism NOUN /raɪt ˈprɪz.əm/ a prism whose sides are perpendicular to the bases. *Antonym: oblique prism.*

Right Cylinder



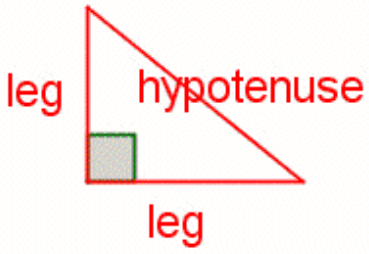
Right Prism

right pyramid NOUN /raɪt ˈpɪr.ə.mɪd/ a pyramid whose apex is directly over the centroid of the base. *Antonym: oblique pyramid.*



Right Pyramid

right triangle NOUN /raɪt ˈtraɪˌæŋ.gəl/ a triangle with exactly one right angle. *Antonym: oblique triangle. See also GeoApp!, GeoApp!.*



Right Triangle

rigid ADJECTIVE /ˈrɪdʒ.ɪd/

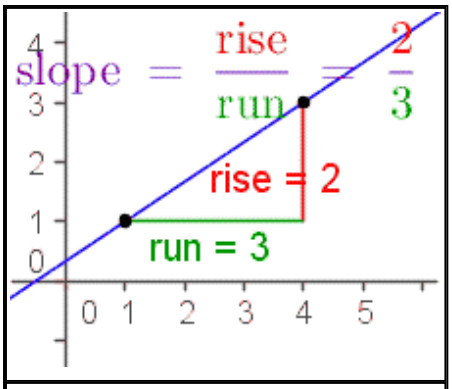
1. not moving.
2. (polygon) angles can not be continuously changed without changing the lengths of the sides.

rigorous ADJECTIVE /ˈrɪg.ɔr.əs/

1. logically valid.
2. exact and accurate.
3. precise.
4. allowing no deviation from a standard.

ring NOUN /rɪŋ/ *See annulus.*

rise NOUN /raɪz/ the vertical component of a slope. *Formula:* $\text{slope} = \frac{\text{rise}}{\text{run}}$.



Rise

rod NOUN /rɒd/ an old unit of measure of length.
Formulas: $1 \text{ rod} = 5.5 \text{ yards}$.
$1 \text{ rod} \approx 5.0292 \text{ meters}$.
$320 \text{ rods} = 1 \text{ statute mile}$.

roll a die VERB /roʊl eɪ daɪ/ to take a die and throw or drop it in such a way as it rolls, revealing a number between 1 and 6, inclusive. *Synonym: toss a die.*

Roman numeral NOUN /ˈroʊ.mən ˈnum.ər.əl/ a numeral used in ancient Rome constructed from the digits $\text{I}=1$, $\text{V}=5$, $\text{X}=10$, $\text{L}=50$, $\text{C}=100$, $\text{D}=500$, $\text{M}=1000$.

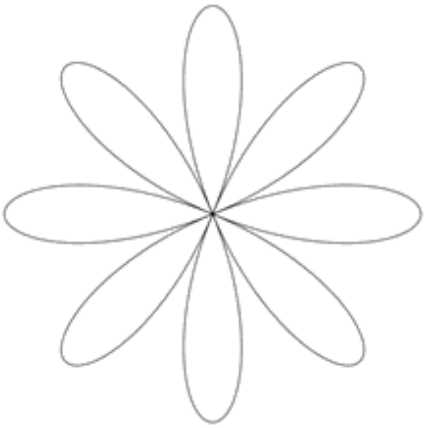
root NOUN /rut/

1. (of a polynomial) a number that, when substituted into a polynomial, makes the polynomial equal to zero.
   Example: 2 is a root of $x^2 - x - 2$ since $2^2 - 2 - 2 = 4 - 2 - 2 = 0$. *Synonym: solution.*
2. a number or expression that, when multiplied by itself a certain number of times, equals the original number or expression. *Examples:* $a^{\frac{1}{2}}$, $\sqrt[n]{x}$

root mean square NOUN /rut min skwɛər/ a measure of central tendency for datasets containing positive and negative numbers. *Formula:*

$$R = \sqrt{\frac{a_1^2 + a_2^2 + a_3^2 + \cdots + a_n^2}{n}}.$$

rose curve NOUN /roʊz kɜrv/ a curve with multiple "petals" generated by the polar equation $r = \cos(k\theta)$ where k is any integer. *Synonym: rhodonea curve.*



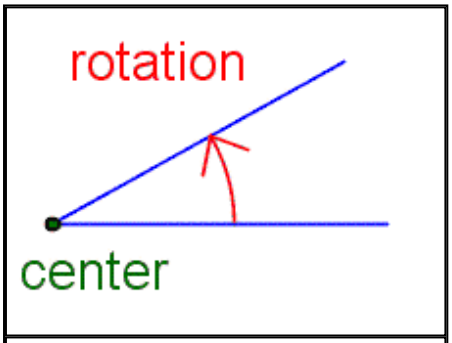
Rose Curve

rotate VERB /roʊˈteɪt/ to move in a circular direction around a center point or line. *Synonym: revolve.*

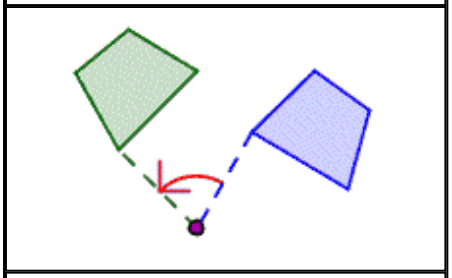
rotation NOUN /roʊˈteɪ.ʃən/

1. the measure of angular distance between two intersecting lines.
2. the movement of an object in a circle around a center of rotation.

See also GeoApp!.



Rotation (def. 1)

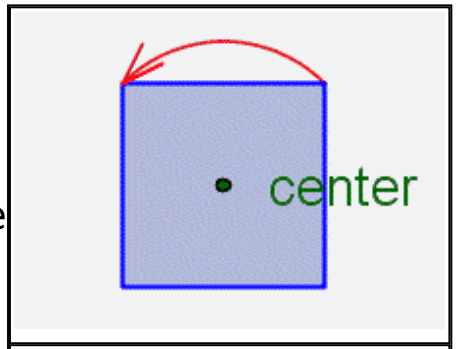


Rotation (def. 2)

rotational NOUN /roʊˈteɪ.ʃə.nl/ having to do with moving an object around a center of rotation.

rotational speed NOUN /roʊˈteɪ.ʃə.nl spid/ how fast something turns in a circle. Rotational speed is usually measured in revolutions per minute or revolutions per second. *Synonym: orbital speed.*

rotational symmetry NOUN /roʊˈteɪ.ʃə.nl ˈsɪm.ɪ.tri/ a figure has rotational symmetry if it can be rotated around a fixed point by less than a full circle and the rotated figure exactly matches the original figure.



Rotational Symmetry

rotation of axes NOUN /roʊˈteɪ.ʃən ʌv ˈæk.siz/ a transformation in analytical geometry where the axes are rotated about the origin. *Formula:* (x,y) becomes $(x \cos \theta - y \sin \theta, x \sin \theta + y \cos \theta)$ where θ is the clockwise rotation of the axes.

round /raʊnd/

1. VERB to find a number close to a given number, possibly with fewer digits. *Example:* round 2.57 to 2 significant digits: 2.6. *Synonym: round off.*
2. ADJECTIVE circular or spherical in shape.

round down VERB /raʊnd daʊn/ to round to a lower number. *Example:* round 6.53 down to 6.5.

rounded ADJECTIVE /ˈraʊn.dɪd/ reduced to fewer digits using a rounding algorithm.

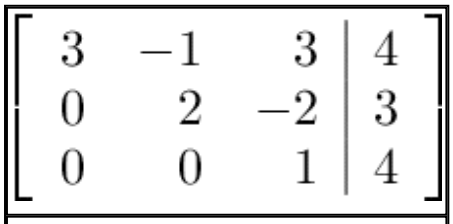
rounding /ˈraʊn.dɪŋ/

1. NOUN the act of finding a number that is close to another number, possibly with fewer digits.
2. ADJECTIVE having to do with the process of rounding. *Example:* rounding error.

round up VERB /raʊnd ˈʌp/ to round to a higher number. *Example:* round 4.59 up to 4.6.

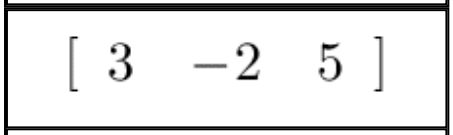
row NOUN /roʊ/ a set of values arranged horizontally.

row-echelon form NOUN /roʊ ˈɛʃ.əˌlɒn fɔrm/ an augmented lower triangular matrix.



Row-Echelon Form

row matrix NOUN /roʊ ˈmeɪ.trɪks/ a matrix with a single row. *Plural: row matrices* /roʊ ˈmeɪ.trɪˌsiz/. *Synonym: row vector.*



Row Matrix

row operation NOUN /roʊ ˌɒ.pəˈreɪ.ʃən/ one of a set of operations that can be performed on the rows of a matrix without changing the solution of a linear system represented by the matrix.

- Any two rows can be swapped.
- Any row can be multiplied by a nonzero scalar.
- Any row can be added to another row.

row rank NOUN /roʊ reɪŋk/ the maximum number of linearly independent rows in a matrix.

row vector NOUN /roʊ ˈvɛk.tər/ *See row matrix.*

royalty NOUN /ˈrɔɪ.əl.ti/ a portion of sales paid for use of a creative work such as a book.

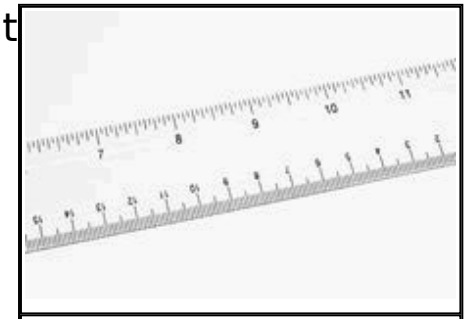
rule NOUN /rul/

1. an algorithm.
2. a postulate or theorem.
3. a formula.

rule of 72 NOUN /rul ʌv 'sɛ.vən.ti tu/ a formula for approximating the doubling time of principal at a certain interest rate. *Formula:* $t_d \approx \frac{72}{i}$ where t_d is the doubling time and i is the annualized interest rate. If the interest rate is 10%, use the number 10 for i *Example:* the approximate doubling time of an investment that returns 10% annually is $t_d \approx \frac{72}{10} = 7.2 \text{ years}$.

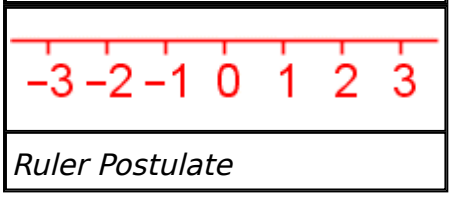
rule of sum NOUN /rul ʌv sʌm/ when selecting from two or more sets of events that can *not* both happen, the sample space of each of the events is added together to get the total sample space. *Formula:* $S(e_1 \text{ and } e_2 \text{ and } \ldots \text{ and } e_n) = S(e_1) + S(e_2) + \ldots + S(e_n)$. *Example:* Andrea wants one piece of fruit. She can stay home and choose from apples or kiwi. Or she can go to the store and buy bananas. There are 2 choices at home and 1 at the store, making a total of 2 + 1 = 3 choices.

ruler NOUN /'ru.lər/ a flat, straight object with tick marks on it used for measuring distance.



Ruler

Ruler Postulate NOUN /'ru.lər 'pɒs.tʃə.lɪt/ every point on a line can be paired with a real number. The distance between any two points on a line is the absolute value of the difference of their coordinates. *See also* *number line*.



Ruler Postulate

run NOUN /rʌn/ the horizontal component of a slope. *Formula:*

$$\text{slope} = \frac{\text{rise}}{\text{run}}.$$

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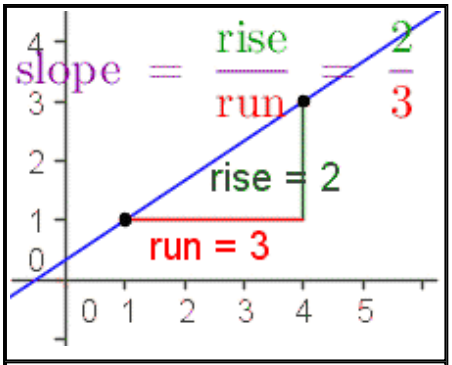
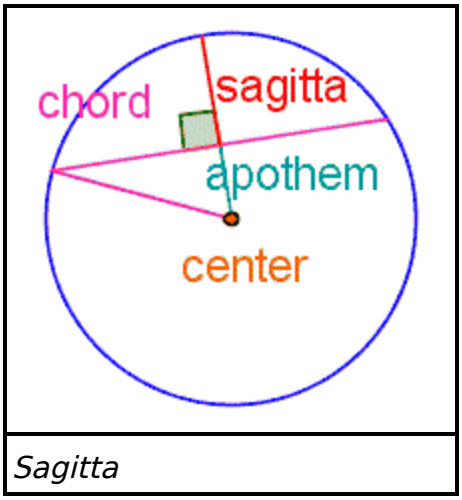


Run

S

s ABBREVIATION second.

sagitta NOUN /sə'dʒɪ.tə/ a line segment from the midpoint of a chord to the edge of the circle that is collinear with the apothem of the chord. *See also GeoApp!.*



Sagitta

sale price NOUN /seɪl praɪs/ the price at which something is sold before sales tax.

Formula: sale price + sales tax = total due.

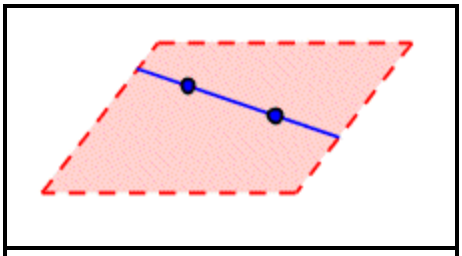
sales tax NOUN /seilz tɑks/ a percentage that is added on to the total of a sale.

Formula: sale price + sales tax = total due.

same ADJECTIVE /seɪm/

1. begin the same thing. *Example:* Same Plane Postulate.
2. alike; closely similar.

Same Plane Postulate NOUN /seɪm pleɪn 'pɒs.tʃə.lɪt/ if two points lie on a plane, then the entire line defined by those points lies on the same plane.



Same Plane Postulate

sample /'sɑm.pəl/

1. NOUN a few objects selected from a set.
2. NOUN a portion of a population being studied.

3. NOUN a survey of a portion of a population.
   Antonym: census.
4. VERB to discover data associated with a population.

sample size NOUN /'sɑm.pəl saɪz/ the number of data points in a sample.

sample space NOUN /'sɑm.pəl speɪs/

1. (probability) all the possible outcomes of an experiment.
   Examples: the sample space for the flip of a coin is $\{\text{heads, tails}\}$, the sample space for the roll of a single six-sided die is $\{1, 2, 3, 4, 5, 6\}$.
2. (statistics) all possible values a sample can take.

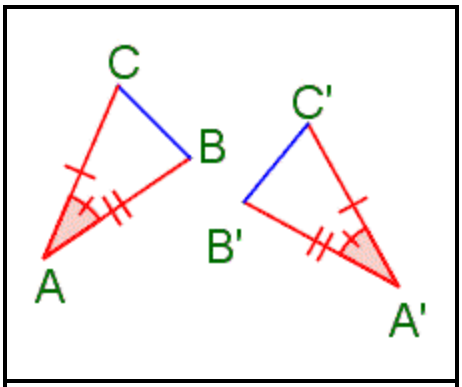
sampling NOUN /'sɑm.plɪŋ/

1. data taken from a sample of a population.
2. the process of selecting a sample.

sampling distribution NOUN /'sɑm.plɪŋ dɪ'strɪ.byu.ʃən/ the expected distribution of samples within a population given the sample size.

sampling error NOUN /'sɑm.plɪŋ 'ɛr.ər/ an error resulting from using sampling to estimate information about a population.

SAS congruence NOUN /es eɪ es kən'gru.əns/ (side-angle-side congruence) two triangles are congruent if two adjacent sides and the enclosed angle of one triangle are congruent with corresponding sides and angle of the other triangle.



SAS Congruence

Math definition: Given ΔABC and $\Delta A'B'C'$, if $\overline{AB} \cong \overline{A'B'}$ and $\overline{AC} \cong \overline{A'C'}$ and $\angle BAC \cong \angle B'A'C'$, then $\Delta ABC \cong \Delta A'B'C'$.

satisfy VERB /'sæt.ɪsˌfaɪ/

1. to make an equation true when substituted in.

   Example: 5 satisfies $0 = x^2 - 3x - 10$ since $0 = 5^2 - 3 \cdot 5 - 10 = 25 - 15 - 10 = 0$.
2. to fulfill requirements or conditions, particularly of a theorem.

scalar NOUN /'skeɪ.lər/ a real number that is multiplied by a math object that is used to 'scale' the object (make the object larger or smaller). *See also scale factor.*

scalar multiplication NOUN /'skeɪ.lər ˌmʌl.tə.plɪ'keɪ.ʃən/

1. (equation) multiply each term of the equation by a real number.

   Example: $5(-x^2 + 2x + 1) = -5x^2 + 10x + 5$.
2. (matrix) multiply each element of the matrix by a real number. *Formula:*

$$c \cdot \begin{bmatrix} a_{1,1} & a_{1,2} \\ a_{2,1} & a_{2,2} \end{bmatrix} = \begin{bmatrix} c \cdot a_{1,1} & c \cdot a_{1,2} \\ c \cdot a_{2,1} & c \cdot a_{2,2} \end{bmatrix}.$$

3. (vector) multiply each element of a vector by a real number. *Formula:* $c\langle x,y\rangle = \langle cx,\ cy\rangle$; $c\langle x,y,z\rangle = \langle cx,cy,cz\rangle$.
4. (matrix row) multiply each element in a row of a matrix by a real number. *Formula:*

$$\left[\begin{array}{cc|c} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \end{array}\right] \xrightarrow{R2 = c \cdot R2} \left[\begin{array}{cc|c} a_{1,1} & a_{1,2} & a_{1,3} \\ c \cdot a_{2,1} & c \cdot a_{2,2} & c \cdot a_{2,3} \end{array}\right]$$

scalar product NOUN /'skeɪ.lər 'prɒ.dəkt/ *See dot product.*

scale /skeɪl/

1. NOUN the interval that represents '1' on a graph.
2. VERB to make larger or smaller by a ratio.
3. NOUN the ratio between the size of an object and the size of a drawing of the object. *Example:* 20:1 scale model.
4. NOUN a device for measuring weight.

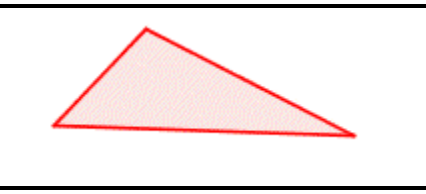
Scale (def 4.)

scale drawing NOUN /skeɪl 'drɔ.ɪŋ/ a drawing that is similar to a figure but is drawn smaller or larger than the figure.

scale factor NOUN /skeɪl 'fæk.tər/ a positive number multiplied by a math object to make it larger or smaller. A scale factor greater than 1 makes the object larger, a scale factor between 0 and 1 makes the object smaller. *See also scalar, GeoApp!.*

scale model NOUN /skeɪl 'mɒd.l/ a model that is similar to a figure but is built smaller or larger than the figure.

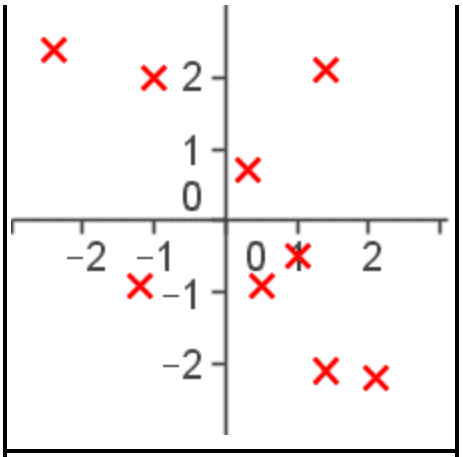
scalene triangle NOUN /skeɪ'lin 'traɪˌæŋ.gəl/ a triangle where no two sides have the same length.



Scalene Triangle

scatter diagram NOUN /'skæ.tər 'daɪ.ə.græm/ *See scatter plot.*

scatter plot NOUN /'skæ.tər plɒt/ a graph made by plotting discrete data points. *Synonym: dot plot.*



Scatter Plot

scientific ADJECTIVE /ˌsaɪ.ənˈtɪf.ɪk/
1. having to do with science.
2. according to the principles of science.

scientific notation NOUN /ˌsaɪ.ənˈtɪf.ɪk noʊˈteɪ.ʃən/ a way to write real numbers that is very useful for large and small numbers. *Format:* $\text{mantissa} \times 10^{\text{exponent}}$ where $0 \leq \text{mantissa} < 10$ and the exponent is an integer. *Example:* $2.643 \times 10^{-9} = 0.000000002643$. *See also e notation, engineering notation.*

scientific sample NOUN /ˌsaɪ.ənˈtɪf.ɪk ˈsɑm.pəl/ a sample where the selection of the sample does *not* influence the information being sampled; a sample where there is no correlation between the selection variable and the variables of interest.

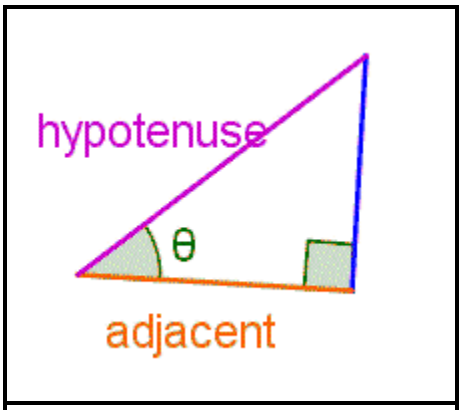
score NOUN /skɔr/
1. a measurement or count, particularly of human performance. *Example:* score on a test.
2. twenty. *Example:* four score and seven years ago.

sec ABBREVIATION
1. second.
2. secant.

sec() COMPUTERS the function representing secant in most computer languages.

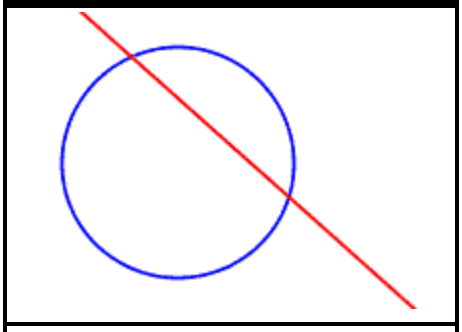
secant NOUN /'si.kænt/ the multiplicative inverse of the cosine function. *Abbreviation:* *sec*.

Formula: $\text{secant} = \frac{1}{\text{cosine}} = \frac{\text{hyponenuse}}{\text{adjacent}}$ *See also* *GeoApp!*.



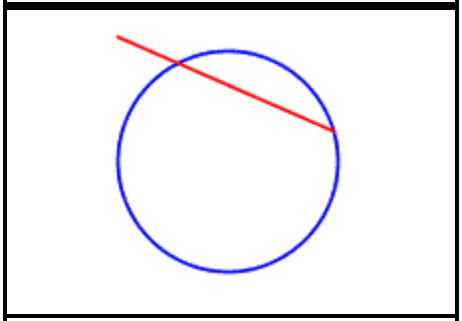
Secant

secant line NOUN /'si.kænt laɪn/ a line that intersects a curve twice in a local region.



Secant Line

secant segment NOUN /'si.kænt 'sɛg.mənt/ a line segment from a point exterior to a circle through the circle to an endpoint on another part of the circle. *See also* *external secant segment*.



Secant Segment

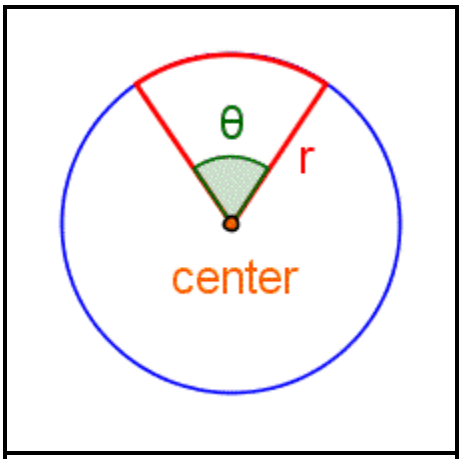
sech ABBREVIATION *See* *hyperbolic secant*.

second NOUN /'sɛ.kənd/

1. a unit of measure of time. *Abbreviations: s,* *sec*. *Formula:* $60 \text{ seconds} = 1 \text{ minute}$.
2. a unit of measure of an angle. *Notation:* $''$. *Formulas:* $60 \text{ seconds} = 1 \text{ arc minute}$, $3600 \text{ seconds} = 1 \text{ degree}$. *Synonym:* *arc second*.
3. coming in position 2 in an ordered list. *Notation:* 2^{nd}.

section NOUN /'sɛk.ʃən/
1. *See cross section, definition 1.*
2. *See conic section.*

sector NOUN /'sɛk.tər/ a part of a circle between two radii of the circle. *See also Parts of a Circle!.*

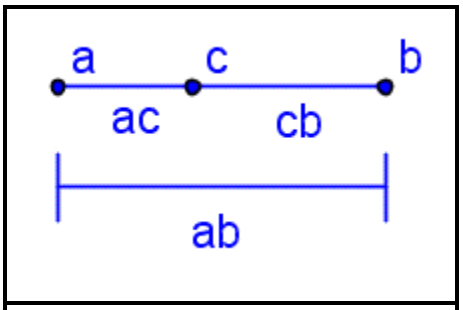


Sector

sector graph NOUN /'sɛk.tər græf/ *See pie chart.*

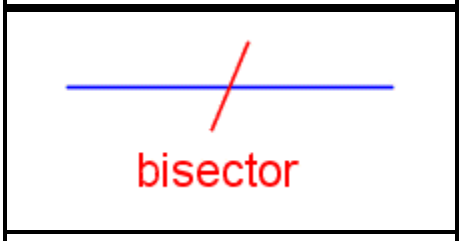
segment NOUN /'sɛg.mənt/
1. a continuous portion.
2. (of a line) a portion of a line between two endpoints. *See also line segment.*
3. (of a circle) a part of a circle cut off by a chord of the circle. *See also Parts of a Circle!.*

Segment Addition Postulate NOUN /'sɛg.mənt ə'dɪ.ʃən 'pɒs.tʃə.lɪt/ point c is between points a and b if and only if $ac + cb = ab$. *See also between.*



Segment Addition Postulate

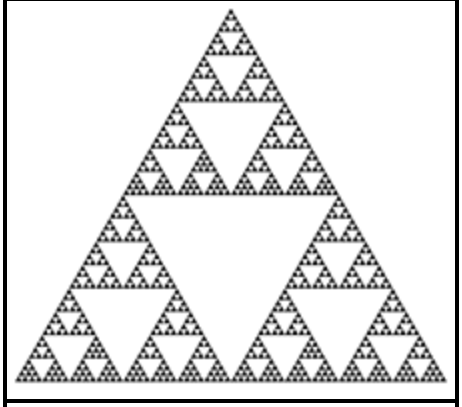
segment bisector NOUN /'sɛg.mənt baɪ'sɛk.tər/ an object that intersects a line segment at its midpoint.



