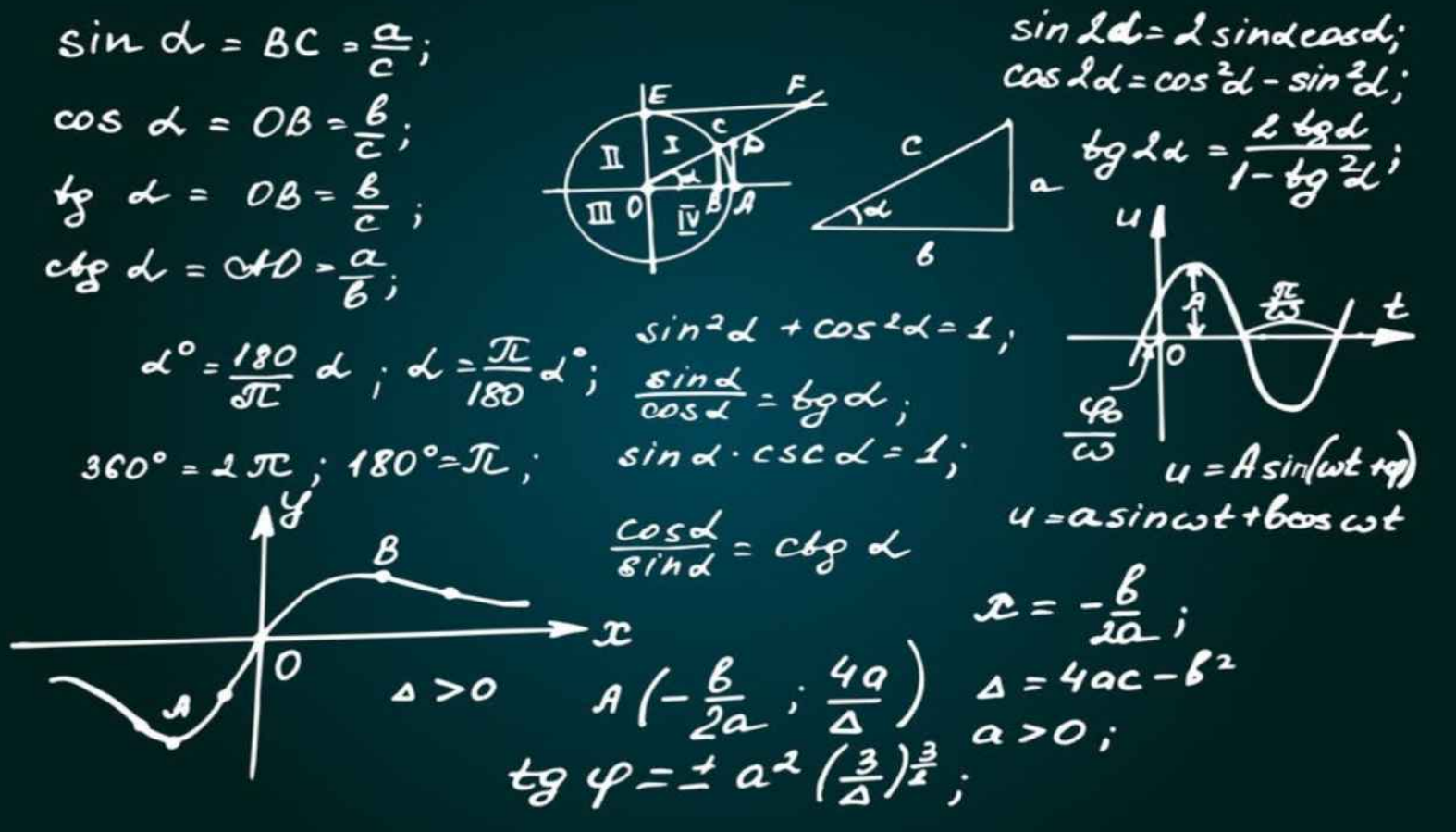
Dictionary of Mathematics



Explained Terms

Terminology

Dictionary of Mathematics Terminology

All Terms of Cancer, Drugs and Genetic terms.

Engineering Dictionaries

abstract algebra:

the area of modern mathematics that considers algebraic structures to be sets with operations defined on them, and extends algebraic concepts usually associated with the real number system to other more general systems, such as groups, rings, fields, modules and vector spaces

Absolute value
Absolute value: The magnitude of a number. It is the number with the sign (+ or -) removed and is symbolised using two vertical straight lines (|5|). Also called modulus.