Segment Bisector

self selected sample NOUN /sɛlf sɪ'lɛk.td 'sɑm.pəl/ a person who chooses into a group (not necessarily into a survey) is self selected. A self selected sample is a biased sample and not a scientific sample. *Synonym:* *voluntary response sample*.

self-similar ADJECTIVE /sɛlf 'sɪm.ə.lər/ if any part of a figure is similar to the whole, the figure is self-similar. *Example:* Sierpinski Triangle.



Sierpinski Triangle

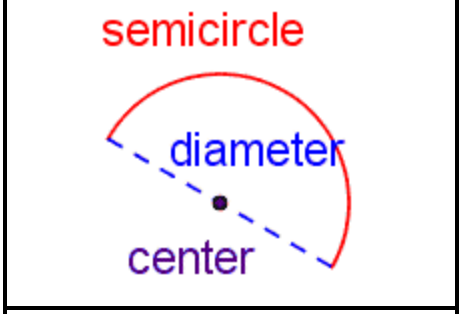
self subtraction NOUN /sɛlf səb'træk.ʃən/ any number subtracted from itself equals zero: $a - a \equiv 0$.

semi- PREFIX /'sɛm.aɪ/

1. half. *Example:* semicircle.
2. partially or somewhat. *Example:* semi-regular.

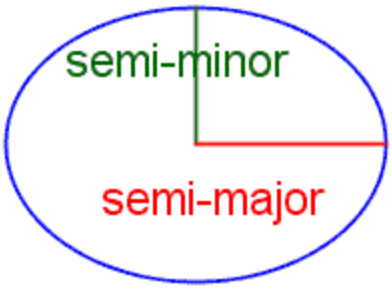
semiannually ADJECTIVE /ˌsɛm.aɪ'æn.yu.ə.li/ twice a year; every six months.

semicircle NOUN /'sɛm.aɪˌsɜr.kəl/ exactly one-half of a circle; an arc cut off from a circle by a diameter of the circle.



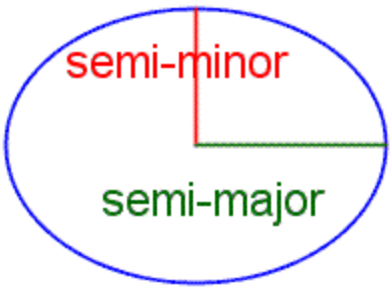
Semicircle

semi-major axis NOUN /'sɛm.aɪ meɪˌdʒər 'æk.sɪs/ one-half of the major axis.



Semi-major Axis

semi-minor axis NOUN /ˈsɛm.aɪ ˈmaɪ.nər ˈæk.sɪs/ one-half of the minor axis.



Semi-minor Axis

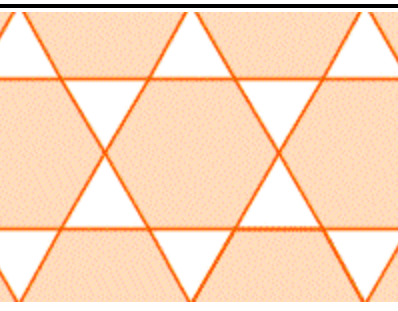
semiperimeter NOUN /ˌsɛm.aɪ.pəˈrɪm.ɪ.tər/ one-half the length of a perimeter.

semi-regular ADJECTIVE /ˈsɛm.aɪ ˈrɛg.yə.lər/ somewhat regular.

semi-regular polyhedron NOUN /ˈsɛm.aɪ ˈrɛg.yə.lər ˌpɒ.liˈhi.drən/ *See Archimedean solid.*

semi-regular solid NOUN /ˈsɛm.aɪ ˈrɛg.yə.lər ˈsɒl.ɪd/ *See Archimedean solid.*

semi-regular tessellation NOUN /ˈsɛm.aɪ ˈrɛg.yə.lər ˌtɛs.əˈleɪ.ʃən/ a uniform tessellation made from two or more regular polygons.



Semi-regular Tessellation

sentence NOUN /'sɛn.təns/ a statement of a mathematical or logical relationship. *Examples:* $y = 6x + 2$, A square has four sides.

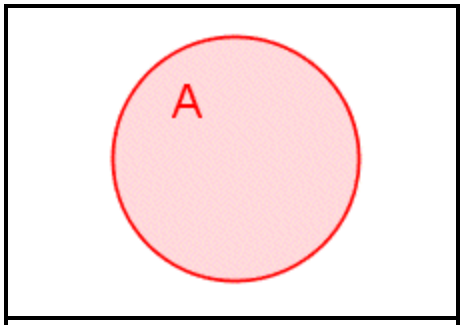
septillion ADJECTIVE, NOUN /sɛp'tɪl.yən/ 10^{24} = 1,000,000,000,000,000,000,000,000. *Synonym: yotta-.*

septillionth ADJECTIVE, NOUN /sɛp'tɪl.yənθ/ 10^{-24} = 0.000000000000000000000001. *Synonym: yocto-.*

sequence NOUN /'si.kwəns/ an ordered set of numbers such that there is a relation between each element, the element before it, and the element after it. *See also arithmetic sequence, geometric sequence.*

series NOUN /'sɪər.iz/ the sum of a sequence of numbers. *Example:* $2 = 1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$. *Plural: series* /'sɪər.iz/.

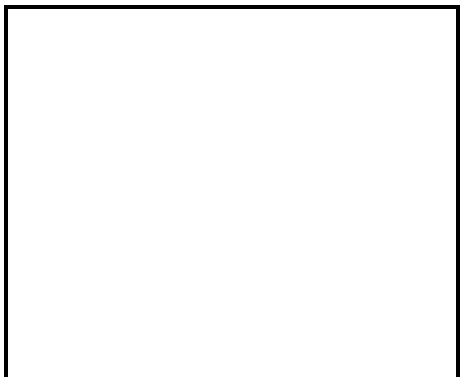
set NOUN /sɛt/ a well defined group of objects. *Notation: upper case letter. Example:* $\mathrm{A} = \{\mathrm{a,b,c}\}$. *Synonym: class.*

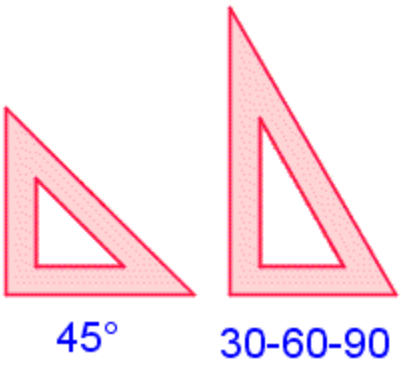


Set

set notation NOUN /sɛt noʊ'teɪ.ʃən/ a convention for writing the definitions of sets. *Example:* $A = \{x \in \mathbb{R} \mid x < 2\}$: set A is the set of all real numbers that are less than 2.

set square NOUN /sɛt skwɛər/ a device for drawing angles.





Set Square

set theory NOUN /sɛt 'θɪər.i/ an axiomatic system about sets on which modern mathematics is based.

seven ADJECTIVE, NOUN /'sɛ.vən/ the number 7.

seventeen ADJECTIVE, NOUN /sɛ.vən'tin/ the number 17.

seventh ADJECTIVE /'sɛ.vənθ/

1. coming in position 7 in an ordered list. *Notation:* 7^{th}.
2. one of seven equal parts (1/7).

seventy ADJECTIVE, NOUN /'sɛ.vən.ti/ the number 70.

sexagesimal ADJECTIVE /ˌsɛk.sə'dʒɛs.ə.məl/ having to do with 60. *Example:* sexagesimal system.

sexagesimal system NOUN /ˌsɛk.sə'dʒɛs.ə.məl 'sɪs.təm/ a number system with a base of 60. *Example:* measure of degrees (1 full circle is 6×60 degrees, 60 arc minutes is one degree, 60 arc seconds is one arc minute).

sextillion ADJECTIVE, NOUN /sɛks'tɪl.yən/ 10^{21} = 1,000,000,000,000,000,000,000. *Synonym: zetta-.*

sextillionth ADJECTIVE, NOUN /sɛks'tɪl.yənθ/ 10^{-21} = 0.000000000000000000001. *Synonym: zepto-.*

shadow stick NOUN /'ʃæ.doʊ stɪk/ a stick with one end in the ground use to measure tall objects by comparing the lengths of the shadows.

shape NOUN /ʃeɪp/

1. a figure, form or pattern.

2. what a figure resembles. *Example:* in the shape of a triangle.

shift /ʃɪft/

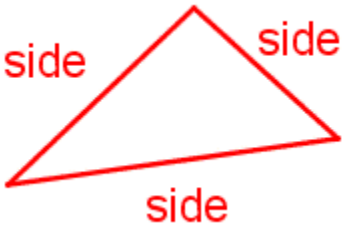
1. VERB (of a graph) to move a graph up or down, or left or right. A graph may be shifted left and right by substituting $(x - x_s)$ for x where x_s is the amount of the left-right shift. A graph may be shifted up and down by substituting $(y - y_s)$ for y in the equation where y_s is the amount of the up-down shift.
2. NOUN the results of a shift.

short scale NOUN /ʃɔrt skeɪl/ a standard for naming multiples of powers of 10 where $10^9 = 1$ billion.
Antonym: long scale.

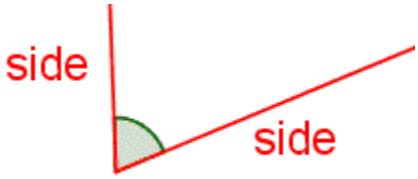
SI ABBREVIATION Système international d'unités (International System of Units).

side NOUN /saɪd/

1. (of a polygon) one of the line segments that make up the boundary of a polygon. *See also leg, definition 2, hypotenuse, definition 1.*
2. (of an angle) one of the line segments or rays that define the angle. *Synonyms: arm, leg, definition 2.*
3. (of a polyhedron) a lateral face of a polyhedron.
4. not at the front, top, back or bottom. *Example:* side view.



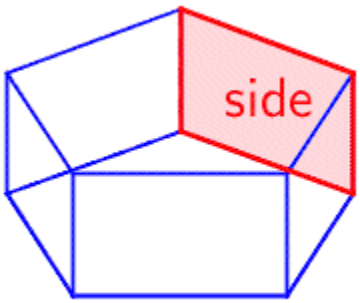
Side of a Polygon



Side of an Angle

5. (of an equation) either the part of the equation before the equals sign, or the part of the equation after the equals sign. *Example:*

$$\overbrace{x + 2}^{\text{left side}} = \overbrace{y - 4}^{\text{right side}}.$$

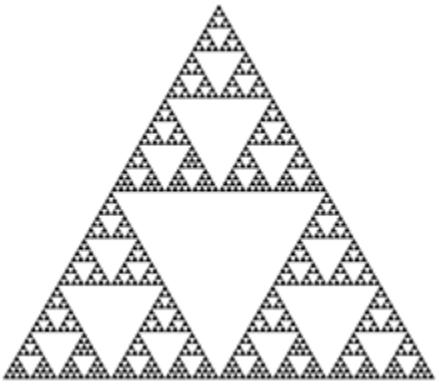


Side of a Polyhedron

side view NOUN /saɪd vyu/ a 2-dimensional drawing of 3-dimensional object from the point of view of a side.

Side View

Sierpinski triangle NOUN /si.ɛərˈpɪn.ski ˈtraɪˌæŋ.gəl/ a triangle from which the middle $1/4$ is successively removed. With each iteration, the area of the triangle decreases by a factor of $1/4$ and the length of the boundary of the triangle increases by a factor of $3/2$. *See also GeoApp!.*



Sierpinski Triangle

Sierpinski, Waclaw PERSON /si.ɛərˈpɪn.ski ʰwɑˈklɑ/ (1882-1969) a Polish mathematician known for the Sierpinski triangle.

Waclaw Sierpinski

Sieve of Eratosthenes NOUN /sɪv ʌv ˌɛr.əˈtɒs.θəˌniz/ a method for finding all prime numbers up to a specified value. As each prime number is discovered, all the multiples of that prime number are crossed out until all prime numbers in the range have been found. *See also Sieve of Eratosthenes.*

sigma SYMBOL /ˈsɪg.mə/

1. the upper case Greek letter Σ, used to indicate repeated addition. *See also sigma notation.*
2. the lower case Greek letter σ, used to indicate standard deviation.

sigma notation NOUN /ˈsɪg.mə noʊˈteɪ.ʃən/ a notation for showing repeated addition of similar terms:

$\sum_{i=1}^{n} a_i = a_1 + a_2 + \cdots + a_n$ where $i = 1$ is the starting value of the iterator, n is the final value of the iterator, and a_i is the i^{th} term. n may be infinity.

sign NOUN /saɪn/

1. a symbol used to show an operation or statement. *Examples:* $+$, $-$, $=$.
2. whether a number is positive or negative.

Historical Note
In ancient India, a number was marked as negative by putting a dot over the number. Negative 3 was written 𑁣. Positive 3 was written 𑁤.

signed ADJECTIVE /saɪnd/ having a sign. *Example:* signed number. *Antonym:* *unsigned*.

signed number NOUN /saɪnd 'nʌm.bər/

1. a number that has a positive or negative sign. *Examples:* $+5$, -3. *Synonym:* *directed number*.
2. (computers) a number that can be positive, negative or zero.

Antonym: *unsigned number*.

significand NOUN /sɪg'nɪf.ɪ.keɪnd/ *See* *mantissa*.

significant ADJECTIVE /sɪg'nɪf.ɪ.kənt/

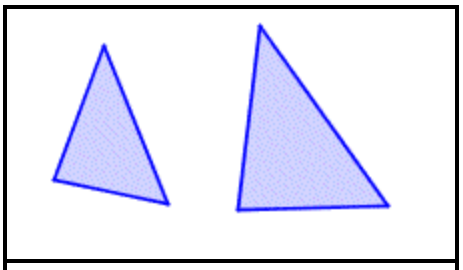
1. having an influence or effect. *Example:* significant digits.
2. (statistics) unlikely to be caused by chance.

significant digits NOUN /sɪg'nɪf.ɪ.kənt 'dɪdʒ.ɪtz/ the number of digits after which an inexact result will happen. If a measurement is accurate to two digits, the number has two significant digits.

similar ADJECTIVE /'sɪm.ə.lər/

1. having the same shape, but possibly different sizes.
2. being the same in some way. *Example:* similar fractions.

Antonym: *dissimilar*.

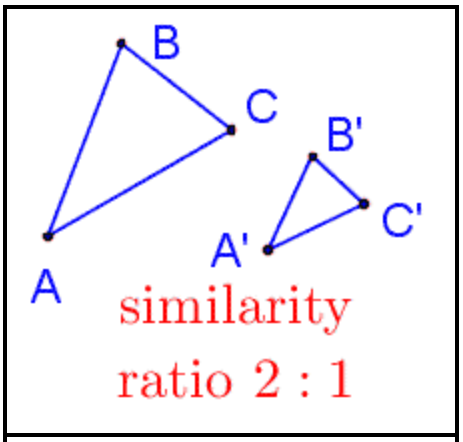


Similar

similar fractions NOUN /'sɪm.ə.lər 'fræk.ʃənz/ fractions having the same denominator. *Example:* $\frac{3}{4}$, $\frac{1}{4}$ are similar fractions.

similarity ADJECTIVE /ˌsɪm.əˈlær.ɪ.ti/ having to do with whether or not objects are similar. *Example:* similarity transformation.

similarity ratio NOUN /ˌsɪm.əˈlær.ɪ.ti ˈreɪ.ʃoʊ/ the constant ratio of lengths of corresponding parts of two similar figures.



Similarity Ratio

similarity transformation NOUN /ˌsɪm.əˈlær.ɪ.ti ˈtræns.fərˌmeɪ.ʃən/ any transformation of a geometric object where the pre-image is similar to the image of the transformation.

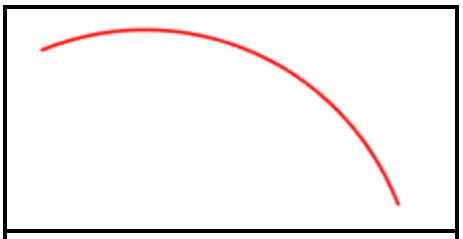
similar terms NOUN /ˈsɪm.ə.lər tɜrmz/ *See like terms.*

simple ADJECTIVE /ˈsɪm.pəl/

1. not made of multiple parts.
2. not complex.

Antonym: complex.

simple curve NOUN /ˈsɪm.pəl kɜrv/ a curve that does *not* intersect itself. *Antonym: complex curve.*


Simple Curve

simple interest NOUN /ˈsɪm.pəl ˈɪn.trɪst/ interest that is *not* added to the principal of a loan. *Formula:* $I = iP$ where i is the interest rate and P is the principal. *Antonym: compound interest.*

simple polygon NOUN /ˈsɪm.pəl ˈpɒl.iˌgɒn/ a polygon whose sides do not intersect each other. *Antonym: complex polygon.*

simple random sample NOUN /ˈsɪm.pəl ˈræn.dəm ˈsɑm.pəl/ a sample where any member of the population has an equal chance of being selected.

simplest form NOUN /ˈsɪm.pləst fɔrm/

1. (fraction) a fraction where the numerator and denominator have no common factors. *Example:* $3/5$. *See also reduced fraction.*
2. (expression) an expression where all fractions are in the simplest form and there are no like terms.

simplify VERB /ˈsɪm.pləˌfaɪ/ convert to a simpler form.

simulate VERB /ˌsɪm.yuˈleɪt/ to generate random events to study a real-life situation. *Example:* a coin can be flipped and heads can simulate the birth of a girl, tails the birth of a boy.

simulation NOUN /ˌsɪm.yuˈleɪ.ʃən/ the generation of random events to study a real-life situation. *Example:* a coin can be flipped and heads can simulate the birth of a girl, tails the birth of a boy.

simultaneous ADJECTIVE /ˌsaɪ.məlˈteɪn.i.əs/

1. at the same time. *Example:* simultaneous events.
2. all at once. *Example:* simultaneous equations.

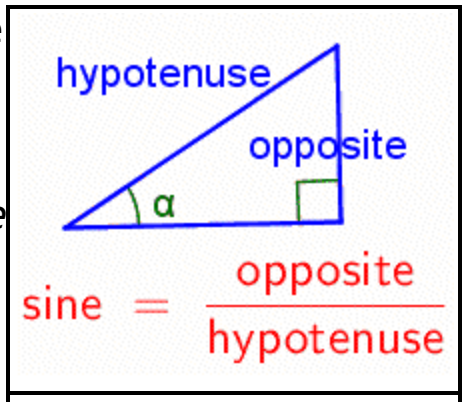
simultaneous equations NOUN /ˌsaɪ.məlˈteɪn.i.əs ɪˈkweɪ.ʃənz/ *See system of equations.*

sin ABBREVIATION sine.

`sin()` COMPUTERS represents the sine function in most computer languages.

sine NOUN /saɪn/ the ratio between the side of a right triangle opposite a vertex and the hypotenuse.

Formula: $\sin = \frac{\text{opposite}}{\text{hypotenuse}}$. *See also GeoApp!.*



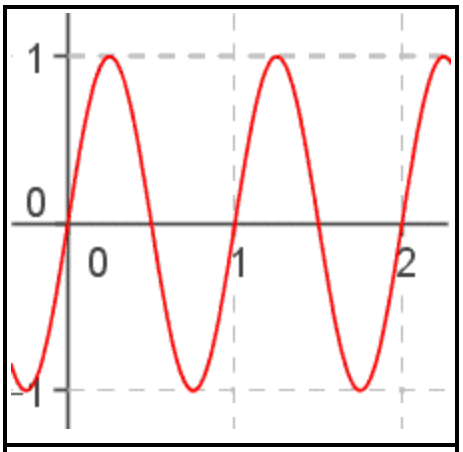
Sine

sine rule NOUN /saɪn rul/ *See Law of Sines.*

singular matrix NOUN /ˈsiŋ.gyə.lr ˈmeɪ.trɪks/ a square matrix for which no inverse exists; a matrix with a zero determinant. *Plural: singular matrices* /ˈsiŋ.gyə.lr ˈmeɪ.trɪˌsiz/.

sinh ABBREVIATION *See hyperbolic sine.*

sinusoid NOUN /ˈsaɪn.yu.sɔɪd/ a curve that is like a sine curve. *Formula:* $y = A\sin(2\pi rt - p)$ where A is the amplitude, r is the frequency in cycles per second, t is the elapsed time and p is the phase shift.



Sinusoid

sinusoidal ADJECTIVE /ˈsaɪn.yu.sɔɪ.dl/ like a sine curve. *Example:* sinusoidal curve.

SI unit NOUN /es aɪ ˈyu.nɪt/ one of several units of measure documented in the International System of Units.

six ADJECTIVE, NOUN /sɪks/ the number 6.

sixteen ADJECTIVE, NOUN /ˈsɪksˈtin/ the number 16.

sixth ADJECTIVE /sɪksθ/

1. coming in position 6 in an ordered list. *Notation:* 6^{th}.
2. one of six equal parts (1/6).

sixty ADJECTIVE, NOUN /ˈsɪks.ti/ the number 60.

size NOUN /saɪz/ how big or how long.

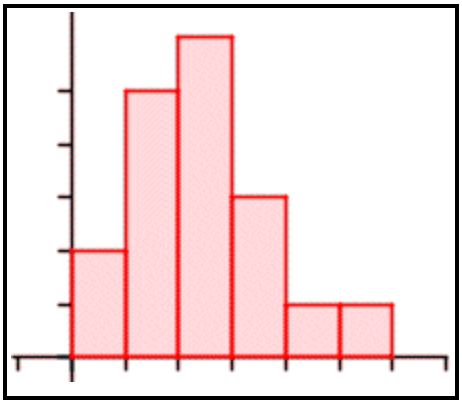
sketch /skɛtʃ/

1. VERB to draw a rough figure without the use of tools such as compass or straightedge.
2. NOUN a rough figure drawn without the use of tools such as compass or straightedge.

skew ADJECTIVE /skyu/

1. oblique; *not* vertical or horizontal. *Example:* skew line.
2. not in the same plane; not perpendicular or parallel. *Example:* skew lines.
3. slanted to one side or the other. *Example:* skewed distribution.

skewed distribution NOUN /skyud dɪ'strɪ.byu.ʃən/ a distribution that is slanted to the left or right as compared to a normal distribution. *Antonym: symmetric distribution.*



Skewed Distribution

skew line NOUN /skyu laɪn/

1. a line that is neither vertical nor horizontal.
2. more than one line in 3 or more dimensions that do *not* intersect and are not parallel.

Synonym: oblique line.

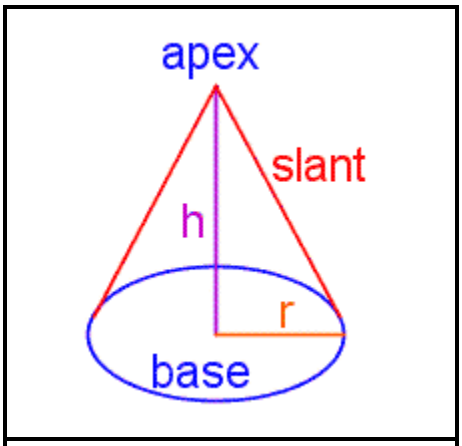
skip count VERB /skɪp kaʊnt/ to count every 2nd, 3rd, etc. integer. *Example:* skip count by 2's: 2, 4, 6, ...
Synonym: count by.

slant /slænt/

1. NOUN a line segment that is neither vertical nor horizontal.
2. VERB to place at a angle that is neither vertical nor horizontal.

slant height NOUN /slænt haɪt/

1. (right regular pyramid), the height of a lateral face.
2. (right cone) the length of any line segment from the edge of the base to the apex.



Slant Height

slice of a solid NOUN /slaɪs ʌv eɪ 'sɒl.ɪd/ the part of a solid to one side of a plane that intersects the solid.

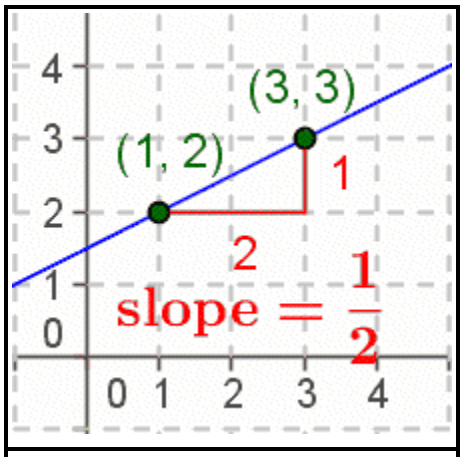
slide /slaɪd/

1. NOUN *See translation, definition 1.*
2. VERB to move along a path.

slide rule NOUN /slaɪd rul/ a computing device with a slider and a stationary part each with a logarithmic scale than can be used to calculate multiplication.

Slide Rule

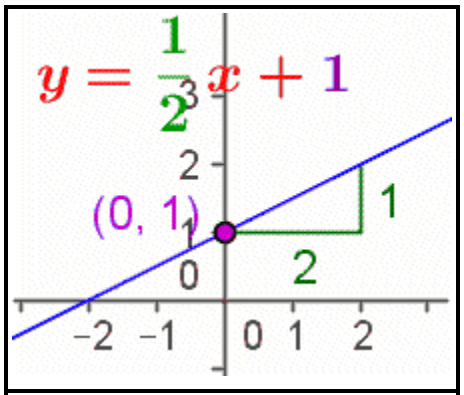
slope NOUN /sloʊp/ (of a line) how steep a line is; rise divided by run; vertical change divided by horizontal change. *Notation:* m. *Equation:* $m = \frac{\Delta y}{\Delta x}$. Given two distinct points on a line, (x_1,y_1) and (x_2,y_2), $m = \frac{y_2 - y_1}{x_2 - x_1}$.



Slope

Synonyms: rate of change, definition 1, gradient, definition 1. See also GeoApp!.

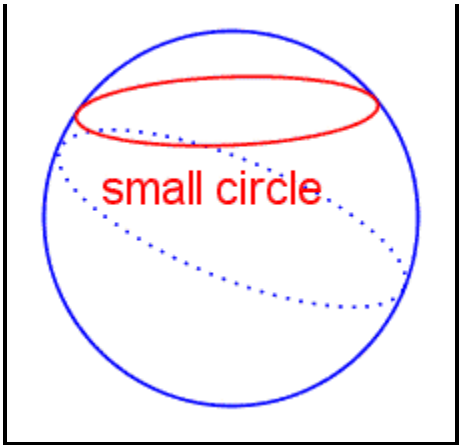
slope-intercept form NOUN /sloʊp ˈɪn.tərˌsɛpt fɔrm/ an equation of a line in the form $y = mx + b$ where m is the slope and b is the y-intercept.



Slope Intercept Form

slope-intercept method NOUN /sloʊp ˈɪn.tərˌsɛpt ˈmɛθ.əd/ an algorithm for graphing a line in slope-intercept form ($y = mx + b$): 1) Plot the y-intercept at $(0,b)$. 2) Plot a point 1 over and m up (if m is positive) or $|m|$ down (if m is negative): $(1,b+m)$. 3) Draw the line containing the two points.

small circle NOUN /smɔl ˈsɜr.kəl/ a circle on the surface of a sphere that is *not* a great circle, that does *not* divide the sphere into two equal halves. *Antonym: great circle.*



Small Circle

smaller ADJECTIVE /ˈsmɔl.ər/ having one or more dimensions that is less.

SOHCAHTOA MNEMONIC /ˈsoʊ.kə.toʊ.ə/ a mnemonic for remembering the definition of trigonometric functions: **SOH** stands for **S**ine equals **O**pposite over **H**ypotenuse; **CAH** stands for **C**osine equals **A**djacent over **H**ypotenuse; TOA stands for **T**angent equals **O**pposite over **A**djacent.

sol- PREFIX /sɔl/ having to do with the sun.

solid /ˈsɒl.ɪd/

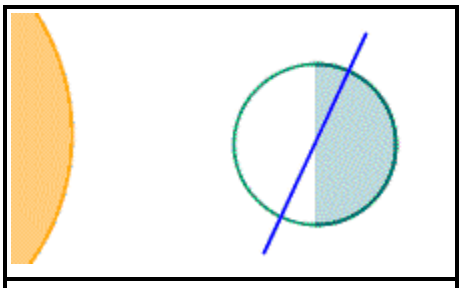
1. NOUN *See geometric solid.*
2. ADJECTIVE having to do with three dimensions.

solid angle NOUN /ˈsɒl.ɪd ˈæŋ.gəl/ an angle in three dimensions. (θ,φ) where θ is an angle on a reference plane, and φ is the angle from the reference plane to the point.

solid geometry NOUN /ˈsɒl.ɪd dʒiˈɒ.mɪ.tri/ the study of geometric objects in 3-dimensional space.

solid of revolution NOUN /ˈsɒl.ɪd ʌv ˌrɛv.əˈlu.ʃən/ a solid created by revolving a two dimensional figure about a line. *Example:* a torus can be formed by rotating a circle around a line that does not intersect the circle.

solstice NOUN /ˈsɔl.stɪs/ one of two days each year when the Earth is most tilted towards or away from the sun.



Solstice

solution NOUN /soʊˈlu.ʃən/

1. a set of one or more values that, when substituted for variables, make an equation true and consistent.
2. a set of one or more values that satisfy all equations in a system of equations. *Synonym: solution set. See also simultaneous equations.*
3. (triangle) the measures of the angles and the lengths of the sides of a triangle.

solution set NOUN /soʊˈlu.ʃən sɛt/ all solutions to a problem. *See solution.*

solve VERB /sɒlv/

1. to find the solution(s) to an problem, equation or a system of equations.
2. (triangle) to find the measures of all the angles and sides of a triangle.

solve graphically VERB /sɒlv ˈgræf.ɪ.klɪ/ find the solution to an equation using a graphing device.

sort VERB /sɔrt/ to place in a specific order or grouping. *Example:* sort numerically.

source error NOUN /sɔrs ˈɛr.ər/ a error that happens while taking a sample.

space NOUN /speɪs/

1. (geometry) a mathematical construct with specific properties in which objects may be placed. *Example:* Euclidean 3-space.
2. (probability) *See sample space, definition 1.*

space figure NOUN /speɪs ˈfɪg.yər/ *See geometric solid.*

spatial ADJECTIVE /'speɪ.ʃəl/ having to do with 3-dimensional space. *Example:* spatial perception.

spatial relationship NOUN /'speɪ.ʃəl rɪ'leɪ.ʃən.ʃɪp/ the location and relative orientation of objects in a 3-dimensional space.

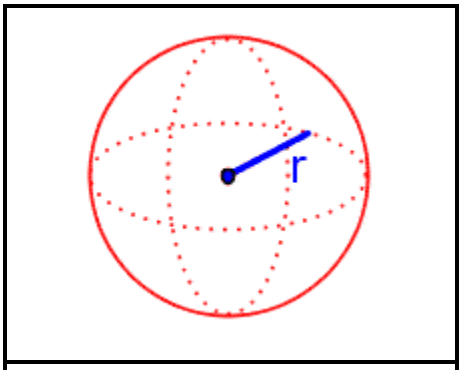
spatial thinking NOUN /'speɪ.ʃəl 'θɪŋk.ɪŋ/ the ability to visualize problems.

speed NOUN /spid/ distance traveled in a unit of time.

Formula: $s = \frac{d}{t}$ where d is distance and t is time.

Example: If a car is traveling at a speed of 50 kilometers per hour, the car travels 50 kilometers each hour, 100 kilometers in two hours, and so on. *Synonym: velocity. For contrast, see velocity.*

sphere NOUN /sfɪər/ a shape like a round ball; all points a given distance from the center of the sphere in three dimensions.



Sphere

spherical ADJECTIVE /'sfɪər.ɪ.kl/
1. having to do with a sphere.
2. shaped like a sphere.

spherical cap NOUN /'sfɪər.ɪ.kl kæp/ *See spherical sector.*

spherical geometry NOUN /'sfɪər.ɪ.kl dʒi'ɒ.mɪ.tri/ *See elliptic geometry.*

spherical polar coordinate NOUN /ˈsfɪər.ɪ.kl ˈpoʊ.lər koʊˈɔr.dnɪt/ location of a point in a spherical coordinate system, consisting of a radius from the origin r, an angle on a reference plane ?, and an angle at a right angle to the reference plane f. *Notation:* (r,θ,φ).

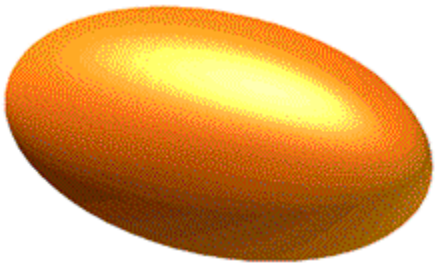
spherical sector NOUN /ˈsfɪər.ɪ.kl ˈsɛk.tər/ a solid created by rotating a sector of a circle about its bisector. *Synonym: spherical cap.*

spherical segment NOUN /ˈsfɪər.ɪ.kl ˈsɛg.mənt/ a portion of a sphere cut off by a plane.

spherical triangle NOUN /ˈsfɪər.ɪ.kl ˈtraɪˌæŋ.gəl/ a triangle formed on the surface of a sphere by three intersecting great circles.

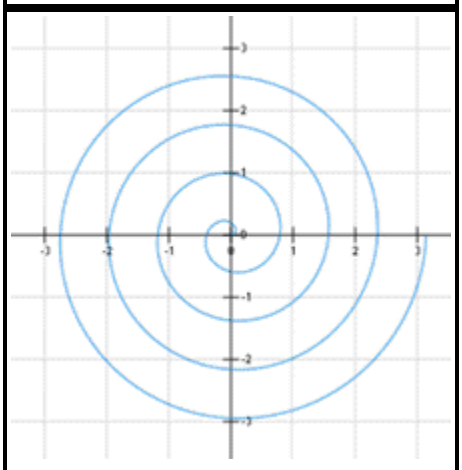
spherical trigonometry NOUN /ˈsfɪər.ɪ.kl ˌtrɪ.gəˈnɒ.mɪ.tri/ a trigonometry dealing with polygons in a spherical geometry and the relationships between lengths of sides and angles.

spheroid NOUN /ˈsfɪər.ɔɪd/ an ellipsoid where two of the axes are equal; a "flattened" sphere; an ellipsoid formed by rotating an ellipse about one of its axes.



Spheroid

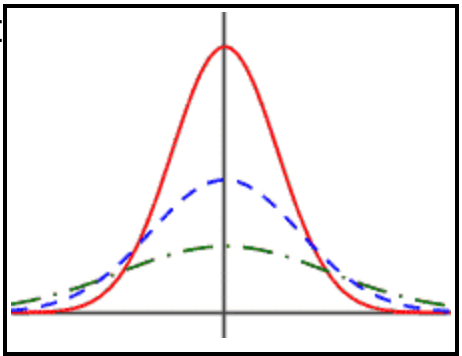
spiral NOUN /ˈspaɪ.rəl/ a shape that revolves around a fixed point while moving away from that point. *Formula:* $r = a\theta$ (polar coordinates).



Spiral

spline NOUN /'splaɪn/ a smooth curve that runs through a series of points.

spread NOUN /'sprɛd/ the arrangement and distance of data points from a central point. *Synonym: distribution.*



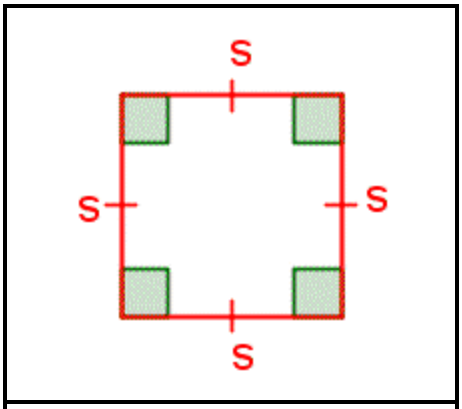
Standard Normal Distribution

spreadsheet NOUN /'sprɛdˌʃit/ a computer program that stores data and instructions in rows and columns.

sq ABBREVIATION square (as in square feet).

square /skwɛər/

1. NOUN a number multiplied by itself. *Example:* x^2.
2. VERB to multiply a number by itself.
3. NOUN a four-sided polygon whose sides are the same length and whose sides intersect at right angles. *Abbreviation: sq.. Synonym: regular quadrilateral.*
4. ADJECTIVE having to do with a square.
5. ADJECTIVE in the shape of a square.
6. ADJECTIVE containing a square.
7. ADJECTIVE having to do with a number multiplied by itself.



Square

square brace NOUN /skwɛər breɪs/ *See bracket.*

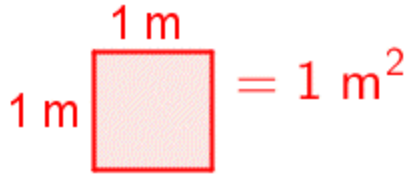
square matrix NOUN /skwɛər 'meɪ.trɪks/ a matrix with the same number of rows as columns. *Plural: square matrices* /skwɛər 'meɪ.trɪˌsiz/.

$$\begin{bmatrix} 1 & -2 & 0 \\ 4 & 7 & -1 \\ 6 & 1 & 4 \end{bmatrix}$$

Square Matrix

square measure NOUN /skwɛər 'mɛ.ʒər/ a measure of area; a measure of two dimensions. *Example:* square meter.

square meter NOUN /skwɛər 'mi.tər/ a measure of an area that is one meter on each side.

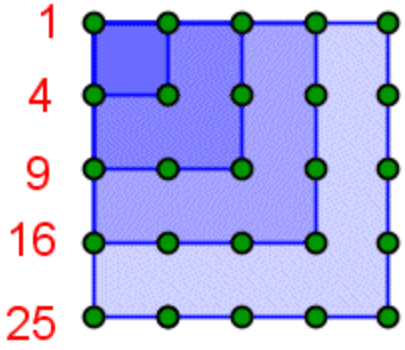


Square Meter

square number NOUN /skwɛər 'nʌm.bər/ an integer that is the square of another integer.

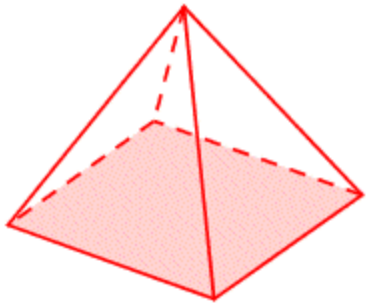
Examples: $1^2=1$, $2^2=4$, $3^2=9$, $4^2=16$, $5^2=25$, ...

Synonym: perfect square.



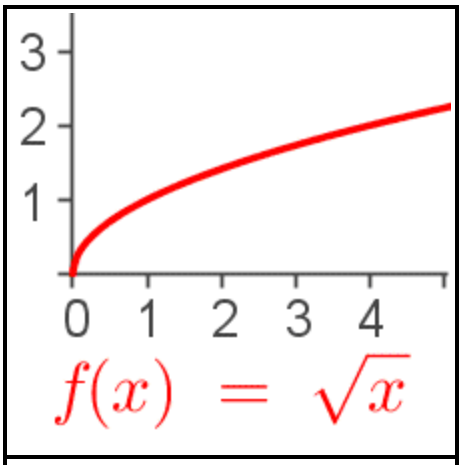
Square Numbers

square pyramid NOUN /skwɛər 'pɪr.ə.mɪd/ a polyhedron with a square base whose sides are isosceles triangles meeting at the apex.



Square Pyramid

square root NOUN /skwɛər rut/ a non-negative number a such that $a^2 = x$. *Notation:* $\sqrt{\ }$. *Math definition:* $y = \sqrt{x}$ if and only if $y^2 = x, y \geq 0$. *Example:* $\sqrt{4} = 2$ because $2^2 = 4$.



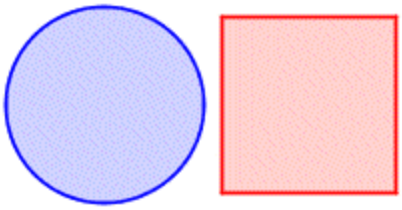
Square Root

square unit NOUN /skwɛər 'yu.nɪt/ a unit of measure where two dimensions having the same unit are multiplied by each other. *Example:* square meter.

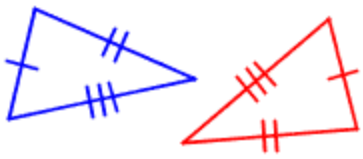
squaring NOUN /'skwɛər.iŋ/

1. the act of transforming something into a square. *Example:* squaring the circle.
2. the act of multiplying something by itself. *Example:* squaring an integer.

squaring the circle NOUN /'skwɛər.iŋ ðə 'sɜr.kəl/ a problem of constructing a square with the same area as a given circle.

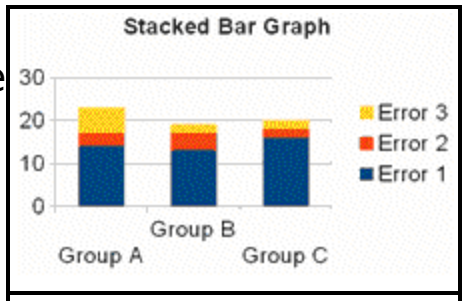

Squaring the Circle

SSS congruence NOUN /es es es kən'gru.əns/ (side-side-side congruence) two triangles are congruent if all three corresponding sides are congruent.


SSS Congruence

stack VERB /stæk/ to place one on top of another.

stacked bar graph NOUN /stækd bɑr græf/ a bar graph where the bars are stacked on top of each other, showing cumulative values.



Stacked Bar Graph

staircase function NOUN /'stɛərˌkeɪs 'fʌŋk.ʃən/ *See step function.*

standard /'stæn.dərd/

1. NOUN a way of doing things that has been decided upon and documented.
2. NOUN something to which other things are compared. *Example:* kilogram is a standard of mass.
3. ADJECTIVE most usual or common. *Example:* standard form.
4. ADJECTIVE generally accepted.

Antonym: nonstandard.

standard deviation NOUN /'stæn.dərd ˌdi.vi'eɪ.ʃən/ a measure of the 'spread' of a dataset; a way to measure the average distance of a single data element from the center of the dataset. *Notation:* σ. *Formula:* $\sigma = \sqrt{\nu}$ where V is the variance.

standard form NOUN /'stæn.dərd fɔrm/ the usual or customary form. *Example:* the standard form of a linear equation.

standard form of a linear equation NOUN /'stæn.dərd fɔrm ʌv eɪ 'lɪn.i.ər ɪ'kweɪ.ʒən/ a linear equation in the form $ax + by = c$.

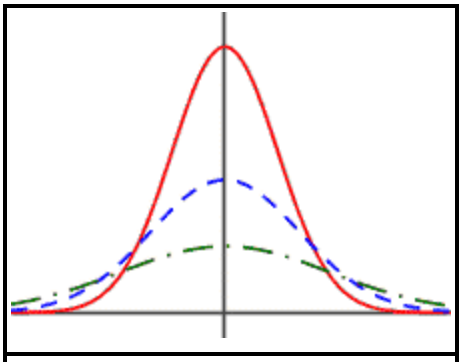
standard form of an exponential equation NOUN /'stæn.dərd fɔrm ʌv ən ˌɛk.spoʊ'nɛn.ʃəl ɪ'kweɪ.ʒən/ an equation in the form $y = ax^b$ where a is the initial value at $x = 0$ and b is the growth or decay factor.

standard form of a polynomial NOUN /ˈstæn.dərd fɔrm ʌv eɪ ˌpɒl.əˈnoʊ.mi.əl/ a polynomial with the terms ordered so higher degree terms are to the left of lower degree terms: $a_0x^n + a_1x^{n-1} + \ldots + a_{n-1}x + a_n$.

standard form of a quadratic equation NOUN /ˈstæn.dərd fɔrm ʌv eɪ kwɒˈdræ.tɪk ɪˈkweɪ.ʒən/ an equation in the form $ax^2 + bx + c = 0$ or $y = ax^2 + bx + c$.

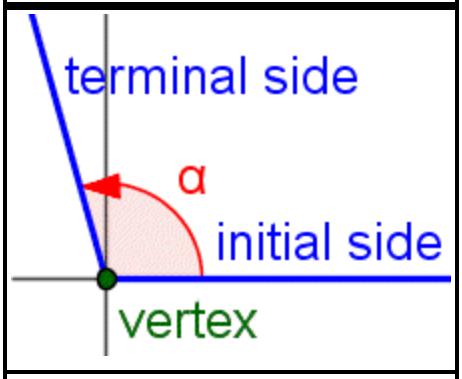
standardized test NOUN /ˈstæn.dərˌdaɪzd tɛst/ a test that is always administered and scored in the same way.

standard normal distribution NOUN /ˈstæn.dərd ˈnɔr.məl dɪˈstrɪ.byu.ʃən/ a normal distribution with a mean of 0.



Standard Normal Distribution

standard position NOUN /ˈstæn.dərd ˌpoʊˈsɪ.ʃən/ an angle is in its standard position on a rectangular coordinate system if the vertex is at the origin and its initial side is along the positive x-axis.



Standard Position

standard unit NOUN /ˈstæn.dərd ˈyu.nɪt/ a convention for naming a large or small units of measure. *Example:* nanometer.

statement NOUN /ˈsteɪt.mənt/ a logical claim; a declaration.

stationary point NOUN /ˈsteɪ.ʃəˌnɛr.i pɔɪnt/ *See fixed point.*

statistic NOUN /stəˈtɪs.tɪk/ a quantity calculated from data elements in a dataset. *Example:* arithmetic average.

statistics NOUN /stəˈtɪs.tɪks/ the science of collection, classification, summarization, analysis and interpretation of data.

stellated ADJECTIVE /ˈstɛl.eɪt.əd/ a polyhedron that is extended by substituting a pyramid for each polygon on the face. *Example:* stellated octahedron. *See also Net!.*

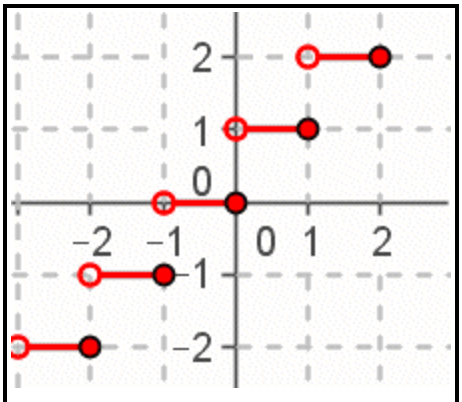
stem and leaf plot NOUN /stɛm ænd lif plɒt/ *See stemplot.*

stemplot NOUN /ˈstɛm.plɒt/ a way to graphically show numerical data where the stem is the most significant digit of the data, and the leaf contains the 2nd most significant digit. *Example:* The illustration shows the stemplot for the dataset {12, 12, 13, 15, 17, 21, 21, 23, 24, 24, 24, 25, 28, 30, 32, 35}. *See also back to back stem and leaf plot.*

1|22357
2|11344458
3|025

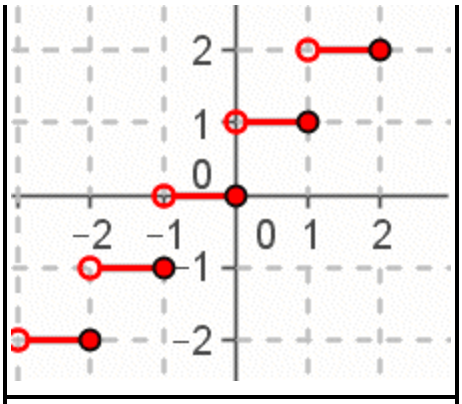
Stemplot

step function NOUN /stɛp ˈfʌŋk.ʃən/ a function that is constant over a number of intervals.
Synonym: staircase function.



Step Function

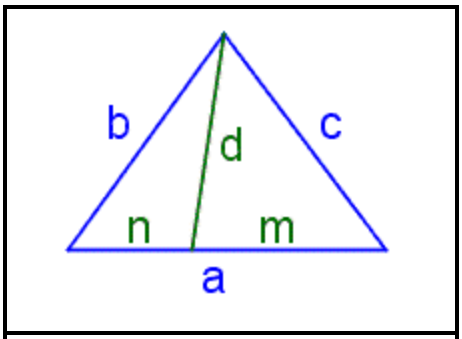
step graph NOUN /stɛp græf/ graph of a step function.



Step Graph

steradian NOUN /stə'reɪ.di.ən/ a solid angle that cuts off a section of the surface of a sphere with an area equal to the radius of the sphere squared.

Stewart's Theorem NOUN /'stu.ərtz 'θɪər.əm/ a theorem relating the length of the sides of a triangle to a cevian of the triangle.

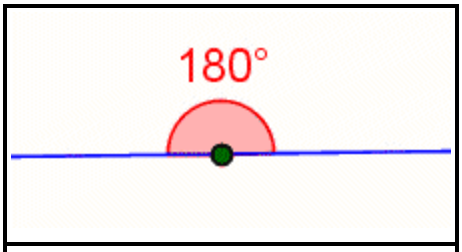


Stewart's Theorem

Formula: $b^2m + c^2n = a(d^2 + m \cdot n)$ where a, b, and c are lengths of sides of the triangle, m and n are the lengths of the segments into which a is divided by the cevian, and d is the length of the cevian.

straight ADJECTIVE /streɪt/ does not curve or bend.

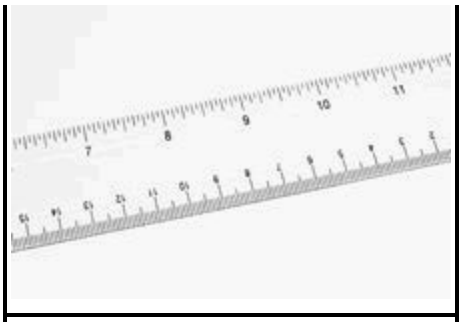
straight angle NOUN /streɪt 'æŋ.gəl/ an angle that measures ½ of a full circle. *See also GeoApp!.*



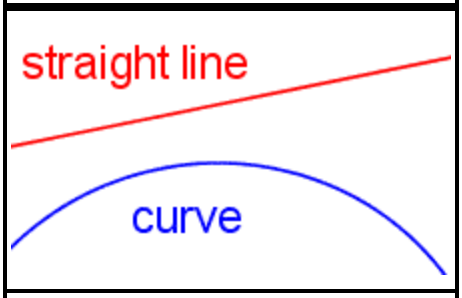
Straight Angle

straightedge NOUN /'streɪtˌɛdʒ/ a tool used to draw straight lines.

straight line NOUN /streɪt laɪn/ a line that does *not* curve or bend.



Straight Edge



Straight Line

strategy NOUN /'stræ.tə.dʒ.i/ a plan or method for accomplishing a task.

stratified ADJECTIVE /'stræ.tə˧faɪd/ divided into groups or categories.

stratified sample ADJECTIVE /'stræ.tə˧faɪd 'sɑm.pəl/ populations are divided into homogeneous categories before sampling. Samples are then taken at random within each stratified group. *Example:* age groupings. *Synonym: stratified random sample.*

stratify VERB /'stræ.tə˧faɪ/ to place into groups or categories.

strictly ADJECTIVE /'strɪkt.li/ precisely; no more and no less.

strictly greater than ADJECTIVE /'strɪkt.li 'greɪ.tər ðæn/ greater than but *not* equal to. *Notation:* $a > b$.

strictly less than ADJECTIVE /'strɪkt.li lɛs ðæn/ less than but *not* equal to. *Notation:* $a < b$.

strictly self-similar ADJECTIVE /'strɪkt.li sɛlf 'sɪm.ə.lər/ a figure is strictly self-similar if any of its parts of any size or location are similar to the whole.

study /'stʌ.di/

1. NOUN the process of examining detail in order to discover truth.
2. NOUN (statistics) the process of collecting data on a population and analyzing that data.
3. NOUN (statistics) the result of collecting data on a population and analyzing that data.
4. VERB to examine detail in order to discover truth.
5. VERB (statistics) to collect data on a population and analyze that data.