Abstract number
Abstract number: A number with no associated units.

Acute angle
Acute angle: An angle with degree measure less than 90. See MathWorld: Geometry: Trigonometry: Angles.

Acute angle
An angle less than 90°.

Addition
Addition: The process of finding the sum of two numbers, which are called addend and the augend (sometimes both are called the addend).

Adjacent
Adjacent sides are next to each other and are joined by a common vertex.

Algebra
Algebra is the branch of mathematics where symbols or letters are used to represent numbers.

algebra:
a branch of mathematics that uses symbols or letters to represent variables, values or numbers, which can then be used to express operations and relationships and to solve equations

algebraic equation:
a combination of numbers and letters equivalent to a sentence in language, e.g. y = x2 + 3x - 4

algebraic expression:
a combination of numbers and letters equivalent to a phrase in language, e.g. x2 + 3x - 4

Algorithm
Algorithm: Any mathematical procedure or instructions involving a set of steps to solve a problem.

algorithm:
a step by step procedure by which an operation can be carried out

amicable numbers:
pairs of numbers for which the sum of the divisors of one number equals the other number, e.g. 220 and 284, 1184 and 1210

analysis (mathematical analysis):
grounded in the rigorous formulation of calculus, analysis is the branch of pure mathematics concerned with the notion of a limit (whether of a sequence or of a function)

analytic (Cartesian) geometry:
the study of geometry using a coordinate system and the principles of algebra and analysis, thus defining geometrical

shapes in a numerical way and extracting numerical information from that representation

Angle
An angle is formed when two straight lines cross or meet each other at a point. The size of an angle is measured by the amount one line has been turned in relation to the other.

Approximate
An approximate value is a value that is close to the actual value of a number.

Arc
Part of a circumference of a circle.

Arctan
Arctan: The inverse of the trigonometric function tangent shown as arctan(x) or tan-1(x). It is useful in vector conversions and calculations.
See Wikipedia: Mathematics: Trigonometric Functions.

Area
The amount of space a shape takes up. E.g. the area of the lawn is 35 square metres.

Arithmetic mean
Arithmetic mean: M = (x1 + x2 + ... xn) / n (n = sample size).

Arithmetic sequence
Arithmetic sequence: A sequence of numbers in which each term (subsequent to the first) is generated by adding a fixed constant to its predecessor.

arithmetic:

the part of mathematics that studies quantity, especially as the result of combining numbers (as opposed to variables) using the traditional operations of addition, subtraction, multiplication and division (the more advanced manipulation of numbers is usually known as number theory)

Associative property
Associative property: A binary operation (*) is defined associative if, for a*(b*c) = (a*b)*c. For example, the operations addition and multiplication of natural numbers are associative, but subtraction and division are not.

associative property:
property (which applies both to multiplication and addition) by which numbers can be added or multiplied in any order and still yield the same value, e.g. (a + b) + c = a + (b + c) or (ab)c = a(bc)

Asymmetrical
A shape which has no lines of symmetry.

Asymptote
Asymptote: A straight line that a curve approaches but never meets or crosses. The curve is said to meet the asymptote at infinity. In the equation y = 1/x, y becomes infinitely small as x increases but never reaches zero.

asymptote:
a line that the curve of a function tends towards as the independent variable of the curve approaches some limit (usually infinity) i.e. the distance between the curve and the line approaches zero

Average
A value to best represent a set of data. There are three type of average - the mean, the median and the mode.

Average
Average: The sum of several quantities divided by the number of quantities (also called mean).

Avogadro's number
Avogadro's number: The number of molecules in one mole is called Avogadro’s number (approximately
6.022 × 1023 particles/mole).

Axiom
Axiom: Any assumption on which a mathematical theory is based.

Axis
An axis is one of the lines used to locate a point in a coordinate system.

base
n the number of unique digits (including zero) that a positional numeral system uses to represent numbers, e.g. base 10 (decimal) uses 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 in each place value position; base 2 (binary) uses just 0 and 1; base 60 (sexagesimal, as used in ancient Mesopotamia) uses all the numbers from 0 to 59; etc

Bayesian probability:
a popular interpretation of probability which evaluates the probability of a hypothesis by specifying some prior probability, and then updating in the light of new relevant data

Bearing
A three digit angle measured from north in a clockwise direction.

bell curve:
the shape of the graph that indicates a normal distribution in probability and statistics

BIDMAS
A way of remembering the order in which operations are carried out. It stands for Brackets - Indices - Division - Multiplication - Addition - Subtraction.

bijection:
a one-to-one comparison or correspondence of the members of two sets, so that there are no unmapped elements in either set, which are therefore of the same size and cardinality

Binary operation
Binary operation: An operation that is performed on just two elements of a set at a time.

binomial coefficients:
the coefficients of the polynomial expansion of a binomial power of the form (x + y) n, which can be arranged geometrically according to the binomioal theorem as a symmetrical triangle of numbers known as Pascal's Triangle, e.g. (x + y)4 = x4 + 4x3y + 6x2y2 + 4xy3 + y4 the coefficients are 1, 4, 6, 4, 1

binomial:
a polynomial algebraic expression or equation with just two terms, e.g. 2x3 - 3y = 7; x2 + 4x; etc

Bisect
To divide an angle or shape exactly in half.

Boolean algebra or logic:

a type of algebra which can be applied to the solution of logical problems and mathematical functions, in which the variables are logical rather than numerical, and in which the only operators are AND, OR and NOT

Brackets
Used to determine the order in which operations are carried out. For example, 3 + 4 x 2 = 11 but (3 + 4) x 2 = 14.

Brownian motion
Brownian motion: See an article (by Lee & Hoon) and an animation and a second one..

Butterfly effect
Butterfly effect: In a system when a small change results in an unpredictable and disproportionate disturbance, the effect causing this is called a butterfly effect.

Calculate
To work out the value of something. This does not have to mean you need a calculator!

Calculus
Calculus: Branch of mathematics concerned with rates of change, gradients of curves, maximum and minimum values of functions, and the calculation of lengths, areas and volumes. It involves determining areas (integration) and tangents (differentiation), which are mutually inverse. Also called real analysis. See also Dr. Vogel's Gallery of Calculus Pathologies; MathWorld: Calculus; Wikipedia: Mathematics: Calculus; Visual Calculus; PlanetMath: Calculus; Math Archives: Calculus; Calculus Animations with Mathcad.

calculus (infinitesimal calculus):
a branch of mathematics involving derivatives and integrals, used to study motion and changing values

calculus of variations:
an extension of calculus used to search for a function which minimizes a certain functional (a functional is a function of a function)

cardinal numbers:
numbers used to measure the cardinality or size (but not the order) of sets - the cardinality of a finite set is just a natural number indicating the number of elements in the set; the sizes of infinite sets are described by transfinite cardinal numbers, 0 (aleph-null), 1 (aleph-one), etc

Cartesian coordinates
Cartesian coordinates: Cartesian coordinates (x,y) specify the position of a point in a plane relative to the horizontal x and the vertical y axes. The x and y axes form the basis of two-dimensional Cartesian coordinate system.

Cartesian coordinates:
a pair of numerical coordinates which specify the position of a point on a plane based on its distance from the the two fixed perpendicular axes (which, with their positive and negative values, split the plane up into four quadrants)

Centilitre (cl)
A measure of volume. 100 centilitres = 1 litre (100 cl = 1 l). 1 centilitre = 10 millilitres (1 cl = 10 ml).

Centimetre (cm)
A measure of distance. 1 centimetre = 10 millimetres. (1 cm = 10 mm). 100 centimetres = 1 metre. (100 cm = 1 m).

Chaos:
Chaos: Apparent randomness whose origins are entirely deterministic. A state of disorder and irregularity whose

evolution in time, though governed by simple exact laws, is highly sensitive to starting conditions: a small variation in these conditions will produce wildly different results, so that long-term behaviour of chaotic systems cannot be predicted. This sensitivity to initial conditions is also known as the butterfly effect(when a butterfly flaps its wings in Mexico, the result may be a hurricane in Florida a month later).

Chord
A straight line drawn from one point on the edge of a circle to another.

Chord
Chord: A straight line joining two points on a curve or a circle. See also secant line.

Circle
Circle: A circle is defined as the set of points at a given distance (or radius) from its centre. If the coordinates of the centre of a circle on a plane is (a,b) and the radius is r, then (x-a)2 + (y-b)2 = r2. The equation that characterises a circle has the same coefficients for x2 and y2. The area of a circle is A = pr2 and circumference is C = 2pr. A circle with centre (a,b) and radius r has parametric equations: x = a + r.cos q and y = b + r.sin q (0 ≤ q ≤ 2p). A ‘tangent’ is a line, which touches a circle at one point (called the point of tangency) only. A ‘normal’ is a line, which goes through the centre of a circle and through the point of tangency (the normal is always perpendicular to the tangent). A straight line can be considered a circle; a circle with infinite radius and centre at infinity. See a Lecture Note, BBC Bitesize: Circle; Wikipedia: Mathematics: Circle; MathWorld: Geometry: Circles.