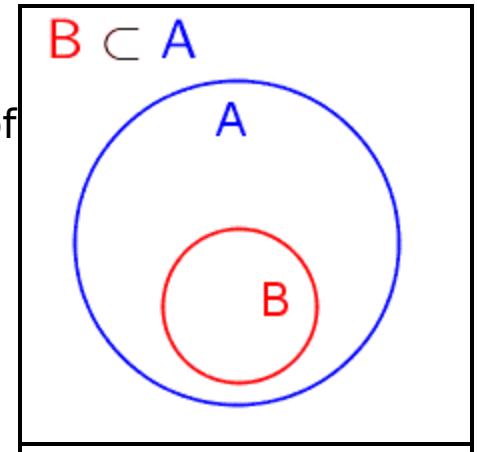
sub- PREFIX /sʌb/ less than, below, part of.
Example: subscript.

subdomain NOUN /ˈsʌb.doʊ.meɪn/ a part of the domain; a specific interval of the domain. *Example:* $f(x)$ is defined on the subdomain $x > 0$.

subitise VERB /ˈsub.ɪˌtaɪz/ to perceive at a glance.

subscript NOUN /ˈsʌb.skrɪpt/ any characters written below and to the right in a smaller font. *Example:* In x_1, 1 is the subscript. *Synonym: index* (British English).

subset NOUN /ˈsʌbˌsɛt/ set B is a subset of set A if and only if every member of set B is also a member of set A. *Notations:* $B \subset A$ (proper subset), $B \subseteq A$ (B may contain all the elements of A).
Synonym: inclusion relation.



Subset

substitute VERB /ˈsʌb.stɪˌtut/ to replace a variable or expression with another variable or expression that is equal to the original variable or expression. *Example:* substitute $x - 2$ for y into the equation $y = 3x$. The result is $x - 2 = 3x \Rightarrow -2 = 2x \Rightarrow x = -1$.
Synonym: replace.

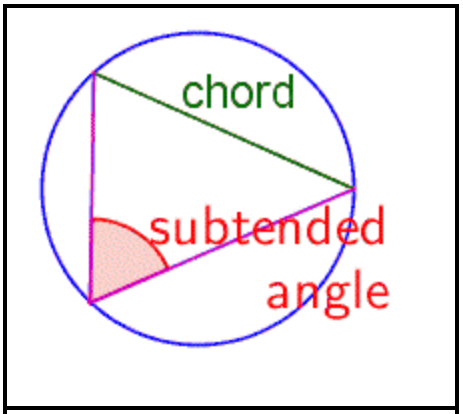
substitution NOUN /ˈsʌb.stɪˌtu.ʃən/ the process or act of substituting. *Example:* substitution property of equality.

substitution method NOUN /ˈsʌb.stɪˌtu.ʃən ˈmɛθ.əd/ a method for solving simultaneous equations involving substituting an expression in for a variable.
Example: $y = 3,\ x + y = 1 \rightarrow x + 3 = 1 \rightarrow x = -2$.

substitution principle NOUN /ˈsʌb.stɪˌtu.ʃən ˈprɪn.sə.pəl/ *See substitution property.*

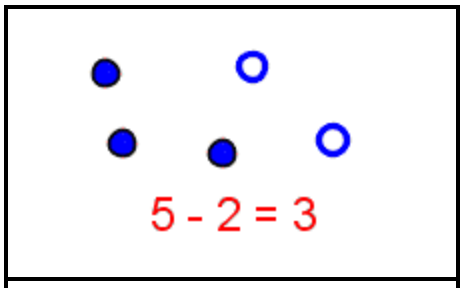
substitution property NOUN /ˈsʌb.stɪˌtu.ʃən ˈprɒ.pər.ti ʌv ɪˈkwɒl.ɪ.ti/ if $a = b$ then b can be substituted for a.
Example: if $y = 5$ and $x = y - 2$, then $x = 5 - 2 = 2$.

subtended angle NOUN /sʌbˈtɛnd.əd ˈæŋ.gəl/ any angle whose vertex lies on the circumference of a circle and whose legs intersect the end points of a chord or arc of the circle. *See also GeoApp!.*



Subtended Angle

subtract VERB /səb'trækt/ to take away from a whole. *Notation:* −. *Example:* $5 - 2 = 3$. *Synonym:* *decrease*.



Subtract

subtraction NOUN /səb'træk.ʃən/ the process of subtracting. *Formula:* $\text{minuend} - \text{subtrahend} = \text{difference}$. *Inverse:* *addition*.

subtraction of polynomials NOUN /səb'træk.ʃən ʌv ˌpɒl.ə'noʊ.mi.əlz/ to subtract one polynomial from another, subtract the like terms.

$$\begin{array}{rrrrrrr} & 3x & + & 4y & + & -7 & \\ -(& 2x & & & + & 6 & + & 2xy) \\ \hline & x & + & 4y & + & -13 & + & -2xy \end{array}$$

Subtraction of Polynomials

subtraction property of equality NOUN /səb'træk.ʃən 'prɒ.pər.ti ʌv ɪ'kwɒl.ɪ.ti/ a value can be subtracted from both sides of an equation without changing the truth value of the equation. *Math definition:* for any real or complex numbers a, b and c; if $a = b$ then $a - c = b - c$ and if $a \neq b$ then $a - c \neq b - c$.

subtraction property of inequality NOUN /səb'træk.ʃən 'prɒ.pər.ti ʌv ˌɪn.ɪ'kwɒl.ɪ.ti/ a value can be subtracted from both sides of an inequality without changing the truth value of the inequality. *Math definition:* for any real or complex numbers a, b and c; if $a < b$ then $a - c < b - c$ and if $a > b$ then $a - c > b - c$.

subtraction sign NOUN /səb'træk.ʃən saɪn/ the symbol '−' is used to show subtraction.

subtrahend NOUN /'sʌb.trəˌhɛnd/ an expression that is subtracted. *Formula:* minuend − subtrahend = difference. *Example:* 5 − 2 = 3.

successive NOUN /sʌk'sə.sɪv/ coming one after the other in a specific order with no gaps. *Example:* successive integers: 5, 6, 7, 8.

successor NOUN /sʌk'səs.ər/ what comes immediately after in order.

sufficient ADJECTIVE /sə'fɪ.ʃənt/ is enough to show that something is true. *Example:* to show that a number is an integer is sufficient to show that it is a real number, since all integers are also real numbers.

sum /sʌm/

1. NOUN the total of an addition problem. *Formula:* addend + addend = sum. *Example:* 3 + 2 = 5. *Antonym: difference, definition 1.*
2. VERB *See add, definition 1. Antonym: subtract.*

sum difference identities NOUN /sʌm 'dɪfr.əns aɪ'dɛnˌtɪ.tiz/ trigonometric identities involving the sum and differences of angles. *See also Trigonometric Identities.*

summarize VERB /'sʌm.ər.aɪz/ to create a short description of data.

summary ADJECTIVE, NOUN /'sʌm.ər.i/ a short compilation of fact or data the gives a good idea of the properties of the data.

summary statistics NOUN /'sʌm.ər.i stə'tɪs.tɪks/ a short set of statistical information about a dataset. *Example:* five number summary.

summation /sə'meɪ.ʃən/

1. NOUN the act or process of adding a list of values.
2. ADJECTIVE having to do with adding a list of values. *Example:* summation notation.

summation notation NOUN /səˈmeɪ.ʃən noʊˈteɪ.ʃən/ *See sigma notation.*

summation sign NOUN /səˈmeɪ.ʃən saɪn/ the symbol $\sum$ is used to show repeated addition. *Example:* $\sum_{n=1}^{5} n = 1 + 2 + 3 + 4 + 5 = 15$. *Synonym: sigma, definition 1.*

sum of a geometric sequence NOUN /sʌm ʌv eɪ ˌdʒi.əˈmɛt.rɪk ˈsi.kwəns/ *See geometric series.*

sum of cubes NOUN /sʌm ʌv kyubz/ a polynomial identity used to factor certain cubic equations. *Equation:* $a^3 + b^3 = (a + b)(a^2 - ab + b^2)$.

sum rule NOUN /sʌm rul/ *See rule of sum.*

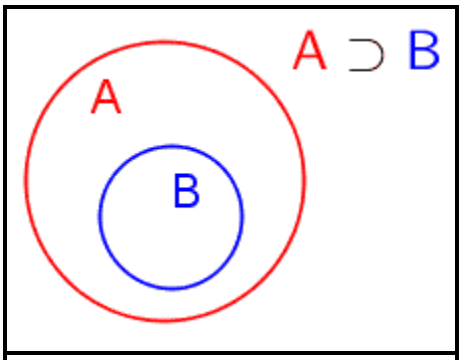
sum to product identities NOUN /sʌm tu ˈprɒ.dəkt aɪˈdɛnˌtɪ.tiz/ trigonometric identities involving converting sums to products. *See also Trigonometric Identities.*

super- PREFIX /ˈsu.pər/

1. greater than. *Example:* superset.
2. above. *Example:* superscript.

superscript NOUN /ˈsu.pərˌskrɪpt/ text appearing above and to the right in a smaller font. *Example:* in x^2, the superscript is 2.

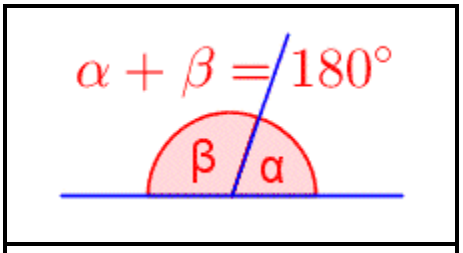
superset NOUN /'su.pər.sɛt/ a set that contains all of the members of another set, and possibly others. If A is a superset of set B then set B is a subset of set A.
Notation: $A \supset B$.



Superset

supplementary ADJECTIVE /ˌsʌp.lə'mɛn.tə.ri/
1. totaling 180°.
2. added to complete something

supplementary angles NOUN /ˌsʌp.lə'mɛn.tə.ri 'æŋ.gəlz/ two angles that, taken together, make a straight angle. Supplementary angles do *not* have to be adjacent. *See also GeoApp!.*



Supplementary Angles

supplementary angles congruence theorem NOUN /ˌsʌp.lə'mɛn.tə.ri 'æŋ.gəlz kən'gru.əns 'θɪər.əm/ angles supplementary to the same angle or to congruent angles are congruent.

supplementary units NOUN /ˌsʌp.lə'mɛn.tə.ri 'yu.nɪtz/ the units radian and steradian in SI units.

Supplement Theorem NOUN /ˌsʌp.lə'mɛnt 'θɪər.əm/ if two angles form a linear pair, then they are supplementary angles.

supremum NOUN /ˌsu'pri.mʌm/ *See least upper bound.*

surd /sɜrd/
1. ADJECTIVE *See irrational number.*
2. NOUN *See irrational, definition 1.*

surface NOUN /'sɜr.fɪs/ the boundary between a geometric solid and the rest of the containing space. *Example:* the surface of a sphere.

surface area NOUN /ˈsɜr.fɪs ˈɛər.i.ə/ the area of the surface of a 3-dimensional geometric figure. *See also area.*

surface of revolution NOUN /ˈsɜr.fɪs ʌv ˌrɛv.əˈlu.ʃən/ a surface formed by rotating a figure around a line.

survey /ˈsɜr.veɪ/

1. VERB to sample a population to obtain data.
2. NOUN the process of sampling a population.
3. NOUN the result of sampling a population.

swap VERB /swɒp/ exchange places.

swap rows VERB /swɒp roʊz/ exchange rows in a matrix.

Example: Swap rows 1 and 3:

$$\begin{bmatrix} -1 & 3 \\ 2 & 0 \\ 4 & -2 \end{bmatrix} \xrightarrow{\text{Swap } R1 \text{ and } R3} \begin{bmatrix} 4 & -2 \\ 2 & 0 \\ -1 & 3 \end{bmatrix}.$$

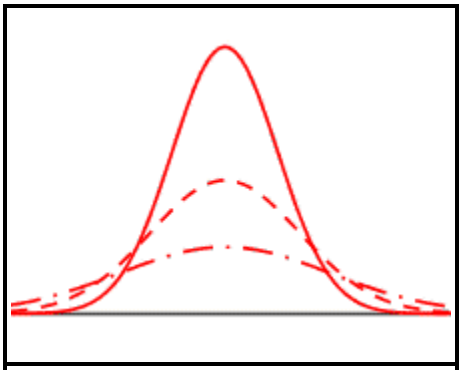
symbol NOUN /ˈsɪm.bəl/ a letter, character or other mark used to represent something. *Examples:* Π, A, $=$.

symmetric ADJECTIVE /sɪˈmɛ.trɪk/

1. a relation R is symmetric if $a\mathrm{R}b$ always implies $b\mathrm{R}a$. *Example:* if $x = 5$ then $5 = x$.
2. (geometric figures) having a property of symmetry such as symmetry about a line or a point.

Synonym: symmetrical. Antonym: asymmetric.

symmetric distribution NOUN /sɪˈmɛ.trɪk dɪˈstrɪ.byu.ʃən/ a distribution that is not skewed to one side or another; a distribution that is symmetric about the mean. *Antonym: skewed distribution.*



Symmetric Distribution

symmetric property of equality NOUN /sɪ'mɛ.trɪk 'prɒ.pər.ti ʌv ɪ'kwɒl.ɪ.ti/ for real and complex numbers, if $a = b$, then $b = a$. *Example:* if $2 + 3 = 5$, then $5 = 2 + 3$.

symmetry NOUN /'sɪm.ɪ.tri/ a property of objects that leaves an object unchanged under a transformation. *Examples:* axial symmetry, radial symmetry, rotational symmetry.

synthetic division NOUN /sɪn'θɛt.ɪk dɪ'vɪ.ʒən/ an algorithm for quickly dividing one polynomial by another.

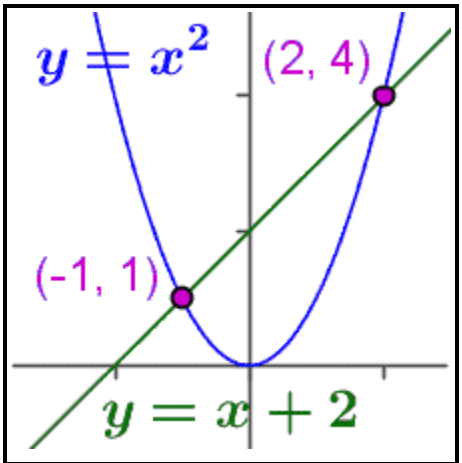
synthetic substitution NOUN /sɪn'θɛt.ɪk 'sʌb.stɪˌtu.ʃən/ an algorithm for finding the value of a polynomial given a particular value of the independent variable.

system NOUN /'sɪs.təm/ a set of objects that work together as a whole.

systematic ADJECTIVE /ˌsɪs.tə'mæt.ɪk/ being ordered and planned.

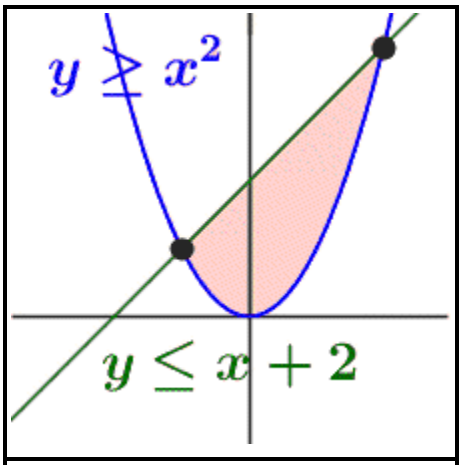
systematic sample NOUN /ˌsɪs.tə'mæt.ɪk 'sɑm.pəl/ a sample obtained by choosing every k^{th} member of a population. *Example:* choose every tenth person who walks through a door.

system of equations NOUN /'sɪs.təm ʌv ɪ'kweɪ.ʃənz/ a set of equations that are taken to be simultaneously true. *Synonym:* *simultaneous equations*.



System of Equations

system of inequalities NOUN /ˈsɪs.təm ʌv ˌɪn.ɪˈkwɒl.ɪt.iz/ a set of inequalities that are taken to be simultaneously true. *See also* *linear programming*.



System of Inequalities

Système international d'unités NOUN /ˈsis.təm ˌɪn.tərˈnæ.ʃə.nl ˈduˌni.teɪ/ International System of Units: an international convention for naming units of measure. *Example:* nanometer.

T

t ABBREVIATION metric ton or tonne (1000 kilograms).

T ABBREVIATION

1. ton (2000 pounds).
2. *See tera-* 10^{12}.

table NOUN /'teɪ.bəl/ a set of data organized in rows and columns. *Example:*

Table heading		
Column heading	**Column heading**	**Column heading**
cell	cell	cell
cell	cell	cell

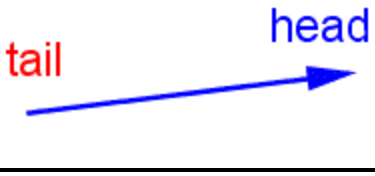
.

tabular ADJECTIVE /'tæb.yə.lər/

1. taking the form of a table.
2. placed in table form.

tabulate VERB /'tæb.yə.leɪt/ to organize into a table.

tail NOUN /teɪl/ where a vector starts; the end of a vector without an arrow.



Tail

take a logarithm VERB /teɪk eɪ 'lɔ.gəˌrɪð.əm/ find the value of a logarithm. *Example:* take the logarithm of 2.

take a root VERB /teɪk eɪ rut/ find a root of a number. *Example:* take the square root of 2.

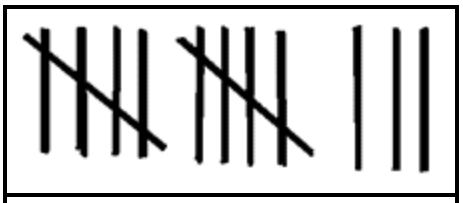
take away VERB /teɪk ə'weɪ/ subtract. *Example:* $5 \text{ take away } 2 = 5 - 2$.

tally /'tæl.i/

1. VERB to count using a tally table or tally marks.

2. NOUN a completed set of tally marks. *Example:* “That tallies to $147.”.
3. NOUN a total.

tally mark NOUN /'tæl.i mɑrk/ a mark used to count. *Synonym: hash mark.*



Tally Marks

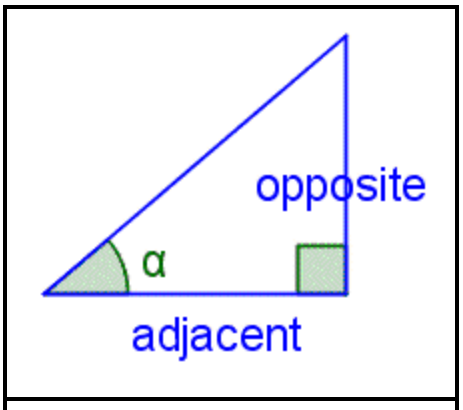
tally table NOUN /'tæl.i 'teɪ.bəl/ a set of tally marks placed together.

tan ABBREVIATION *See tangent.*

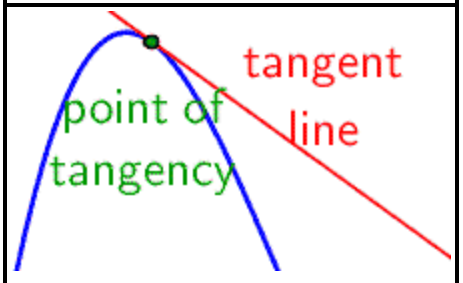
`tan()` COMPUTERS the tangent function in most computer languages.

tangent /'tæn.dʒənt/

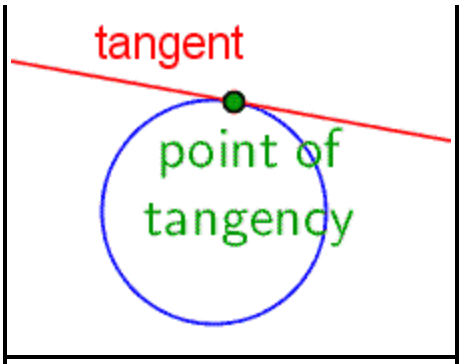
1. NOUN of a right triangle, the ratio of the length of the side opposite the angle divided by the length of the side adjacent to the angle. *Formula:*



Tangent



Tangent to a Curve



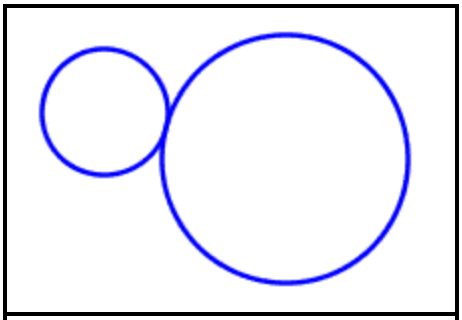
Tangent to a Circle

$$\text{tangent} = \frac{\text{opposite}}{\text{adjacent}} = \frac{\text{sine}}{\text{cosine}}.$$

Inverse: arctangent. See also GeoApp!.

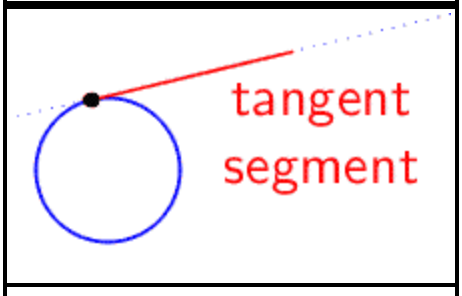
2. NOUN a line that touches a curve exactly once.
3. ADJECTIVE touching a circle exactly once. *See also GeoApp!.*

tangent circles NOUN /'tæn.dʒənt 'sɜr.kəlz/ circles that touch exactly once.



Tangent Circles

tangent segment NOUN /'tæn.dʒənt 'sɛg.mənt/ a line segment that is tangent to a circle where one endpoint of the segment is the point of tangency. *See also Parts of a Circle!.*



Tangent Segment

tangram NOUN /'tæn.græm/ a Chinese shape puzzle whose pieces can be put together to form different shapes. Traditional tangrams have seven pieces.

Tangram

tanh ABBREVIATION *See hyperbolic tangent.*

`tanh()` COMPUTERS the hyperbolic tangent function in most computer languages.

tape measure NOUN /tæp ˈmɛ.ʒər/ a strip of cloth or metal used to measure distance.

tare NOUN /tær/

1. packing material including the box.
2. the weight of packaging material including the box.

   Formula: gross weight – tare = net weight

   .

temperature NOUN /ˈtɛm.pər.ə.tʃər/ how hot or cold something is. *See also degree, definition 6.*

template NOUN /ˈtɛm.plɪt/ a pattern used as a guide in making something accurately.

ten ADJECTIVE, NOUN /tɛn/ the number 10. *Synonym: deka-.*

tend VERB /tɛnd/ to approach a certain value. *Example:* the function tends to zero.

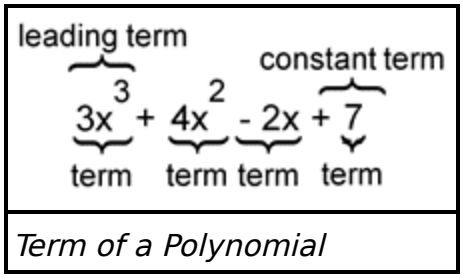
tendency NOUN /ˈtɛn.dən.si/ the likelihood of many systems to behave in a particular way.

tenth ADJECTIVE, NOUN /tɛnθ/

1. one of ten equal parts (1/10). *Synonym: deci-.*
2. coming in position 10 in an ordered list. *Notation:* 10^{th}.

tera- PREFIX /ˈtɛr.ə/ 10^{12}. *Abbreviation: T.*
Example: 5 terameters $= 5 \times 10^{12}$ meters.
Synonym: trillion.

term NOUN /tɜrm/
1. (of a polynomial) a coefficient and zero or more variables multiplied together that are separated from any other terms by addition or subtraction.
2. (of a sequence) a number in a sequence.
3. (in a proof) a concept used in the proof that may or may not be defined.

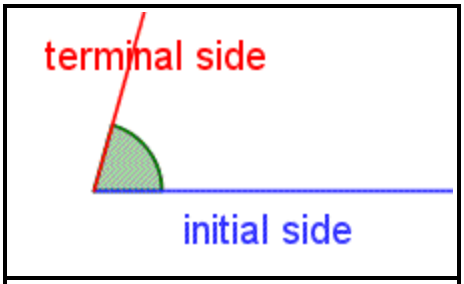


Term of a Polynomial

terminal ADJECTIVE /ˈtɜr.mə.nl/ having to do with an end.

terminal line NOUN /ˈtɜr.mə.nl laɪn/ *See terminal side.*

terminal side NOUN /ˈtɜr.mə.nl saɪd/ the second of two rays or line segments that define an angle. *Antonym: initial side.*



Terminal Side

terminate VERB /ˈtɜr.məˌneɪt/
1. to come to an end.
2. to cause to come to an end.

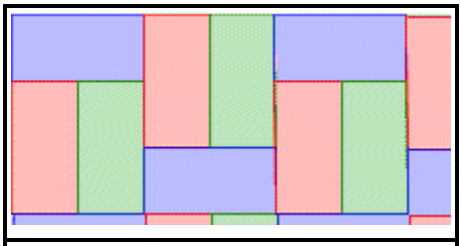
terminating ADJECTIVE /ˈtɜr.məˌneɪt.iŋ/ having the property of ending. *Example:* terminating decimal. *Antonym: nonterminating.*

terminating decimal NOUN /ˈtɜr.məˌneɪt.iŋ ˈdɛs.ə.məl/ a decimal that has a last digit. *Example:* 3.52. *Antonym: nonterminating decimal.*

ternary ADJECTIVE /ˈtɜr.nər.i/ having to do with the number 3.

ternary numeration NOUN /ˈtɜr.nər.i ˌnum.əˈreɪ.ʃən/ a base three numeration system. *Example:* $201_3 = 2\times3^2 + 0\times3 + 1 = 18 + 0 + 1 = 19_{10}$.

tessellation NOUN /ˌtɛs.əˈleɪ.ʃən/ an arrangement of 2-dimensional geometric figures that completely fills a plane.



Tessellation

tesseract NOUN /ˈtɛs.əˌrækt/ the extension of a cube into four dimensions. *Synonym: hypercube.*

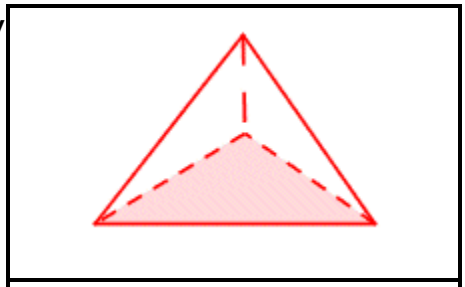
test /tɛst/

1. VERB to try something to see if it is true or valid.
2. NOUN a process used to try something, especially to see if knowledge has been acquired.

tetra- PREFIX /ˈtɛ.trə/ four.

tetragon NOUN /ˈtɛ.trə.gɒn/ *See quadrilateral.*

tetrahedron NOUN /ˌtɛ.trəˈhi.drən/ any polyhedron with four faces. All tetrahedra have four vertices. All tetrahedra have triangles for faces. *Plural: tetrahedra* /ˌtɛ.trəˈhi.drə/. *See also Net!.*



Tetrahedron

then ADVERB /ðɛn/ *See if ... then ...*.

theorem NOUN /ˈθɪər.əm/ a proposition that has been proved and generally accepted. *Example:* Pythagorean Theorem.

theoretical ADJECTIVE /ˌθi.əˈrɛt.ɪ.kəl/

1. having to do with a theory.
2. calculated, *not* measured.
3. based on theory, *not* experiment. *Example:* theoretical probability.

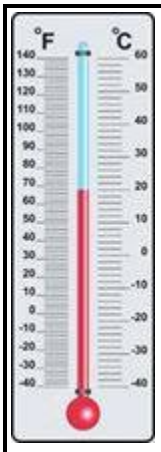
Antonyms: anecdotal, empirical, observational.

theoretical probability NOUN /ˌθi.əˈrɛt.ɪ.kəl ˌprɒb.əˈbɪl.ɪ.ti/ a probability based on theory, and *not* on experimentation. *Antonym: experimental probability.*

theory NOUN /ˈθɪər.i/ a collection of axioms, definitions and theorems. *Example:* set theory.

therefore ADVERB /ˈðɛərˌfɔr/ it can be concluded that; the preceding arguments lead to the following conclusion. *Notation:* ∴.

thermometer NOUN /ˌðərˈmɒm.ə.tər/ a device used to measure temperature.



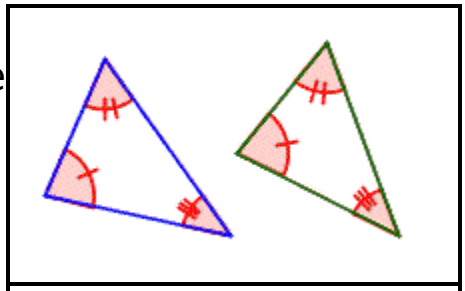
Thermometer

theta SYMBOL /ˈðeɪ.tə/ the Greek letter θ, often used as a variable for angles.

third ADJECTIVE /θɜrd/

1. coming in position 3 in an ordered list. *Notation:* 3^{rd}.
2. one of three equal parts, 1/3.

third angle theorem NOUN /θɜrd ˈæŋ.gəl ˈθɪər.əm/ if two angles of one triangle are congruent to two angles of a second triangle, then the third angles of the triangles are also congruent.


Third Angle Theorem

third power NOUN /θɜrd ˈpaʊ.ərz/ exponent of 3. *Example:* x^3. *Antonym: cube, definition 2.*

thirteen ADJECTIVE, NOUN /θɜrˈtin/ the number 13.

thirty ADJECTIVE, NOUN /ˈθɜr.ti/ the number 30.

thousand ADJECTIVE, NOUN /ˈθaʊ.zənd/ 1000. *Synonym: kilo-.*

thousands separator NOUN /ˈθaʊ.zəndz ˈsɛp.əˌreɪ.tər/ either a comma ',' or a period '.' used to divide large numbers into groups of three. The comma, called a comma separator, is used in U.S., Canada, England, and most of Asia. The period is used in most of Europe. *Example:* $1,325,602$.

thousandth ADJECTIVE, NOUN /ˈθaʊ.zəndθ/

1. coming in position 1000 in an ordered list.

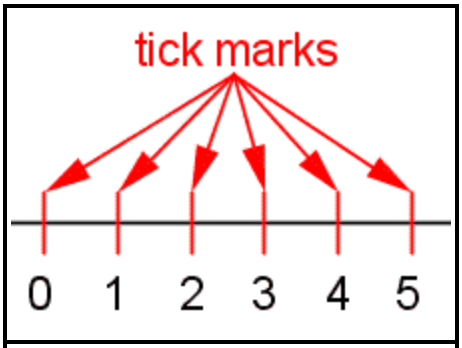
   Notation: 1000^{th}.
2. one of one thousand equal parts (1/1000).
   Synonym: milli-.

three ADJECTIVE, NOUN /θri/ the number 3.

three dimensional ADJECTIVE /θri dɪˈmɛn.ʃə.nl/ having three dimensions, usually length, width and height. *Abbreviation: 3-D. Example:* solids are three dimensional.

three space NOUN /θri speɪs/ *See 3-space.*

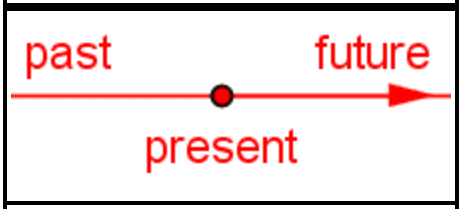
tick mark NOUN /tɪk mɑrk/ a short line segment used to show the position of values on a number line or axis.



Tick Marks

time NOUN /taɪm/

1. the sequence of past, present and future.
2. an interval of time between two events. *Example:* 15 seconds.
3. time of day. *Example:* 1:00 PM.



Time

time interval NOUN /taɪm ˈɪn.tər.vəl/ the time that passes between two events. *Synonym: time period.*

timeline NOUN /'taɪm.laɪn/ a set of events marked on a line showing order in which things happen.

time period NOUN /taɪm 'pɪər.i.əd/ a specific time interval. *Example:* second. *Synonyms: period of time, time interval.*

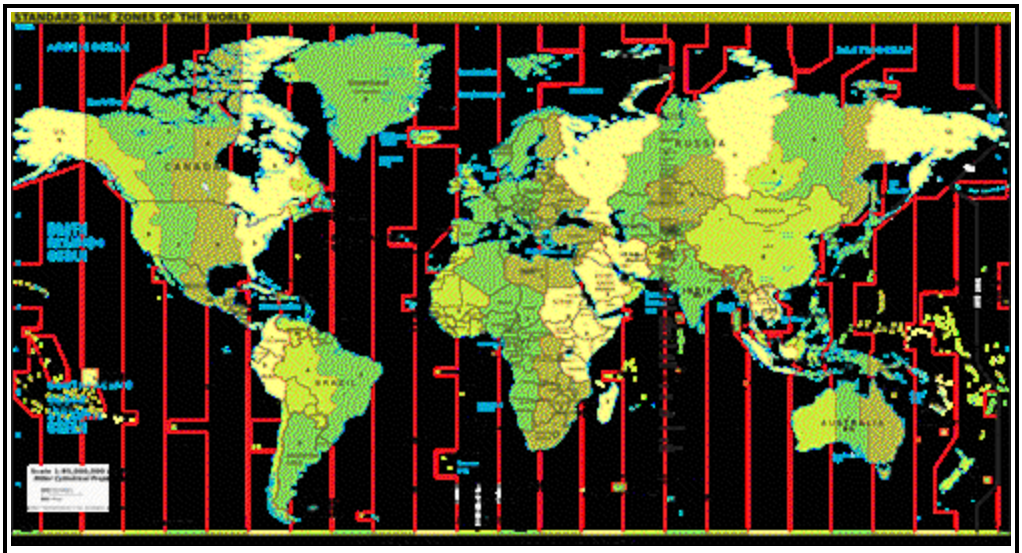
times PREPOSITION /taɪmz/

1. multiplied by. *Notations:* ·, ×. *Example:* 3 times 5 equals 15.
2. occurs more than once.

times table NOUN /taɪmz 'teɪ.bəl/ a table containing integers and their products. *See Multiplication Facts.*

time table NOUN /taɪm 'teɪ.bəl/ a table showing the times of events, such as a bus schedule.

time zone NOUN /taɪm zoʊn/ a region throughout which the same standard time is used.



Time Zones

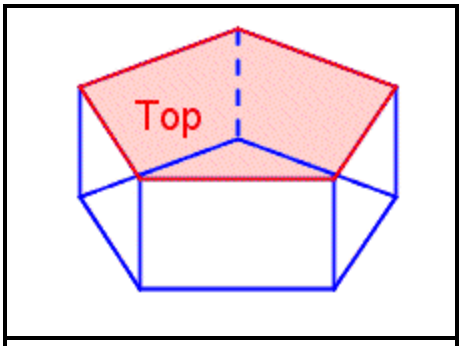
tolerance NOUN /'tɑl.ər.ɛns/ the maximum allowable error in a measurement.

ton NOUN /tʌn/ a unit of measure of weight. *Abbreviation: T.*

Formulas: 1 ton = 2000 pounds,
1 ton ≈ .908 metric tons.

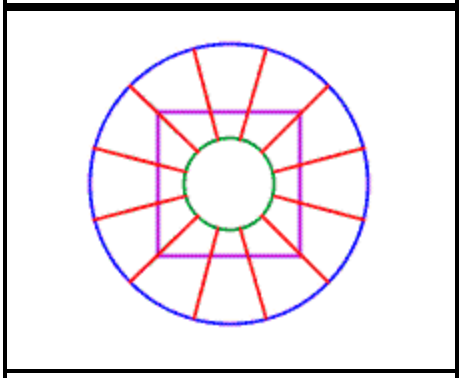
tonne NOUN /tʌn/ a unit of measure of mass. *Abbreviation:* *t*.
Formulas: 1 tonne = 1 metric ton,
1 tonne = 1000 kg, 1 tonne ≈ 1.1 tons.
Synonym: *metric ton*.

top NOUN /tɔp/ the upper surface of a geometric figure.



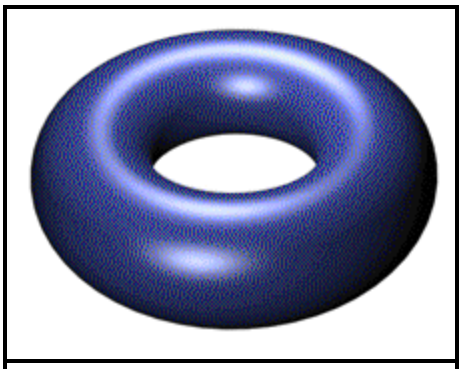
Top

topology NOUN /tɔˈpɒ.lə.dʒi/ the study of how points are connected together. The study of the properties of the deformation of shapes that do *not* involve cutting or gluing.


Topology

top view NOUN /tɔp vyu/ a 2-dimensional figure showing a 3-dimensional object as viewed from the top.

torus NOUN /ˈtɔr.əs/ a doughnut shaped solid.


Torus

toss a coin VERB /tɒs eɪ kɔɪn/ *See* *flip a coin*.

total /ˈtoʊt.l/

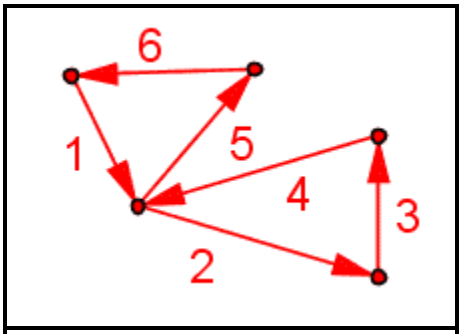
1. VERB to add a list of numbers. Keyword for addition.

2. NOUN the result of adding a list of numbers. *Example:* the total of 5, 3, and 7 is 15. *Synonym: sum.*
3. NOUN all.

to the nth power PREPOSITION /tu ðə ɛnθ 'paʊ.ər/ raised to an exponent. *Example:* 4 to the fifth power is $4^5 = 4 \cdot 4 \cdot 4 \cdot 4 \cdot 4 = 1024$. *See also exponent.*

trace VERB /treɪs/ to move along a curve.

traceable network NOUN /'treɪ.sə.bəl 'nɛtˌwɜrk/ a network graph that can be traced in one continuous path without retracing any edge. A graph is traceable if it has all even nodes or exactly two even nodes with the rest of the nodes odd.



Traceable Network

trajectory NOUN /trə'dʒɛk.tər.i/ the path of an object as it moves through space.

trans- PREFIX /træns/
1. across. *Example:* transfinite number.
2. through.

transcendental ADJECTIVE /ˌtræn.sɛn'dɛn.tl/ not algebraic; having to do with something other than addition, subtraction, multiplication, division or the taking of roots.

transcendental equation NOUN /ˌtræn.sɛn'dɛn.tl ɪ'kweɪ.ʒən/ an equation that is *not* an algebraic equation; an equation that has operations other than addition, subtraction, multiplication, division or the taking of roots.

transcendental function NOUN /ˌtræn.sɛn'dɛn.tl 'fʌŋk.ʃən/ a function that is *not* an algebraic function; a function that has operations other than addition, subtraction, multiplication, division or the taking of roots.

transcendental number NOUN /ˌtræn.sɛn'dɛn.tl 'nʌm.bər/ a number that is *not* an algebraic number; a number that can not be a root of a real-valued polynomial with rational coefficients. *Antonym: algebraic number.*

transfinite number NOUN /træns'faɪ.naɪt 'nʌm.bər/ a number that can be finite or infinite; a real number or positive or negative infinity.

transform VERB /træns'fɔrm/ change from one form to another, usually by a rule. *Example:* a translation is a geometric transformation that moves a figure without changing the orientation or size. *Synonym: convert.*

transformation NOUN /'træns.fərˌmeɪ.ʃən/

1. a rule for changing the form of an object.
2. the act of changing the form an object.

transformational ADJECTIVE /ˌtræns.fər'meɪ.ʃə.nl/ having to do with transformations. *Example:* transformational geometry.

transformational geometry NOUN /ˌtræns.fər'meɪ.ʃə.nl dʒi'ɒ.mɪ.tri/ a branch of geometry that deals with transformations such as translation, reflection, or rotation.

transformational motion NOUN /ˌtræns.fər'meɪ.ʃə.nl 'moʊ.ʃən/ a motion generated by a transformation such as translation, reflection, or rotation

transformational proof NOUN /ˌtræns.fər'meɪ.ʃə.nl pruf/ a proof that uses geometric transformations.

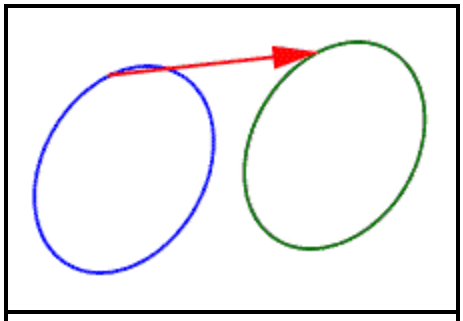
transitive ADJECTIVE /'træn.zɪ.tɪv/ if two objects are related to a third object, then they are related to each other. *Math definition:* relation R is transitive if and only if $a\mathrm{R}b$ and $b\mathrm{R}c$ imply $a\mathrm{R}c$. *Example:* if $a = b$ and $b = c$, then $a = c$.

Transitive Property of Equality NOUN /ˈtræn.zɪ.tɪv ˈprɒ.pər.ti ʌv ɪˈkwɒl.ɪ.ti/ if two numbers are equal to a third number, then they are equal to each other. *Math definition:* if $a = b$ and $b = c$, then $a = c$.

Transitive Property of Inequality NOUN /ˈtræn.zɪ.tɪv ˈprɒ.pər.ti ʌv ˌɪn.ɪˈkwɒl.ɪ.ti/ if one number is less than a second, and the second is less than a third, then the first is also less than the third. *Math definition:* if $a < b$ and $b < c$ then $a < c$. If $a > b$ and $b > c$ then $a > c$.

translation NOUN /trænzˈleɪ.ʃən/

1. (geometry) a transformation where each point of an object is moved a particular direction and distance. *Synonyms: glide, slide.*
2. (rectangular coordinate system) where the axes in a rectangular coordinate system are moved a certain distance and direction.



Translation

translational ADJECTIVE /trænzˈleɪ.ʃə.nl/ having to do with a translation; having to do with moving an object a certain direction and distance. *Example:* translational symmetry.

translational symmetry NOUN /trænzˈleɪ.ʃə.nl ˈsɪm.ɪ.tri/ a translation exists that will place one object exactly on top of another so that all points of both objects coincide.

translation of axes NOUN /trænzˈleɪ.ʃən ʌv ˈæk.siz/ exchange of the axes in a coordinate system while leaving the objects in that system unmoved. *Example:* translate the x and y axes.

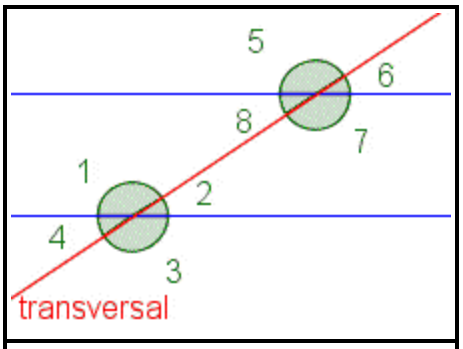
transpose VERB /trænsˈpoʊz/ to cause to exchange places.

transpose a matrix VERB /trænsˈpoʊz eɪ ˈmeɪ.trɪks/ *See matrix transposition.*

transposition NOUN /ˌtræns.pəˈzɪ.ʃən/

1. a process of exchanging places.
2. the result of changing places.

transversal NOUN /trænz'vɜr.səl/ a line that intersects two other lines.



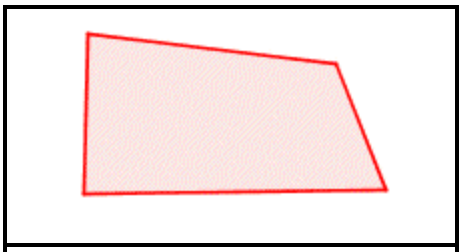
Transversal

transverse axis NOUN /trænz'vɜrs 'æk.sɪs/ the major axis of an ellipse or a hyperbola that passes through the foci.

transversed line NOUN /trænz'vɜrsd laɪn/ a line through which a transversal passes.

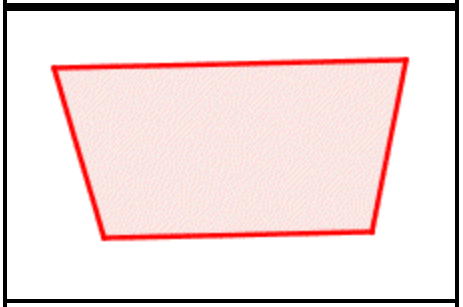
trapezium NOUN /trə'pi.zi.əm/

1. (British English) *See trapezoid.*
2. (American English) a quadrilateral with no sides that are parallel.



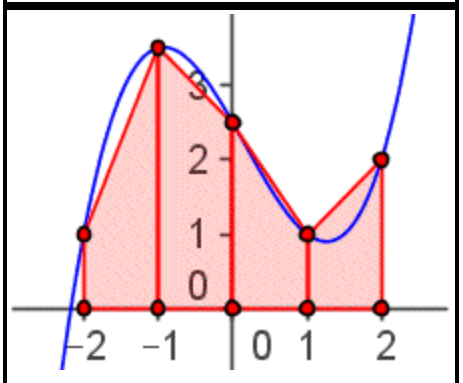
Trapezium

trapezoid NOUN /'træ.pəˌzɔɪd/ (American English) a four sided polygon where exactly one pair of opposite sides are parallel. *Synonym: trapezium* (British English) /trə'pi.zi.əm/.



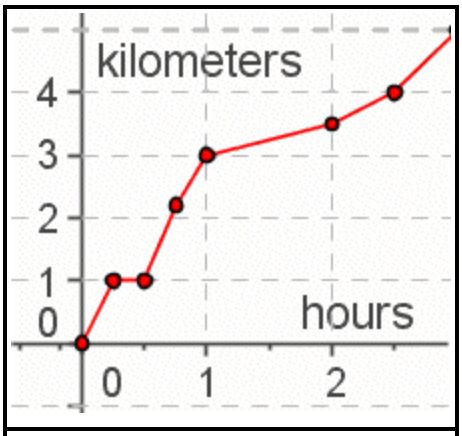
Trapezoid

trapezoidal rule NOUN /'træ.pəˌzɔɪ.dl rul/ an algorithm for estimating the area under a curve. Trapezoids are drawn using points on a curve and the areas of the trapezoids are added together.



Trapezoidal Rule

travel graph NOUN /'træv.əl græf/ a graph showing the relationship between distance and time traveled.

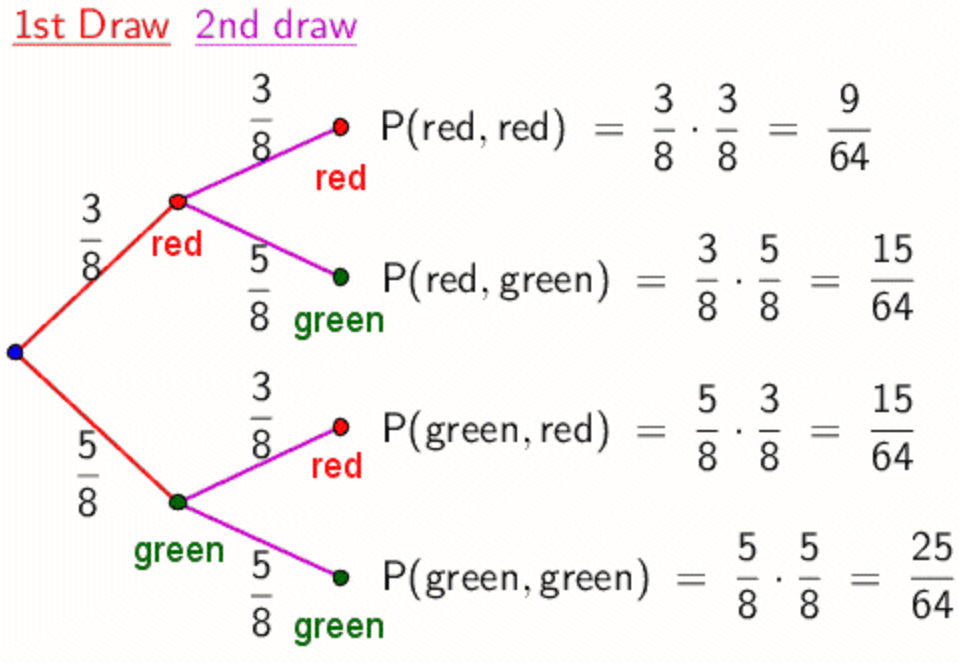


Travel Graph

traversable ADJECTIVE /'træv.ər.sə.bl/ a figure is traversable if the edges can be traced without lifting the pencil from the paper and without going over any part more than once.

treble NOUN /'trɛ.bl/ *See triple.*

tree diagram NOUN /tri 'daɪ.ə.græm/ a diagram starting with all possibilities and diagramming all possible combinations. *Example:* Two balls are selected with replacement at random from three red balls and five green balls.



Tree Diagram

trend /trɛnd/

1. NOUN the general direction of a variable over time.
2. VERB to tend to go in a particular direction.

trend line NOUN /trɛnd laɪn/ a line on a graph showing the direction and proportion of a trend.

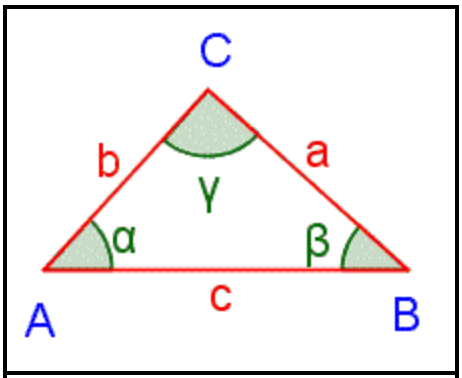
tri- PREFIX /traɪ/ three

trial NOUN /'traɪ.l/

1. one of a series of duplicate experiments. *Example:* one flip of a coin is a trial.
2. an attempt to accomplish a result.

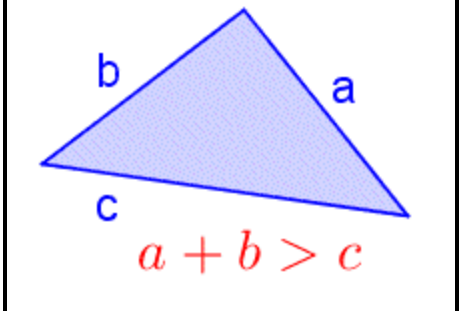
trial and error IDIOM /'traɪ.l ænd 'ɛr.ər/ trying something and, if it doesn't work, trying something else. *Synonym: guess and check.*

triangle NOUN /'traɪˌæŋ.gəl/ a three sided polygon. *See also GeoApp!.*



Triangle

Triangle Inequality Theorem NOUN /'traɪˌæŋ.gəl ˌɪn.ɪ'kwɒl.ɪ.ti 'θɪər.əm/ the sum of the lengths of any two sides of a triangle is greater than the length of the remaining side.



Triangle Inequality Theorem

Triangle Sum Theorem NOUN /'traɪˌæŋ.gəl sʌm 'θɪər.əm/ *See Angle Sum Theorem. See also GeoApp!.*

triangular ADJECTIVE /traɪ'æŋ.gyə.lər/

1. having to do with a triangle. *Example:* triangular number.
2. shaped like a triangle. *Example:* triangular matrix.

3. containing a triangle. *Example:* triangular prism.

triangular matrix NOUN
/traɪ'æŋ.gyə.lər 'meɪ.trɪks/ one of an upper triangular matrix or a lower triangular matrix. An upper triangular matrix has all zeros above and to the right of the main diagonal. A lower triangular matrix has all zeros below and to the left of the main diagonal. *Plural: triangular matrices* /traɪ'æŋ.gyə.lər 'meɪ.trɪˌsiz/.

$$\begin{bmatrix} 3 & -1 & 2 \\ 2 & 1 & 0 \\ -2 & 0 & 0 \end{bmatrix}$$

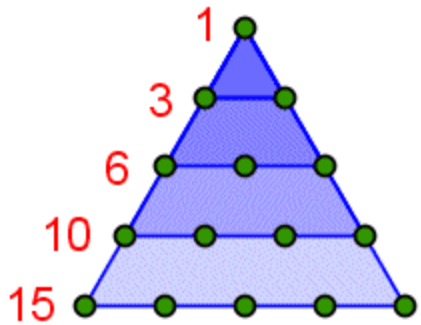
Upper Triangular Matrix

$$\begin{bmatrix} 3 & -1 & 2 \\ 0 & 2 & 1 \\ 0 & 0 & -2 \end{bmatrix}$$

Lower Triangular Matrix

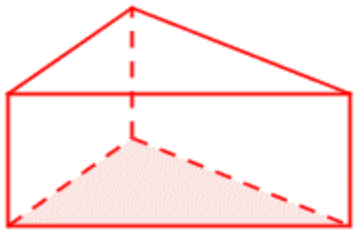
triangular number NOUN
/traɪ'æŋ.gyə.lər 'nʌm.bər/ one of the numbers $1, 3, 6, 10, \ldots$ that can be drawn as points in a triangle. *Formula:*

$$T_n = \frac{n(n-1)}{2}, \quad n > 0.$$



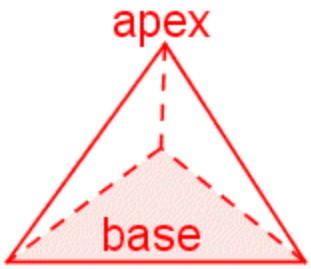
Triangular Number

triangular prism NOUN
/traɪ'æŋ.gyə.lər 'prɪz.əm/ a polyhedron whose bases are congruent triangles and whose sides are rectangles.



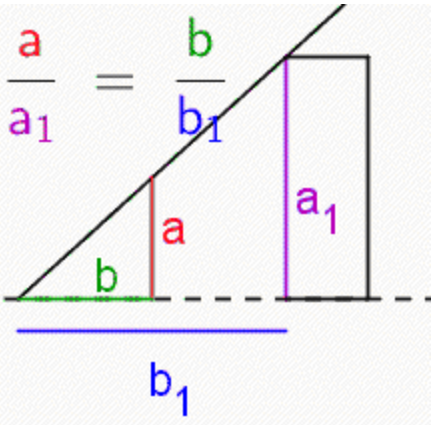
Triangular Prism

triangular pyramid NOUN /traɪ'æŋ.gyə.lər 'pɪr.ə.mɪd/ a polyhedron with a base that is a triangle and sides that are isosceles triangles that come to a point.



Triangular Pyramid

triangulation NOUN /traɪ'æŋ.gyə.leɪ.ʃən/ a method of measuring objects indirectly using similar triangles and ratios.



Triangulation

trichotomy NOUN /traɪ'kɒ.tə.mi/ a division into three parts.

Trichotomy Property of Real Numbers NOUN /traɪ'kɒ.tə.mi 'prɒ.pər.ti ʌv 'riəl 'nʌm.bərz/ for any two real numbers a and b, exactly one of the following is true: $a < b$, $a = b$ or $a > b$.

trigonometric ADJECTIVE /ˌtrɪg.ə.nə'mɛ.trɪk/ having to do with trigonometry.

trigonometric equation NOUN /ˌtrɪg.ə.nə'mɛ.trɪk ɪ'kweɪ.ʒən/ an equation that contains one or more trigonometric functions. *Example:* $y = \sin(x)$.

trigonometric function NOUN /ˌtrɪg.ə.nə'mɛ.trɪk 'fʌŋk.ʃən/

1. one of the functions sine, cosine, tangent, secant, cosecant and cotangent.
2. a function based on trigonometric relationships. *Example:* $f(x) = cos(x)$.

Synonym: circular function.

trigonometric identity NOUN /ˌtrɪg.ə.nəˈmɛ.trɪk aɪˈdɛn.tɪ.ti/ a trigonometric equation that is true for all values of the variables. *Example:* $\sin^2\theta + \cos^2\theta = 1$. *See also Trigonometric Identities.*

trigonometric ratio NOUN /ˌtrɪg.ə.nəˈmɛ.trɪk ˈreɪ.ʃoʊ/ a ratio of the lengths of two sides of a right triangle.

Trigonometric Values of Special Angles NOUN /ˌtrɪg.ə.nəˈmɛ.trɪk ˈvæl.yuz ʌv ˈspɛʃ.əl ˈæŋ.gəlz/ *See exact values of trigonometric functions.*

trigonometry NOUN /ˌtrɪ.gəˈnɒ.mɪ.tri/ the branch of mathematics that deals with right triangles, unit circles and the relationships between the sides and angles of right triangles.

trillion ADJECTIVE, NOUN /ˈtrɪl.yun/ $1{,}000{,}000{,}000{,}000 = 10^{12}$ (short scale). *Synonym: tera-.*

trillionth ADJECTIVE, NOUN /ˈtrɪl.yunθ/ 10^{-12} = 0.000000000001. *Synonym: pico-.*

trinomial /ˈtraɪ.noʊ.mi.l/

1. NOUN a polynomial with three terms. *Example:* $x + 3x^2y + y^3$.
2. ADJECTIVE containing a polynomial with three terms.

triple /ˈtrɪ.pəl/

1. NOUN three objects.
2. ADJECTIVE threefold; three times.
3. VERB to multiply by 3.

Synonym: treble.

trirectangular NOUN /traɪ.rɛkˈtæŋ.gyə.lər/ a spherical triangle with three right angles.

trisect VERB /traɪˈsɛkt/ to divide into three equal parts. *Example:* trisect an angle.

trisection NOUN /traɪ'sɛk.ʃən/ division into three equal parts.

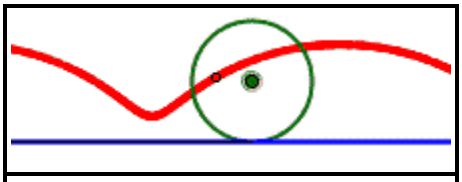
trivial ADJECTIVE /'trɪ.vi.əl/

1. immediately clear; obvious.
2. having to do with zero.

trivial solution NOUN /'trɪ.vi.əl soʊ'lu.ʃən/

1. a solution that is immediately obvious or uninteresting.
2. a solution of zero.

trochoid NOUN /'troʊ.kɔɪd/ the shape made when a point on a disk is traced as the disk rolls along a line. *See also cycloid.*



Trochoid

true ADJECTIVE /tru/

1. (Boolean algebra) one of two truth values. True is sometimes written 1. *See also truth value.*
2. (equations) both sides of the equation have the same value.
3. (logic) consistent with fact

Antonym: false.

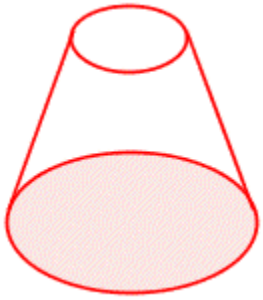
`trunc()` COMPUTERS the truncate function converts a floating point or decimal number to an integer in many computer languages.

truncate VERB /'trʌŋ.keɪt/

1. to shorten a number by dropping nonsignificant digits. *Example:* the number 3.5893 truncated to 3 significant digits is 3.58.
2. to remove part of a geometric object. *Example:* truncate a pyramid.

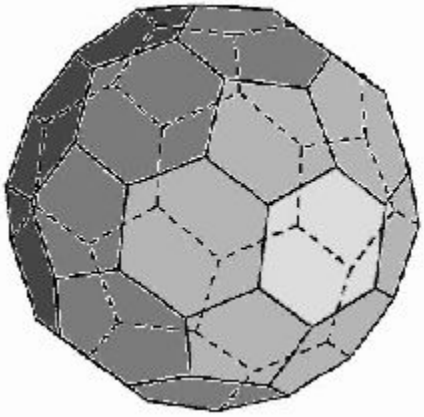
truncated ADJECTIVE /'trʌŋ.keɪ.td/ having part cut off. *Example:* truncated cone. *See also Net!.*

truncated cone NOUN /'trʌŋ.keɪ.td koʊn/ a cone with the top cut off, usually parallel to the base. *See also conical frustum.*



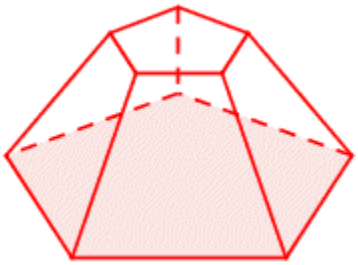
Truncated Cone

truncated icosahedron NOUN /ˈtrʌŋ.keɪ.td aɪˌkoʊ.səˈhid.rən/ a polyhedron with 12 regular pentagonal faces, 20 regular hexagonal faces, 60 vertices and 90 edges. *See also Net!.*



Truncated Icosahedron

truncated pyramid NOUN /ˈtrʌŋ.keɪ.td ˈpɪr.ə.mɪd/ a pyramid with the top cut off, usually parallel to the base. *See also Net!.*



Truncated Pyramid

truncation NOUN /ˈtrʌŋ.keɪt.ʃən/
1. the act of truncating.
2. having the property of being truncated.

truth NOUN /truθ/ a fact that has been verified.

truth table NOUN /truθ ˈteɪ.bəl/ a table showing the arguments and results of a Boolean operation. *Synonym: Boolean operation table.*

Exclusive Disjunction Truth Table		
P	Q	$P \oplus Q$
False	False	False
False	True	True
True	False	True
True	True	False

truth value NOUN /truθ 'væl.yu/ exactly one of true, false or unknown. *Example:* the truth value of $5=3$ is false. *Synonym: logical value.*

try VERB /traɪ/ to attempt.

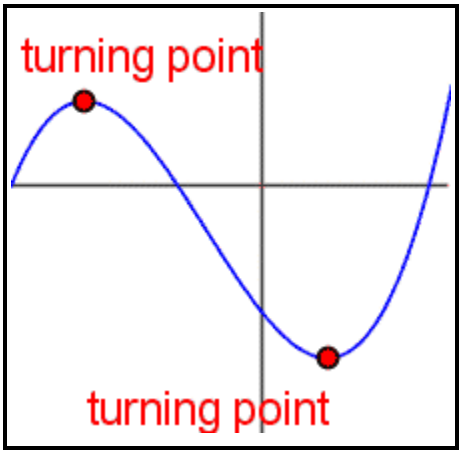
try, test, revise NOUN /traɪ tɛst rɪ'vaɪz/ a method for solving problems:

1. Try a solution.
2. Test the solution to see if it is valid.
3. Revise the solution and repeat.

turn /'tɜrn/

1. VERB to change direction.
2. VERB to rotate.
3. NOUN a rotation of 360 degrees; one full rotation.

turning point NOUN /'tɜr.nɪŋ pɔɪnt/ a point at which a graph changes vertical direction; a local minimum or a local maximum. *Synonyms: vertex, extremum.*



Turning Point

turning symmetry NOUN /ˈtɜr.nɪŋ ˈsɪm.ɪ.tri/ *See rotational symmetry.*

twelve ADJECTIVE, NOUN /twɛlv/ the number 12.

twelve hour time NOUN /twɛlv ˈaʊ.ər taɪm/ a notation for time that goes from 12:00 AM to 12:00 PM for the morning and from 12:00 PM to 12:00 AM for the afternoon and evening.

twenty ADJECTIVE, NOUN /ˈtwɛn.ti/ the number 20.

twenty-four hour time NOUN /ˈtwɛn.ti fɔr ˈaʊ.ər taɪm/ a notation for time that goes from 0000 (midnight) to 2355 (1 minute before midnight).

twice ADVERB /twaɪs/

1. two times. *Example:* turn the handle twice.
2. multiplied by two. *Example:* twice 3 is 6.

two ADJECTIVE, NOUN /tu/ the number 2.

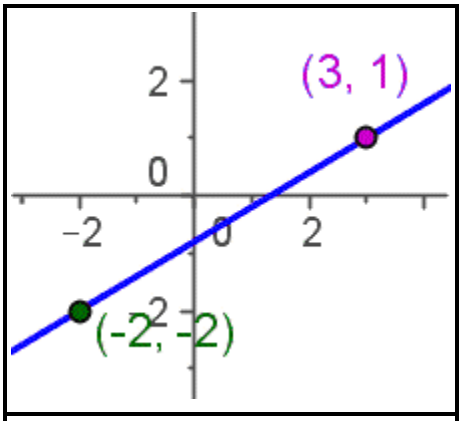
two column proof NOUN /tu ˈkɒl.əm pruf/ a notation for proofs in which statements are listed in one column and the justification of the statements in the other column.

two dimensional ADJECTIVE /tu dɪˈmɛn.ʃə.nl/ having two dimensions, usually length and width. *Abbreviation: 2-D.*

two point form NOUN /tu pɔɪnt fɔrm/ a linear equation in the form

$$y = \frac{y_2 - y_1}{x_2 - x_1}(x - x_1) + y_1$$

where (x_1, y_1) and (x_2, y_2) are any two distinct points on the line.



Two Point Form

two point perspective NOUN /tu pɔɪnt pərˈspɛk.tɪv/ a perspective drawing that uses two vanishing points.

two space NOUN /tu speɪs/ *See 2-space.*

two step equation NOUN /tu stɛp ɪˈkweɪ.ʒən/ an equation that takes two steps to solve. *Example:* $3x - 2 = 4 \rightarrow 3x = 6 \rightarrow x = 2$.

U

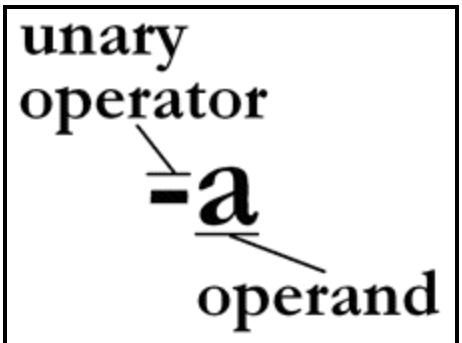
un- PREFIX /ʌn/ not

una- PREFIX /ˈyu.nə/ one

unary ADJECTIVE /ˈyu.nər.i/ having one. *Example:* unary operator.

unary operation NOUN /ˈyu.nər.i ˌɒ.pəˈreɪ.ʃən/ an operation that takes one operand. *Example:* $-x$.

unary operator NOUN /ˈyu.nər.i ˈɒ.pəˌreɪ.tər/ an operator having one operand. *Example:* negation.



Unary Operator

unbounded ADJECTIVE /ʌnˈbaʊn.dɪd/ having no end. *Example:* unbounded interval. *Synonym: infinite. Antonym: bounded.*

unbounded interval NOUN /ʌnˈbaʊn.dɪd ˈɪn.tər.vəl/ an interval that extends to negative infinity, positive infinity or both. *Examples:* $[3,\infty)$, (∞,∞). *Antonym: bounded interval.*

unchanged ADJECTIVE /ˈʌn.tʃeɪndʒd/ not made different.

uncountable ADJECTIVE /ʌnˈkaʊn.tə.bəl/ is infinite and does *not* have a one to one correspondence with the set of natural numbers. *Example:* the set of real numbers. *Synonym: nondenumerable. Antonyms: countable, denumerable.*

undefined ADJECTIVE /ˌʌn.dɪˈfaɪnd/

1. mathematically meaningless. *Example:* division by zero.

2. not having an explicit definition. *Example:* undefined term.

Antonym: defined.

undefined term NOUN /ˌʌn.dɪˈfaɪnd tɜrm/

1. a word or phrase that is described rather than defined.
2. a word or phrase whose definition is implied in axioms.

Examples: points, lines, planes. *Synonym: primitive.*

underestimate VERB /ˌʌn.dərˈɛs.tɪ.meɪt/

1. to estimate less than the actual value.
2. to intentionally estimate less than the actual value.

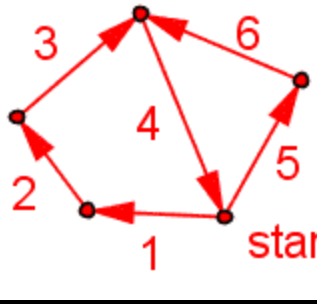
underrepresent VERB /ʌn.dərˌrɛp.rɪˈzɛnt/ to use less of a group or partition of a population in a sample than the actual proportion within the population being sampled.

undo VERB /ʌnˈdu/ to reverse the doing of.

unequal ADJECTIVE /ʌnˈi.kwəl/ not equal; not having the same value. *Notation:* ≠. *Antonym: equal.*

uni- PREFIX /ˈyu.nɪ/ one. *Example:* uniform (having one form).

unicursal ADJECTIVE /ˌyu.nəˈkər.səl/ a network graph for which a path exists that traces each edge exactly once.

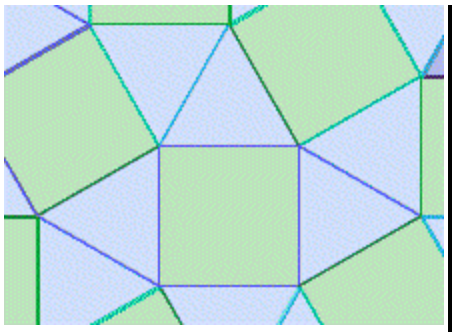


Unicursal

uniform ADJECTIVE /ˈyu.nəˌfɔrm/ the same throughout. *Example:* uniform tessellation.

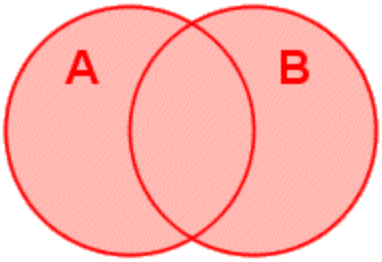
uniform cross section NOUN /ˈyu.nəˌfɔrm krɔs ˈsɛk.ʃən/ a cross section parallel to the base that is similar to the base.

uniform tessellation NOUN /ˈyu.nəˌfɔrm ˌtɛs.əˈleɪ.ʃən/ a tessellation that has the same combination of shapes and angles at each vertex.



Uniform Tessellation

union NOUN /'yun.yən/ a set containing all the members of two or more sets. *Notation:* $\cup$. *Math definition:* $A \cup B = \{x \mid x \in A \text{ or } x \in B\}$. *Synonym: join.*

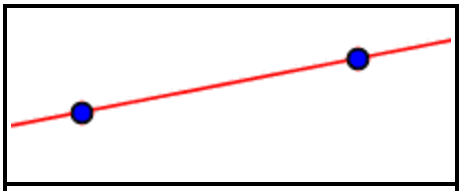


Union

unique ADJECTIVE /yu'nik/ there exists one and only one. *Example:* two points determine a unique line.

Unique Factorization Theorem NOUN /yu'nik fæk¸toʊr.i'zeɪ.ʃən 'θɪər.əm/ *See Fundamental Theorem of Arithmetic.*

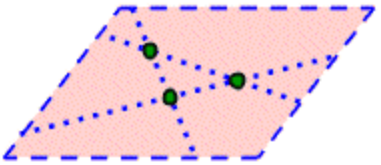
Unique Line Postulate NOUN /yu'nik laɪn 'pɒs.tʃə.lɪt/ through any two distinct points there is exactly one line.



Unique Line Postulate

uniqueness ADJECTIVE /yu'nik.nəs/ the property of being the only one.

Unique Plane Postulate NOUN /yu'nik pleɪn 'pɒs.tʃə.lɪt/ through any three non-collinear points there is exactly one plane; three points define a plane.



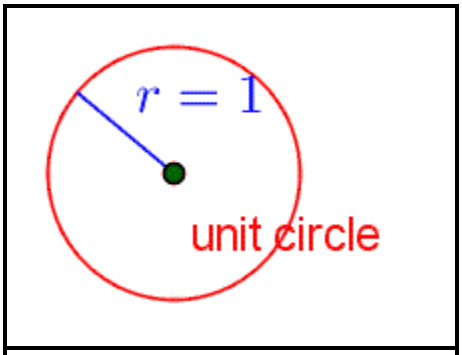
Unique Plane Postulate

unique solution NOUN /yu'nik soʊ'lu.ʃən/ a solution that is the only possible solution of a problem or linear system.

unit NOUN /'yu.nɪt/

1. one of something that is measured or counted. *Example:* meter.
2. one in any unit of measure. *Example:* unit conversion..
3. the number 1; the identity element. *Example:* unit circle.

unit circle NOUN /'yu.nɪt 'sɜr.kəl/ a circle with a radius of 1. *See also GeoApp!.*



Unit Circle

unit conversion NOUN /'yu.nɪt kən'vɜr.ʒən/ conversion from one unit of measure to a related unit of measure. *Example:* convert from meters to feet.

unit digit NOUN /'yu.nɪt 'dɪdʒ.ɪt/ the digit in the one's place; the whole digit with the smallest place value. *Example:* in the number 543.2, the unit digit is 3.

unit fraction NOUN /'yu.nɪt 'fræk.ʃən/ a fraction with a numerator of 1 and a denominator that is a positive integer. *Example:* $1/5$.

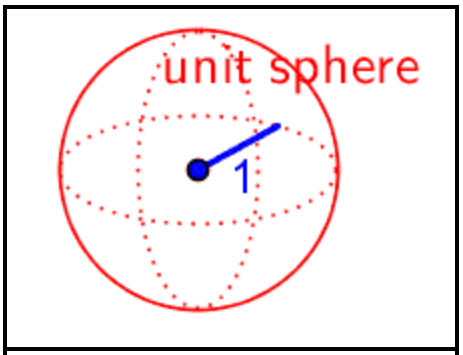
unit matrix NOUN /'yu.nɪt 'meɪ.trɪks/ *See identity matrix.*

unit of measure NOUN /'yu.nɪt ʌv 'mɛ.ʒər/ a meaning of 1 in a single dimension of a metric space. *Examples:* 'meter' is a unit of measure of distance, 'second' is a unit of measure of time.

unit price NOUN /'yu.nɪt praɪs/ the price for a single item. *Formula:* $\text{unit price} \times \text{quantity} = \text{extended price}$.

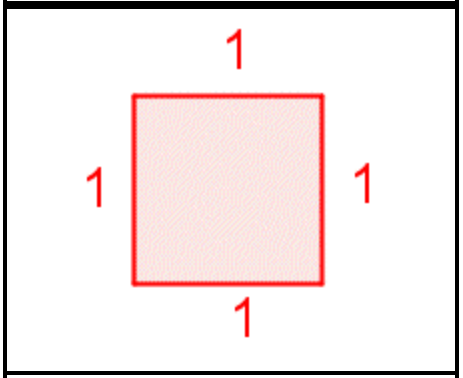
unit rate NOUN /ˈyu.nɪt ˈreɪt/
1. the price or cost for one item.
2. a rate with a denominator of 1.

unit sphere NOUN /ˈyu.nɪt sfɪər/ a sphere with a radius of 1.



Unit Sphere

unit square NOUN /ˈyu.nɪt skwɛər/ a square with sides that measure 1.



Unit Square

unit vector NOUN /ˈyu.nɪt ˈvɛk.tər/ a vector with a magnitude of 1.

unity NOUN /ˈyu.nɪ.ti/ any mathematical object defined as 1. *Example:* “Let the length of line segment l be unity.”.

universal ADJECTIVE /ˌyu.nəˈvɜr.səl/
1. containing everything. *Example:* universal set.
2. applying to everyone. *Example:* universal time.

universal set NOUN /ˌyu.nəˈvɜr.səl sɛt/ a set containing all members. The universal set is drawn as a box which contains all other drawings of sets.

universal time NOUN /ˌyu.nəˈvɜr.səl taɪm/ *See Greenwich Mean Time.*

unknown NOUN /ʌnˈnoʊn/ a quantity that has *not* been identified. *Antonym: known. See also variable.*

unknown value NOUN /ʌnˈnoʊn ˈvæl.yu/ *See unknown.*

unlike ADJECTIVE /ʌn'laɪk/ not similar to; having differences that are important. *Example:* unlike terms. *Antonym: like.*

unlike fractions NOUN /ʌn'laɪk 'fræk.ʃənz/ fractions that do not have the same denominator. *Example:* $\frac{3}{4}$ and $\frac{2}{3}$ are unlike fractions. *Antonym: like fractions.*

unlikely ADJECTIVE /ʌn'laɪk.li/ has a low probability of happening. *Example:* You are unlikely to get away with that. *Antonym: likely.*

unlike terms NOUN /ʌn'laɪk tɜrmz/ two terms of an expression that have different variables or different exponents on the variables. *Example:* $2x$ and $3x^2$ are unlike terms.. *Synonym: dissimilar terms. Antonym: like terms.*

unreasonable ADJECTIVE /ʌn'riz.nə.bəl/

1. showing a lack of reason. *Antonym: reasonable.*
2. not justified.

unsigned ADJECTIVE /ʌn'saɪnd/ not having a positive or negative sign. An unsigned number is assumed to be positive. *Antonym: signed.*

unsigned integer NOUN /ʌn'saɪnd 'ɪn.tɪ.dʒər/

1. (arithmetic) an integer without a '+' or '-' in front of it. Unsigned integers are assumed to be positive or zero.
2. (computers) an integer, variable or constant that can only take positive whole numbers or zero.

unsigned number NOUN /ʌn'saɪnd 'nʌm.bər/ a number that does *not* have a + or - in front of it. Unsigned numbers are assumed to be positive or zero. *Antonym: signed number.*

up ADVERB /'ʌp/

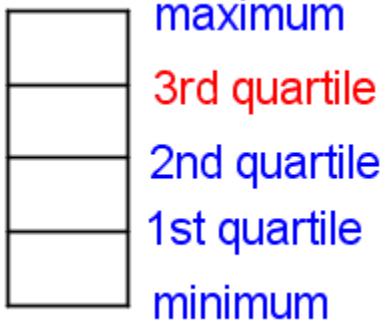
1. in a vertical direction moving away from the surface of the earth.
2. increasing.

upper ADJECTIVE /'ʌp.ər/ larger or higher. *Example:* upper extreme. *Antonym: lower.*

upper bound NOUN /'ʌp.ər baʊnd/ a value which is greater than or equal to all other values in a set. *Antonym: lower bound.*

upper extreme NOUN /'ʌp.ər ɪk'strim/ *See least upper bound.*

upper quartile NOUN /'ʌp.ər 'kwɔr.taɪl/ the 3rd quartile of a dataset. *See also quartile.*



Upper Quartile

upper triangular matrix NOUN /'ʌp.ər traɪ'æŋ.gyə.lər 'meɪ.trɪks/ a matrix having all zeros above and to the right of the main diagonal. *Plural: upper triangular matrices* /'ʌp.ər traɪ'æŋ.gyə.lər 'meɪ.trɪˌsiz/.

$$\begin{bmatrix} 3 & -1 & 2 \\ 2 & 1 & 0 \\ -2 & 0 & 0 \end{bmatrix}$$

Upper Triangular Matrix

US Customary Unit NOUN /yu es 'kʌs.təˌmɛr.i 'yu.nɪt/ one of the units of measure customarily used in the United States. *Examples:* foot, mile, gallon.

US Standard Units NOUN /yu es 'stæn.dərd 'yu.nɪtz/ *See US Customary Unit.*

V

V SYMBOL 5 in Roman numerals.

valid ADJECTIVE /'væl.ɪd/

1. well founded. *Example:* a valid reason.
2. justifiable. *Example:* a valid argument.

Antonym: invalid.

valid argument NOUN /'væl.ɪd 'ɑr.gyə.mənt/ an argument that can be justified based on axioms, definitions, constraints and previously proved theorems.

validate VERB /væ'lɪ.deɪt/

1. to find out if something is correctly inferred, deduced or calculated. *Example:* validate a claim.
2. to show that something is correctly inferred, deduced or calculated. *Example:* validate a solution.
3. to check one's work.

Synonyms: check, verify.

validity NOUN /və'lɪd.ɪ.ti/ the property of being correctly inferred or deduced.

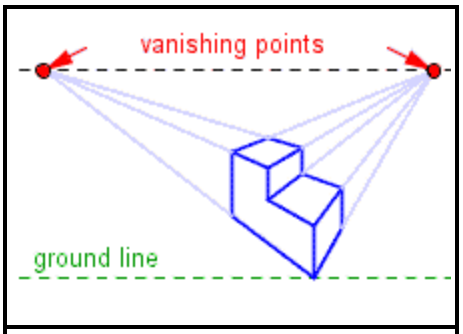
value NOUN /'væl.yu/

1. a number associated with a mathematical object. *Example:* the value of $3 + 5$ is 8.
2. (of a function) the output of a function associated with a particular input. *Example:* “the value of $f(x)$ when x is 2.”.
3. how much something is worth.

valued ADJECTIVE /'væl.yud/ having variables with a particular property. *Example:* real-valued equation.

vanish VERB /'væ.nɪʃ/ to disappear. *Example:* vanishing point.

vanishing point NOUN /ˈvæ.nɪ.ʃɪŋ pɔɪnt/ a point in a perspective view where a figure appears to vanish in the distance. *See also GeoApp!.*



Vanishing Point

variable NOUN /ˈvɛər.i.ə.bəl/
1. something that can assume any of a set of values.
2. a symbol representing a value that can assume any of a set of values.
3. a characteristic of a population being studied. *Examples:* age, gender.

Synonym: unknown.

variable expression NOUN /ˈvɛər.i.ə.bəl ɪkˈsprɛ.ʃən/ an expression that contains at least one variable.

variable of interest NOUN /ˈvɛər.i.ə.bəl ʌv ˈɪn.trɪst/ (statistics) a variable that is being examined.

variance NOUN /ˈvɛər.i.əns/ a measure of the spread of a dataset. The average of the squares of the deviations of the members of a dataset. Standard deviation is the square root of the variance. *Formula:*

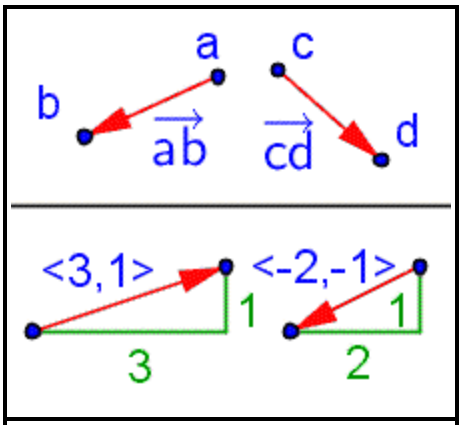
$$V = \frac{{d_1}^2 + {d_2}^2 + \cdots + {d_n}^2}{n}$$ where d_i is the deviation of the i^{th} item in the dataset. *Synonym: mean square deviation.*

variation NOUN /ˌvɛər.iˈeɪ.ʃən/ one of several types of functions with a constant of variation. *Formulas:* $y = ax$ is direct variation; $y = a/x$ is inverse variation, and $z = axy$ is joint variation. In each equation, a is the constant of variation.

vary VERB /'vɛər.i/
1. to change.
2. to differ one from another.

vector NOUN /'vɛk.tər/ a value having a magnitude (length) and a direction, but *not* a location.

Notations: $\overrightarrow{ab}$ (a vector from point a to point b), $<3,-4>$ (a vector with a horizontal component of 3 and a vertical component of -4), $<2,0,-1>$ (a vector with an x component of 2, a y component of 0 and a z component of -1). *See also GeoApp!.*

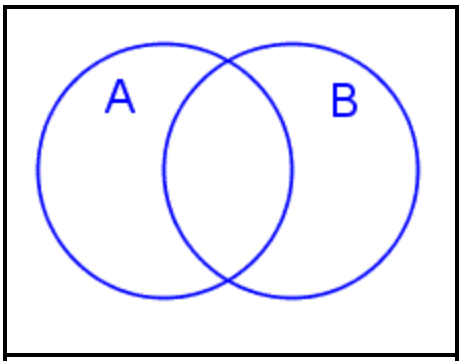


Vector

vector product NOUN /'vɛk.tər 'prɒ.dəkt/ *See cross product.*

velocity NOUN /və'lɒs.ɪ.ti/ speed in a certain direction. *For contrast, see speed.*

Venn diagram NOUN /vɛn 'daɪ.ə.græm/ a drawing used to represent operations on sets. The box represents the universal set and each circle represents a set.



Venn Diagram

Venn, John PERSON /vɛn dʒɒn/ (1834-1923) an English mathematician know for his work in logic.

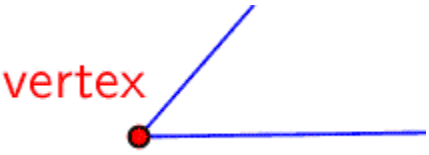
verbal phrase NOUN /'vər.bəl freɪs/ a set of words giving a math problem. *Example:* the quotient of a number divided by 3 plus 6.

verify VERB /'vɛr.ɪ.fi/ to check for validity or correctness. *Synonyms: check, validate, definition 3.*

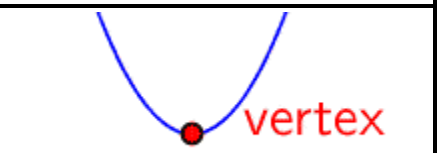
vertex NOUN /'vɜr.tɛks/

1. a point that is the endpoint of two or more non-collinear line segments or rays.
2. a turning point of a polynomial.
3. a point where the sides of a polygon meet.
4. a point where edges of a polyhedron intersect.
5. (graph) a point where two or more edges intersect.

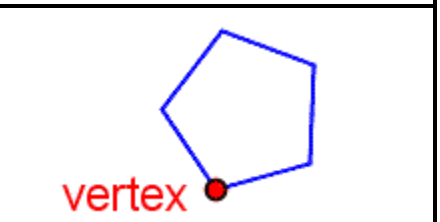
Plural: vertices. Synonym: node.



Vertex of an Angle

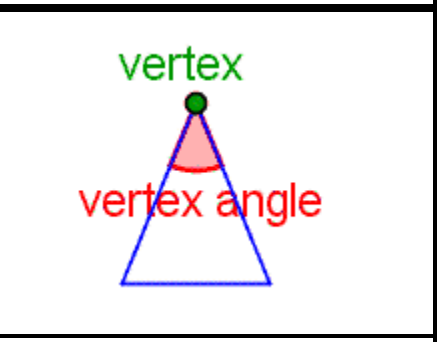


Vertex of a Parabola



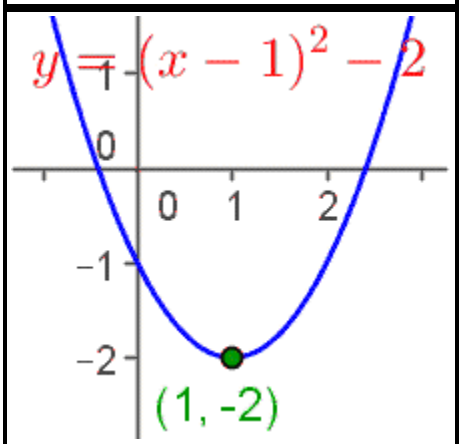
Vertex of a Polygon

vertex angle NOUN /ˈvɜr.tɛks ˈæŋ.gəl/ an interior angle at a vertex of an object.



Vertex Angle

vertex form NOUN /ˈvɜr.tɛks fɔrm/ (of a quadratic equation) $f(x) = a(x - x_0)^2 + y_0$ where (x_0,y_0) is the coordinate of the vertex of the parabola.

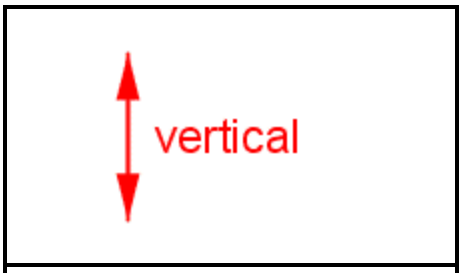


Vertex Form

vertical /ˈvɜr.tɪ.kəl/

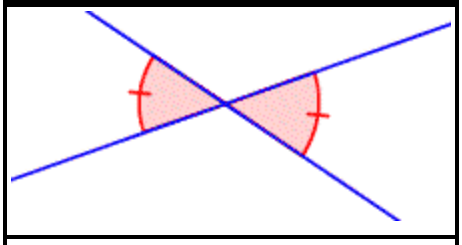
1. ADJECTIVE perpendicular to the horizon; straight up and down.
2. NOUN a line, line segment or ray that is vertical.

Antonym: horizontal.



Vertical

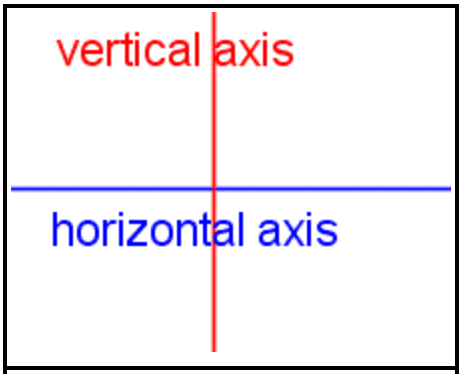
vertical angles NOUN /ˈvɜr.tɪ.kəl ˈæŋ.gəlz/ angles formed by two intersecting lines that are opposite each other.



Vertical Angles

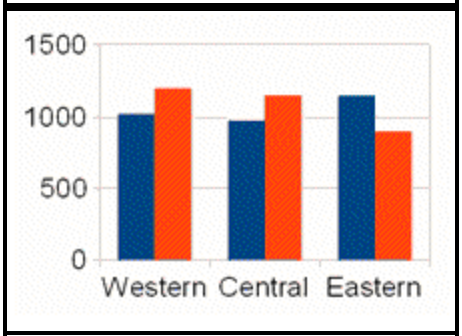
Vertical Angles Congruence Theorem NOUN /ˈvɜr.tɪ.kəl ˈæŋ.gəlz kənˈgru.əns ˈθɪər.əm/ vertical angles are congruent.

vertical axis NOUN /ˈvɜr.tɪ.kəl ˈæk.sɪs/ in a rectangular coordinate system, the axis that goes up and down.
Synonyms: y-axis, imaginary axis.
Antonym: horizontal axis.



Vertical Axis

vertical bar graph NOUN /ˈvɜr.tɪ.kəl bɑr græf/ a bar graph whose bars extend up and down.



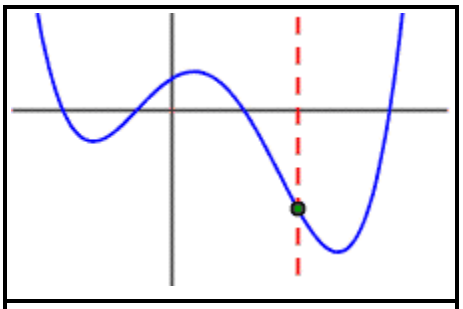
Vertical Bar Graph

vertical intercept NOUN /ˈvɜr.tɪ.kəl ˈɪn.tərˌsɛpt/ *See y-intercept.*

vertical line NOUN /ˈvɜr.tɪ.kəl laɪn/

1. a line that is perpendicular to the horizon.
2. a line that is parallel with the y-axis. *Equation:* $x = a$. *Example:* $x = 1.5$.

vertical line test NOUN /ˈvɜr.tɪ.kəl laɪn tɛst/ a way to see if a relation is a function: If all vertical lines in the domain of a relation cross the graph of the relation no more than once, then the relation is a function.



Vertical Line Test

view NOUN /vyu/ the direction from which a 3-dimensional object is drawn. *Examples:* front view, side view.

vinculum NOUN /ˈvɪŋ.kyə.ləm/ a line segment or brace drawn over a mathematical expression showing that they are to be considered together. *Example:* $\overline{a+b}$. *See also bar.*

visualize VERB /ˈvɪʒ.u.əˌlaɪz/ to form a mental image of. *Example:* visualize the problem.

vol ABBREVIATION *See volume.*

volume NOUN /ˈvɒl.yum/ the amount of space enclosed in a solid. *Abbreviation: vol. See also GeoApp!.*

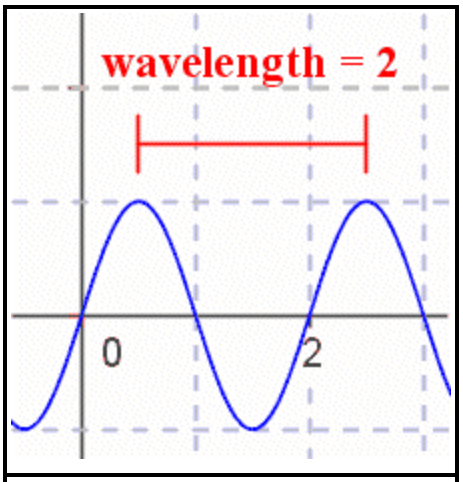
voluntary response sample NOUN /vɒl.ənˈtɪər.i riˈspɒns ˈsɑm.pəl/ *See self selected sample.*

vulgar fraction NOUN /ˈvəl.gər ˈfræk.ʃən/ *See common fraction.*

W

wave NOUN /ˈweɪv/ a periodic motion.

wavelength NOUN /ˈweɪvˌlɛŋkθ/ the distance from the crest to crest of a wave. *See also period.*



Wavelength

week NOUN /wik/ a period of time equaling seven days.

weight NOUN /weɪt/ a measure of the pull of gravity on an object. *Example:* an object on the moon weighs about 1/6 what the same object weighs on Earth.

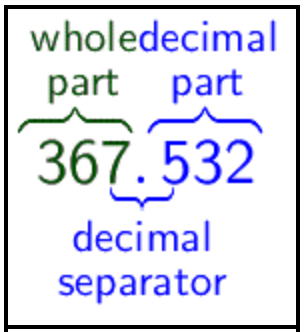
weighted average NOUN /ˈweɪ.td ˈæv.rɪdʒ/ an average where each item is assigned a weight, and the weights all sum to one. *Math definition:* the weighted average of $\{a_1,a_2, \ldots,a_n\}$ is $w_1a_1 + w_2a_2 + \ldots + w_na_n$ where $w_1+w_2+\ldots+w_n = 1$. *Example:* the weighted average of {1,3,5,7} where w_1=.1, w_2=.4, w_3=.2 and w_4=.3, is .1·1 + .4·3 + .2·5 + .3·7 = .1 + 1.2 + 1.0 + 2.1 = 3.4.

whole /hoʊl/

1. ADJECTIVE all of something. *Example:* the whole apple.
2. ADJECTIVE, NOUN something that is not divided into parts. *Example:* a whole number.

whole number NOUN /hoʊl ˈnʌm.bər/ the natural numbers and zero. *Notation:* $\mathbb{Z}^+$. *Math definition:* $\{0, 1, 2, \ldots\}$.

whole part NOUN /hoʊl pɑrt/ the digits to the left of the decimal separator. *Example:* in 52.627, the whole part is 52.

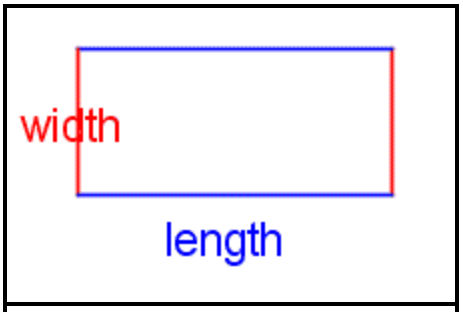


Whole Part

wholesale price NOUN /'hoʊl.seɪl praɪs/ a price a retailer pays for something. *Formula:* wholesale price + markup = retail price. *Synonym: cost.*

width NOUN /wɪdθ/

1. a measurement of distance at right angles to length.
2. the length of something from front to back.



Width

withholding tax NOUN /wɪθ'hɔl.dɪŋ tɑks/ a tax that is deducted from every paycheck.

with respect to IDIOM /wɪθ rɪ'spɛkt tu/ when compared to; when considered with. *Example:* distance with respect to time.

word phrase NOUN /wɜrd freɪs/ a math problem given in regular words. *Example:* Fred has three pencils. Alice has two pencils. How many pencils do they have all together?

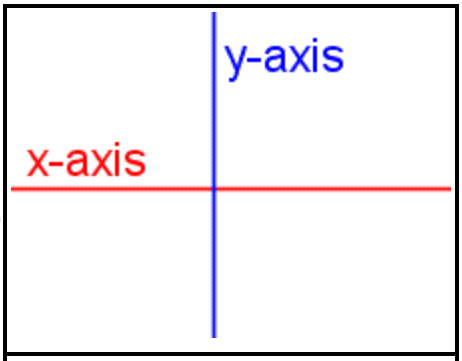
work backwards VERB /wərk 'bæk.wərdz/ to start at the end of a problem in order to solve it.

written form NOUN /'rɪt.ən fɔrm/ a number written out using letters. *Example:* 21 is written 'twenty-one'.

X

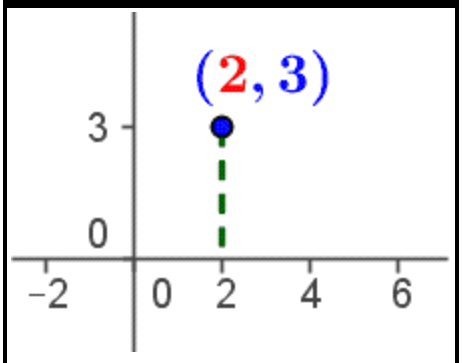
X SYMBOL 10 in Roman numerals.

x-axis NOUN /ɛks ˈæk.sɪs/ the horizontal axis in a 2-dimensional rectangular coordinate system. *Plural: x-axes* /ɛks ˈæk.siz/. *Synonym: axis of abscissas. See also GeoApp!.*



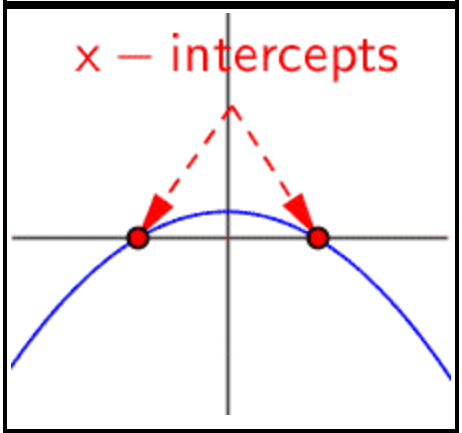
X-axis

x-coordinate NOUN /ɛks koʊˈɔr.dnɪt/ the coordinate corresponding to the x-axis. *See also GeoApp!, GeoApp!.*



X-coordinate

x-intercept NOUN /ɛks ˈɪn.tərˌsɛpt/ the value of x where a graph crosses the x-axis. *Synonym: horizontal intercept.*



X-intercept

xor NOUN /ˈɛks.ɔr/ *See exclusive disjunction.*

Y

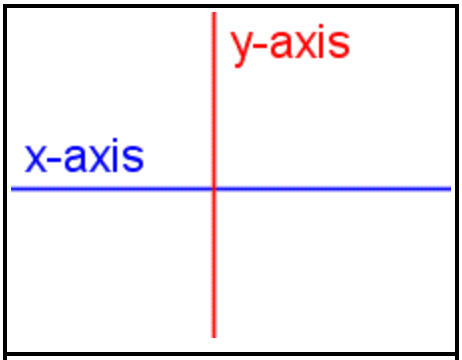
y ABBREVIATION yocto-

Y ABBREVIATION yotta-

yard NOUN /yɑrd/ a unit of measure of distance.

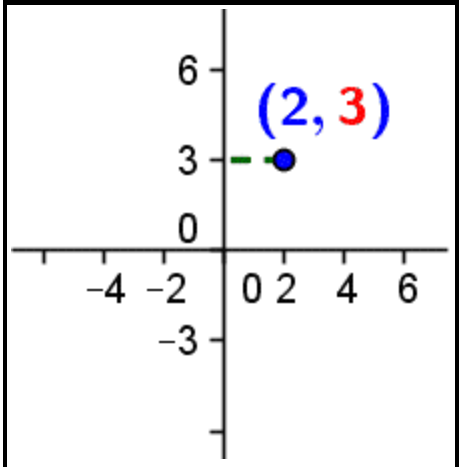
Abbreviation: yd. Formulas: 3 feet = 1 yard,
1760 yards = 1 mile,
1.08 yards ≈ 1 meter.

y-axis NOUN /waɪ ˈæk.sɪs/ the vertical axis of a 2-dimensional rectangular coordinate system. *Plural: y-axes* /waɪ ˈæk.siz/. *Synonym: axis of ordinates. See also GeoApp!.*



Y-axis

y-coordinate NOUN /waɪ koʊˈɔr.dnɪt/ a coordinate corresponding to the y-axis; an ordinate. *See also GeoApp!, GeoApp!.*



Y-coordinate

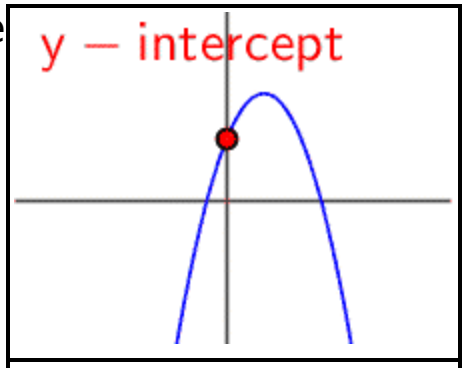
yd ABBREVIATION *See yard.*

year NOUN /yɪər/ a unit of measure of time equal to the time it takes for the Earth to rotate once around the sun. *Abbreviation: yr.*

Formulas: $100 \text{ years} = 1 \text{ century}$, $365¼ \text{ days} \approx 1 \text{ year}$.

yield NOUN, VERB /yild/ income received from an investment, often written as a percentage of the amount invested. *Example:* a bond yielding 5%.

y-intercept NOUN /waɪ ˈɪn.tərˌsɛpt/ the value of y at a point at which a graph crosses the y-axis. *Synonym: vertical intercept.*



Y-intercept

yocto- PREFIX /ˈyɑk.toʊ/ 10^{-24}. *Abbreviation: y.*

Format: $2.2 \text{ yoctometer} = 2.2 \times 10^{-24} \text{ meters}$.

Synonym: septillionth.

yotta- PREFIX /ˈyoʊ.tə/ 10^{24}. *Abbreviation: Y.*

Example: $5 \text{ yottameter} = 5 \times 10^{24} \text{ meters}$.

Synonym: septillion.

yr ABBREVIATION *See year.*

z

z ABBREVIATION zepto- (10^{-21}).

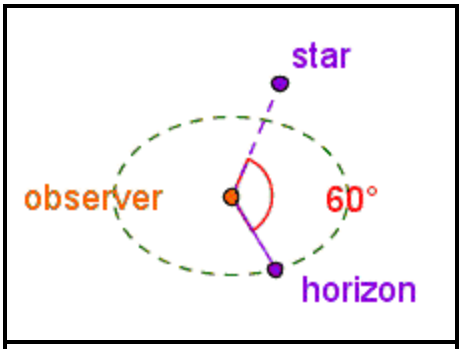
Z ABBREVIATION zeta- (10^{21})

$\mathbf{Z_n}$ SYMBOL an $n \times n$ zero matrix; an $n \times n$ matrix where all elements are zeroes.

z-axis NOUN /zi ˈæk.sɪs/ the vertical axis of a 3-dimensional rectangular coordinate system. *Plural: z-axes* /zi ˈæk.siz/.

z-coordinate NOUN /zi koʊˈɔr.dnɪt/ a coordinate corresponding to the z-axis.

zenith NOUN /ˈzi.nɪθ/ the angle above the horizon of an object in the sky. *See also azimuth.*



Zenith

Zeno's paradox NOUN /ˈzi.noʊz ˈpær.əˌdɔks/ Zeno's paradox claims it is impossible to travel a distance d because one must first travel a distance $d/2$, then $d/4$ and so on. It claims that since the sequence of distances is infinite, that it is impossible to every reach the distance of d. Since it *is* possible to travel a distance d, Zeno's paradox is false.

zepto- PREFIX /ˈzɜp.toʊ/ 10^{-21}. *Abbreviation: z.*

Example: 9 zeptometer $= 9 \times 10^{-21}$ meters.
Synonym: sextillionth.

Zermelo's Axiom of Choice NOUN /zɜr'mɛl.oʊz 'æk.si.əm ʌv tʃɔɪs/ an infinite set, such as the set of all even integers, can be created from other infinite sets, such as the set of all integers.

zero /'zɪər.oʊ/

1. NOUN the number representing nothing. *Synonym: null. Antonym: nonzero.*
2. NOUN the place-holder digit.
3. NOUN (of a function) any point where $f(x) = 0$ is a zero of $f(x)$.
4. ADJECTIVE equaling 0.

zero exponent NOUN /'zɪər.oʊ 'ɛks.poʊ.nənt/ anything to the zero power except zero equals one. *Example:* $b^0 = 1,\ b \neq 0$.

zero matrix NOUN /'zɪər.oʊ 'meɪ.trɪks/ a matrix that contains all zeros. *Notation:* Z_n. *Example:* a 3x3 zero matrix. *Plural: zero matrices* /'zɪər.oʊ 'meɪ.trɪˌsiz/. *Synonym: null matrix.*

$$Z_3 = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

3x3 Zero Matrix

zero pair NOUN /'zɪər.oʊ pɛər/ two values that, when added together, make zero. *Examples:* 5 and -5, a and $-a$.

zero power NOUN /'zɪər.oʊ 'paʊ.ər/ *See zero exponent.*

Zero Product Property NOUN /'zɪər.oʊ 'prɒ.dəkt 'prɒ.pər.ti/ *See 0, Property of Multiplication by.*

zero sum NOUN /'zɪər.oʊ sʌm/ a value plus its additive inverse equals 0. *Math definition:* $a + (-a) = 0$.

zero to the zero power NOUN /'zɪər.oʊ tu ðə 'zɪər.oʊ 'paʊ.ər/ 0^0 is undefined.

zero vector NOUN /'zɪər.oʊ 'vɛk.tər/ a vector containing all zeros. *Example:* $<0,0>$. *Synonym: null vector.*

zetta- PREFIX /ˈzə.tə/ 10^{21}. *Abbreviation: Z.*

Example: 5 zettameter $= 5 \times 10^{21}$ meters.

z-intercept NOUN /zi ˈɪn.tərˌsɛpt/ the value of *Z* where a graph crosses the z-axis.

zone NOUN /zoʊn/

1. part of a geometric solid between two parallel planes.
2. an unbroken connected portion of the surface of a geometric solid.

zulu time NOUN /ˈzu.lu taɪm/ *See Coordinated Universal Time.*

Appendix

Addition Facts

Addition Facts										
+	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

Properties of Addition

Property	Description	Statement
Additive identity; Property of adding zero	Zero added to any number does not change the number.	$a + 0 = 0 + a = a$
Additive inverse	Any number plus its negative equals zero.	$a + (-a) = 0$
Associative property	It does not matter how addition is grouped.	$a + (b + c)$ $= (a + b) + c$
Commutative property	It does not matter in which order addition is performed.	$a + b = b + a$
Addition property of equality	Any number can be added to both sides of an equation without changing the truth value of the equation.	If $a = b$ then $a + c = b + c$. If $a \neq b$ then $a + c \neq b + c$.
Addition property of inequality	Any number can be added to both sides of an inequality without changing the true value of the inequality.	If $a > b$ then $a + c > b + c$. If $a < b$ then $a + c < b + c$.

Multiplication Facts

×	0	1	2	3	4	5	6	7	8	9
0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9
2	0	2	4	6	8	10	12	14	16	18
3	0	3	6	9	12	15	18	21	24	27
4	0	4	8	12	16	20	24	28	32	36
5	0	5	10	15	20	25	30	35	40	45
6	0	6	12	18	24	30	36	42	48	54
7	0	7	14	21	28	35	42	49	56	63
8	0	8	16	24	32	40	48	56	64	72
9	0	9	18	27	36	45	54	63	72	81

Properties of Multiplication

Property	Description	Statement
Multiplicative identity; Property of multiplying by one	Anything times one equals itself.	$a \cdot 1 = 1 \cdot a = a$
Property of multiplying by zero	Anything times zero equals zero.	$a \cdot 0 = 0 \cdot a = 0$
Multiplicative inverse	Any number except zero times its reciprocal equals one.	$a \cdot \frac{1}{a} = 1, \ a \neq 0$
Associative property	It does not matter how multiplication is grouped.	$a \cdot (b \cdot c) = (a \cdot b) \cdot c.$
Commutative property	It does not matter in which order multiplication is performed.	$a \cdot b = b \cdot a$
Multiplication property of equality	Any number except zero can be multiplied by both sides of an equation without	If $a = b$ then $a \cdot c = b \cdot c.$ If $a \neq b$ then $a \cdot c \neq b \cdot c, \ c \neq 0.$

	changing the truth value of the equation.	
Multiplication property of inequality	Any positive number can be multiplied by both sides of an inequality without changing the true value of the inequality. If a negative number is multiplied by both sides of an inequality, the inequality 'flips'.	If $a > b$ and $c > 0$ then $a \cdot c > b \cdot c$. If $a < b$ and $c > 0$ then $a \cdot c < b \cdot c$. If $a > b$ and $c < 0$ then $a \cdot c < b \cdot c$. If $a < b$ and $c < 0$ then $a \cdot c > b \cdot c$.
Distributive property of multiplication over addition and subtraction	Multiplying a number by a sum is the same as multiplying each number in the sum, then adding.	$a(b + c) = ab + ac$ $a(b - c) = ab - ac$

Properties of Fractions

Use landscape to view.

Property	Formula	Example
Addition	$\frac{a}{b} + \frac{c}{d} = \frac{ad + bc}{bd}$	3/4 + 2/3 = (3·3 + 2·4)/(3·4) = (9+8)/12 = 17/12 = 1 5/12.
Addition	$\frac{a}{b} + c = \frac{a + bc}{b}$	2/3 + 5 = (2 + 3·5)/3 = (2+15)/3 = 17/3 = 6 1/3
Subtraction	$\frac{a}{b} - \frac{c}{d} = \frac{ad - bc}{bd}$	3/4 - 2/3 = (3·3 - 2·4)/(3·4) = (9-8)/12 = 1/12.
Subtraction	$\frac{a}{b} - c = \frac{a - bc}{b}$	2/3 - 1 = (2 - 3·1)/3 = (2-3)/3 = -1/3
Subtraction	$c - \frac{a}{b} = \frac{bc - a}{b}$	2 - 3/4 = (2·4 - 3)/4 = (8 - 3)/4 = 5/4 = 1 1/4.
Multiplication	$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$	(2/3 · 3/4 = (2·3)/(3·4) = 6/12 = 1/2.
Multiplication		3 · 1/2 = (3·1)/2 =

	$c \cdot \frac{a}{b} = \frac{ac}{b}$	3/2 = 1 1/2.
Division	$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \cdot \frac{d}{c} = \frac{ad}{bc}$	1/2 ÷ 2/3 = 1/2 · 3/2 = (1·3)/(2·2) = 3/4.
Division	$\frac{a}{b} \div c = \frac{a}{b} \cdot \frac{1}{c} = \frac{a}{bc}$	(3/4)÷2 = (3/4)·(1/2) = (3·1) / (4·2) = 3/8.
Exponentiation	$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$	$(4/3)^2 = (4^2)/(3^2)$ = 16/9 = 1 7/9.
Convert between mixed number and improper fraction	$C\frac{a}{b} = \frac{C \cdot b + a}{b}$	2 3/4 = (2·4 + 3) / 4 = (8+3)/4 = 11/4.
Zero numerator	$\frac{a}{0} = 0, \ a \neq 0$	0/3 = 0.
Self division	$\frac{a}{a} = 1, \ a \neq 0$	3/3 = 1.
Zero denominator	$\frac{a}{0}$ is undefined	3/0 is undefined.
One denominator	$\frac{a}{1} = a$	2/1 = 2.
Negatives	$\frac{-a}{b} = -\frac{a}{b}$	(-3)/2 = -3/2.
Negatives	$\frac{a}{-b} = -\frac{a}{b}$	3/(-2) = -3/2.

Negatives	$\frac{-a}{-b} = \frac{a}{b}$	(-3)/(-2) = 3/2.

Properties of Exponents

Property	Description	Statement
Multiplication	If the same base is multiplied, add the exponents	$b^m b^n = b^{m+n}$.
Division	If the same base is divided, subtract the exponents.	$\frac{b^m}{b^n} = b^{m-n}$
Distributive property of exponents	Exponents can distribute through multiplication.	$(a \cdot b)^m = a^m \cdot b^m$
Distributive property of exponents	Exponents can distribute through division.	$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$
Negative exponent	A negative exponent means reciprocal.	$a^{-m} = \frac{1}{a^m}$
Exponent of an exponent	A base raised to a power which is raised to another power is equal to the base raised to the product of the powers.	$(b^m)^n = b^{m \cdot n}$ Important: $b^{(m^n)} \neq b^{m \cdot n}$
Fractional exponent	The denominator of a fractional exponent means take a root.	$b^{\frac{m}{n}} = \left(\sqrt[n]{b}\right)^m = \sqrt[n]{b^m}$
Exponent of one	Any number raised to the 1 power equals itself.	$b^1 = b$

Base of zero	Zero to any power but zero equals zero.	$0^a = 0,\ a \neq 0$
Exponent of zero	Any number except zero raised to the zero power equals one.	$b^0 = 1,\ b \neq 0$
Zero to the zero power	Zero to the zero power is undefined.	0^0 is undefined.

Properties of Logarithms

Property	Description	Equation
Product property	The logarithm of a product is equal to the sum of the logarithms.	$\log_b m \cdot n = \log_b m + \log_b n$
Quotient property	The logarithm of a fraction is equal to the logarithm of the numerator less the logarithm of the denominator.	$\log_b \frac{m}{n} = \log_b m - \log_b n$
Exponent property	The logarithm of a number to a power is equal to the power times the logarithm of the number.	$\log_b m^n = n \log_b$
Change of base	How to change the base of a logarithm.	$\log_b m = \frac{\log_c m}{\log_c b}$

Operations on Complex Numbers

Operation	Formula Example
Addition	$(a + bi) + (c + di) = a + c + (b + d)i$ $(3 + 2i) + (-2 - 3i) = 3 - 2 + (2 - 3)i = 1 - i$
Subtraction	$(a + bi) - (c + di) = a - c + (b - d)i$ $(2 - i) - (3 + 2i) = 2 - 3 + (-1 - 2)i = -1 - 3i$
Multiplication	$(a + bi)(c + di) = ac - bd + (ad + bc)i$ $(1 + 2i)(2 - 3i) =$ $1 \cdot 2 - 2 \cdot (-3) + (1 \cdot (-3) + 2 \cdot 2)i =$ $2 + 6 + (-3+4)i = 8+i$
Division	$\frac{a+bi}{c+di} = \frac{a+bi}{c+di} =$ $\frac{2+i}{-1+3i} = \frac{2 \cdot (-1) + 1 \cdot 3 + (1 \cdot (-1) - 2 \cdot 3)i}{(-1)^2 - 3^2}$ $= \frac{-2+3+(1-6)i}{1-9} = \frac{1-5i}{8} = \frac{1}{8} - \frac{5}{8}i$
Magnitude (absolute value)	$\lvert a+bi \rvert = \sqrt{a^2+b^2}$ $\lvert 1-2i \rvert = \sqrt{1^2+(-2)^2} = \sqrt{1+4} = \sqrt{5}$
Direction	

	direction of $a + bi$ is $\arctan \dfrac{b}{a}$ direction of $1 - 2i$ is $\arctan \dfrac{-2}{1}$ $= \arctan(-2) \approx -1.10715$ rad.
Polar form	$a + bi = \left(\sqrt{a^2 + b^2},\ \arctan \dfrac{b}{a} \right)$ $1 - 2i = \left(\sqrt{1^2 + (-2)^2},\ \arctan \dfrac{-2}{1} \right)$ $\approx \left(\sqrt{5}, -1.10715 \right)$

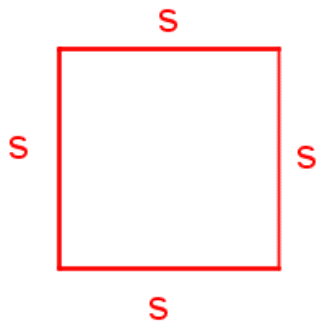
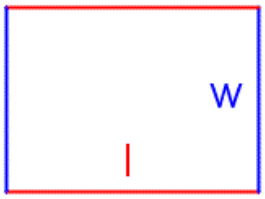
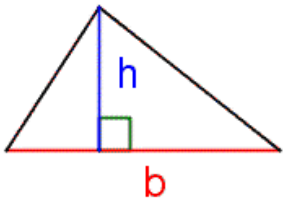
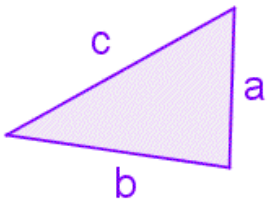
Roots of Integers

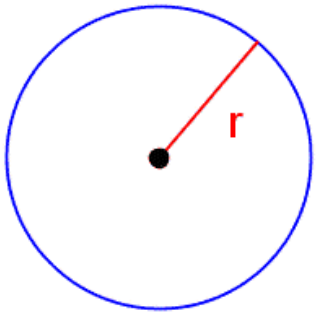
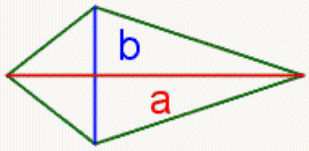
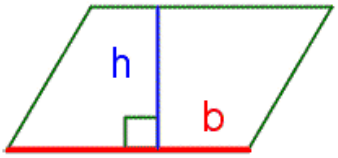
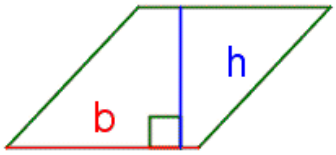
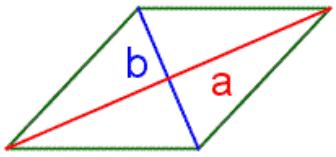
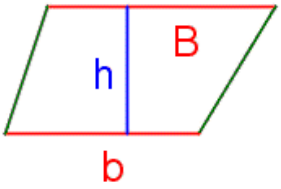
All inexact values are rounded to 6 decimal digits.				
n	$\sqrt{n}$	$\sqrt[3]{n}$	$\sqrt[4]{n}$	$\sqrt[5]{n}$
1	1	1	1	1
2	1.41421	1.25992	1.18921	1.14870
3	1.73205	1.44225	1.31607	1.24573
4	2	1.58740	1.41421	1.31951
5	2.23607	1.70998	1.49535	1.37973
6	2.44949	1.81712	1.56508	1.43097
7	2.64575	1.91293	1.62658	1.47577
8	2.82843	2	1.68179	1.51572
9	3	2.08008	1.73205	1.55185
10	3.16228	2.15443	1.77828	1.58489

Divisibility Rules

n	**A number is divisible by n if …**
2	the number ends in 0, 2, 4, 6, or 8; the number is even. *Example:* 738: the number ends in 8 so 738 is divisible by 2.
3	the sum of the digits is divisible by 3. *Example:* 168: 1 + 6 + 8 = 15; 1 + 5 = 6. 6 is divisible by 3, so 168 is divisible by 3.
4	the last two digits are divisible by 4. *Example:* 948: 48 is divisible by 4, so 948 is divisible by 4.
5	the last digit is 0 or 5. *Example:* 525: The last digit is 5, so 525 is divisible by 5.
6	the number is divisible by 2 and the number is divisible by 3.
7	double the last digit, then subtract the double from the rest of the number. If the result is divisible by 7, then the number is divisible by 7. Repeat for large numbers. *Example:* 273: 3·2 = 6; 27-6 = 21. 21 is divisible by 7 so 273 is divisible by 7.
8	the last three digits are divisible by 8.
9	the sum of the digits is divisible by 9. *Example:* 414: 4 + 1 + 4 = 9; 9 is divisible by 9, so 414 is divisible by 9.
10	the last digit is 0.

Areas of Geometric Shapes (2-D)

Shape	**Diagram**	**Formula**
Square		$A = s^2$
Rectangle		$A = l \cdot w$
Triangle		$\mathrm{A} = \frac{1}{2}\,\mathrm{bh}$
Triangle		$s = \frac{l+m+n}{2}$ $A = \sqrt{s(s-l)(s-m)(s-n)}$
circle		$A = \pi r^2$

		
Kite		$A = \frac{1}{2}\,ab$
Parallelogram		$A = bh$
Rhombus		$A = bh$
Rhombus		$A = \frac{1}{2}\,ab$
Area of a Trapezoid		$A = \frac{1}{2}\,h\,(B + b)$

Trigonometry Definitions

$$\text{sine} = \frac{\text{opposite}}{\text{hypotenuse}}$$

$$\text{cosine} = \frac{\text{adjacent}}{\text{hypotenuse}}$$

$$\text{tangent} = \frac{\text{sine}}{\text{cosine}} = \frac{\text{opposite}}{\text{adjacent}}$$

$$\text{cosecant} = \frac{1}{\text{sine}} = \frac{\text{hypotenuse}}{\text{opposite}}$$

$$\text{secant} = \frac{1}{\text{cosine}} = \frac{\text{hypotenuse}}{\text{adjacent}}$$

$$\text{cotangent} = \frac{1}{\text{tangent}} = \frac{\text{adjacent}}{\text{opposite}}$$

Greek Letters

Greek Letters			
Name	**Upper Case**	**Lower Case**	**Conventional Use**
Alpha /ˈæl.fə/	Α	α	Geometry: angle.
Beta /ˈbeɪ.tə/	Β	β	Geometry: angle.
Gamma /ˈgæm.ə/	Γ	γ	gamma function, a generalization of factorial.
Delta /ˈdɛl.tə/	Δ	δ	Change. 'Δx' (read delta-x) means the change in x.
Epsilon /ˈɛp.sə‚lɒn/	Ε	ε	Eccentricity of conic sections. An arbitrarily small quantity.
Zeta /ˈzeɪ.tə/	Ζ	ζ	Riemann zeta function
Eta /ˈeɪ.tə/	Η	η	Dirichlet eta function
Theta /ˈθeɪ.tə/	Θ	θ	variable that represents the measure of an angle.
Iota /aɪˈoʊ.tə/	Ι	ι	
Kappa /ˈkæp.ə/	Κ	κ	Kappa curve: $(x^2 + y^2)y^2 = x^2.$
Lambda /ˈlæm.də/	Λ	λ	

Mu /myu/	Μ	μ	Abbreviation for a micrometer, or micron.
Nu /nu/	Ν	ν	Nu function
Xi /ksi/	Ξ	ξ	Xi function
Omicron /ˈɒm.ɪˌkrɒn/	Ο	ο	
Pi /paɪ/	Π	π	The constant ratio of the circumference of a circle to the diameter. π ≈ 3.14159.
Rho /roʊ/	Ρ	ρ	
Sigma /ˈsɪg.mə/	Σ	σ	An operator used to indicate repeated addition.
Tau /taʊ/	Τ	τ	An alternate notation for the divisor function. The half-period ratio of an elliptic function.
Upsilon /ˈʌp.səˌlɒn/	Υ	υ	Physics: one of a family of heavy, short-lived, neutral mesons.
Phi /faɪ/	Φ	φ	Golden section
Chi /kaɪ/	Χ	χ	
Psi /saɪ/	Ψ	ψ	
Omega /oʊˈmeɪ.gə/	Ω	ω	Omega constant.

Trigonometric Identities

Pythagorean Identities

$$\sin^2\theta + \cos^2\theta = 1$$
$$\tan^2\theta + 1 = \sec^2\theta$$
$$\cot^2\theta + 1 = \csc^2\theta$$

Cofunction Identities

$$\sin(p/2 - u) = \cos(u)$$
$$\cos(p/2 - u) = \sin(u)$$
$$\tan(p/2 - u) = \cot(u)$$
$$\cot(p/2 - u) = \tan(u)$$
$$\csc(p/2 - u) = \sec(u)$$
$$\sec(p/2 - u) = \csc(u)$$

Even Odd Identities

$$\sin(-u) = -\sin(u)$$
$$\cos(-u) = \cos(u)$$
$$\tan(-u) = -\tan(u)$$
$$\csc(-u) = -\csc(u)$$
$$\sec(-u) = \sec(u)$$
$$\cot(-u) = -\cot(u)$$

Sum Difference Identities

$$\sin(u \pm v) = \sin(u)\cos(v) \pm \cos(u)\sin(v)$$
$$\cos(u \pm v) = \cos(u)\cos(v) \pm \sin(u)\sin(v)$$
$$\tan(u \pm v) = \frac{\tan(u) \pm \tan(v)}{1 \mp \tan(u)\tan(v)}$$

Double Angle Identities

$$\sin(2u) = 2\sin(u)\cos(u)$$
$$\cos(2u) = 2\cos^2(u)\text{-}\sin^2(u)$$
$$\cos(2u) = 2\cos(2u)\text{-}1$$
$$\cos(2u) = 1 - 2\sin(2u)$$
$$\tan(2u) = \frac{2\tan(u)}{1 - \tan^2(u)}$$

Half Angle Identities

$$\sin^2\left(\frac{u}{2}\right) = \frac{1 - \cos(u)}{2}$$
$$\cos^2\left(\frac{u}{2}\right) = \frac{1 + \cos(u)}{2}$$
$$\tan^2\left(\frac{u}{2}\right) = \frac{1 - \cos(u)}{1 + \cos(u)}$$

Sum to Product Identities

$$\sin(u) + \sin(v) = 2\sin\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$$

$$\sin(u) - \sin(v) = 2\cos\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$$

$$\cos(u) + \cos(v) = 2\cos\left(\frac{u+v}{2}\right)\cos\left(\frac{u-v}{2}\right)$$

$$\cos(u) - \cos(v) = -2\sin\left(\frac{u+v}{2}\right)\sin\left(\frac{u-v}{2}\right)$$

Product to Sum Identities

$\sin(u)\sin(v) = ½[\cos(u - v) – \cos(u + v)]$
$\cos(u)\cos(v) = ½[\cos(u - v) + \cos(u + v)]$
$\sin(u)\cos(v) = ½[\sin(u + v) + \sin(u – v)]$
$\cos(u)\sin(v) = ½[\sin(u + v) - \sin(u – v)]$

Exact Values of Trigonometric Functions

Angle Degrees	Angle Radians	$\sin x$	$\cos x$	$\tan x$
0°	0 rad.	0	1	0
30°	$\frac{\pi}{6}$ rad.	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
45°	$\frac{\pi}{4}$ rad.	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	1
60°	$\frac{\pi}{3}$ rad.	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$
90°	$\frac{\pi}{2}$ rad.	1	0	Undefined
120°	$\frac{2\pi}{3}$ rad.	$\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$-\sqrt{3}$
135°	$\frac{3\pi}{4}$ rad.	$\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	-1
150°	$\frac{5\pi}{6}$ rad.	$\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{3}}{3}$

180°	π rad.	0	-1	0
210°	$\frac{7\pi}{6}$ rad.	$-\frac{1}{2}$	$-\frac{\sqrt{3}}{2}$	$\frac{\sqrt{3}}{3}$
225°	$\frac{5\pi}{4}$ rad.	$-\frac{\sqrt{2}}{2}$	$-\frac{\sqrt{2}}{2}$	1
240°	$\frac{4\pi}{3}$ rad.	$-\frac{\sqrt{3}}{2}$	$-\frac{1}{2}$	$\sqrt{3}$
270°	$\frac{3\pi}{2}$ rad.	-1	0	Undefined
300°	$\frac{5\pi}{3}$ rad.	$-\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$-\sqrt{3}$
315°	$\frac{7\pi}{4}$ rad.	$-\frac{\sqrt{2}}{2}$	$\frac{\sqrt{2}}{2}$	-1
330°	$\frac{11\pi}{6}$ rad.	$-\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$-\frac{\sqrt{3}}{3}$
360°	2π rad.	0	1	0

Pythagorean Triples

A Pythagorean triple is any three integers which satisfy the Pythagorean theorem: $A^2 + B^2 = C^2$. The trick is to find three numbers that satisfy the equation. Here is one way:

Step	Formula	Example
1	Pick two positive integers m and n.	Pick 5 and 8
2	Let $A = m^2 - n^2$	$A = 8^2 - 5^2$ $A = 64 - 25$ $A = 39$
3	Let $B = 2mn$	$B = 2 \cdot 5 \cdot 8$ $B = 10 \cdot 8$ $B = 80$
4	Let $C = m^2 + n^2$	$C = 8^2 + 5^2$ $C = 64 + 25$ $C = 89$
5	Verify your result: $A^2 + B^2 = C^2$	$39^2 + 80^2 = 89^2$ $1521 + 6400 = 7921$ $7921 = 7921$

Here are the first 11 Pythogorean triples ordered by hypotenuse length.

A	B	C
3	4	5
5	12	13
15	8	17

7	24	25
21	20	29
35	12	37
9	40	41
45	28	53
11	60	61
33	56	65
63	16	65

Measurement

(all approximate ratios are rounded to 8 significant digits)

Length

The preferred unit of measure of length is the meter. A baseball bat is about 1 meter long. A regular doorway is about 2 meters tall.

1 meter ˜ 3.2808399 feet
1 foot = 12 inches
1 yard = 3 feet
1 mile = 5280 feet
1 nautical mile = 1852 meters
1 nautical mile ˜ 1.1507795 miles

Mass

The preferred unit of measure of mass is the kilogram. A quart of milk and a quart of water mass about 1 kilogram each.

1 kilogram = 1000 grams.
1 kilogram ˜ 2.2046226 pounds on the Earth's surface.
1 tonne = 1000 kilograms.

Time

The passage of time is usually measured in seconds. It takes about a second to say, "one-one thousand" at a normal speed.

1 minute = 60 seconds.
1 hour = 3600 seconds.
1 day ˜ 86400 seconds.
1 week = 7 days.
1 month = 28, 29, 30 or 31 days.
1 year ˜ 365¼ days.
1 decade = 10 years.
1 century = 100 years.
1 millennium = 1000 years.

Temperature

In science, temperature is usually measured in kelvins. At sea level, water freezes at 273.15 kelvins and water boils at 373.15 kelvins. 0 kelvin is the theoretical temperature at which all atomic movement stops.

Event	**º Fahrenheit**	**º Celsius**	**kelvin**
Water freezes	32ºF	0ºC	273 k
Water boils	212ºF	100ºC	373 k

Formula for converting Celsius to kelvins: $c + 273.15 = k$.

Formula for converting Fahrenheit to Celsius: $c = \frac{5}{9}(f - 32)$.

Angle

Angles are measured in portions of a full circle. The preferred unit of measure is radians. There are $2\mathrm{p}$ radians in a full circle.

1 radian ˜ 57.295780°
p radians = 180 degrees
1 radian ˜ 51.566202 gradians
p radians = 200 gradians

Solid angle

Solid angles are measured in steradians. A solid angle of 1 steradian cuts a area of 1 square unit off the surface of a unit sphere.

Frequency

Frequency is measured in events per second.

Speed

The preferred unit of measure of speed is meters per second. A fast runner over medium distance runs about 6.7 meters per second.

1 meter per second = 3.6 kilometers per hour
1 meter per second ˜ 3.2808399 feet per second
1 meter per second ˜ 2.2369363 miles per hour
1 kilometer per hour ˜ 0.62137119 miles per hour.

Acceleration

The preferred unit of measure of acceleration is meters per second squared ($\mathrm{m/s^2}$).

1 meter per second squared ˜ 3.2808399 feet per second squa

Help Your Child Learn Math

- Talk with your child's math teacher. Find out how your child is performing in math class.[1]
- Know your child's assignments and when they are due.
- Check your child's homework. Is your child completing their assignments? Does your child put in the effort necessary to do the assignments correctly?
- Make sure your child understands the concepts of mathematics. Can they explain each concept to you? The most important question you can ask is, "Why is that?"[2]
- Encourage group study. In the interactions of a group, children learn things they may not grasp on their own. Children, especially teenagers have ways of teaching each other.
- Set high achievement standards for your child in math. Children respond positively to high standards.
- Help your children learn the vocabulary of mathematics. Mathematics has its own language and, with fluency in this language, many concepts will be acquired much more easily.[2]

1. *Helping Your Child Learn Mathematics*, US Department of Education. Help Your Child Learn Math.
2. Peggy Gisler and Marge Eberts, *Top 10 Ways to Help Your Kids Do Well in Math*, Top 10 Ways to Help Your Kids Do Well in Math

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