Circumference

Circumference: A line or boundary that forms the perimeter of a circle.

Circumference
The perimeter of a circle.

Closure property
Closure property: If the result of doing an operation on any two elements of a set is always an element of the set, then the set is closed under the operation. For example, the operations addition and multiplication of natural numbers (the set) are closed, but subtraction and division are not.

Coefficient
Coefficient: A number or letter before a variable in an algebraic expression that is used as a multiplier.

Coefficient
The number in front of an algebraic symbol. For example the coefficient of 5x is 5.

coefficients:
the factors of the terms (i.e. the numbers in front of the letters) in a mathematical expression or equation, e.g. in the expression 4x + 5y2 + 3z, the coefficients
for x, y2 and z are 4, 5 and 3 respectively

combinatorics:
the study of different combinations and groupings of numbers, often used in probability and statistics, as well as in scheduling problems and Sudoku puzzles

Common denominator
Common denominator: A denominator that is common to all the fractions within an equation. The smallest number that is a common multiple of the denominators of two or more

fractions is the lowest (or least) common denominator (LCM).

Common factor
Common factor: A whole number that divides exactly into two or more given numbers. The largest common factor for two or more numbers is their highest common factor (HCF).

Common logarithm
Common logarithm: Logarithm with a base of 10 shown as log10 [log1010x = x].

Common ratio
Common ratio: In a geometric sequence, any term divided by the previous one gives the same common ratio.

Commutative property
Commutative property: A binary operation (*) defined on a set has the commutative property if for every two elements, a and b, a*b = b*a. For example, the operations addition and multiplication of natural numbers are commutative, but subtraction and division are not.

Complementary angles
Complementary angles: Two angles whose sum is 90o. See also supplementary angles.

complex dynamics:
the study of mathematical models and dynamical systems defined by iteration of functions on complex number spaces

complex number:
a number expressed as an ordered pair comprising a real number and an imaginary number, written in the form a + bi, where a and b are real numbers, and i is the imaginary unit (equal to the square root of -1)

Composite number
Composite number: Any integer which is not a prime number, i.e., evenly divisible by numbers other than 1 and itself.

composite number:
a number with at least one other factor besides itself and one, i.e. not a prime number

congruence:
two geometrical figures are congruent to one another if they have the same size and shape, and so one can be transformed into the other by a combination of translation, rotation and reflection

Congruent
Congruent: Alike in all relevant respects.

Congruent
If you can place a shape exactly on top of another then they are said to be congruent. You may rotate, reflex or translate the shape.

conic section:
the section or curve formed by the intersection of a plane and a cone (or conical surface), depending on the angle of the plane it could be an ellipse, a hyperbola or a parabola

Constant
A letter or symbol whose value always stays the same. The constant Π is a common example.

Constant
Constant: A quality of a measurement that never changes in magnitude.

continued fraction:
a fraction whose denominator contains a fraction, whose denominator in turn contains a fraction, etc, etc

Coordinate
Coordinate: A set of numbers that locates the position of a point usually represented by (x,y) values.

coordinate plane:
a plane with two scaled perpendicular lines that intersect at the origin, usually designated x(horizontal axis)
and y (vertical axis)

coordinate:
the ordered pair that gives the location or position of a point on a coordinate plane, determined by the point's distance from the x and y axes, e.g. (2, 3.7) or (-5, 4)

correlation:
a measure of relationship between two variables or sets of data, a positive correlation coefficient indicating that one variable tends to increase or decrease as the other does, and a negative correlation coefficient indicating that one variable tends to increase as the other decreases and vice versa

Cosine law
Cosine law: For any triangle, the side lengths a, b, c and corresponding opposite angles A, B, C are related as follows: a2 = b2 + c2 - 2bc cosA etc. The law of cosines is useful to determine the unknown data of a triangle if two sides and an angle are known. See Wikipedia: Cosine Law.

Counting number
Counting number: An element of the set C = {1,2,3,...}.

Credit
To add money to a bank account. For example, I had £500 credited to my bank account.

Cross section
The end section created when you slice a 3D shape along it's length.

Cube number
The product when an integer is multiplied by itself twice. For example 5 cubed = 5 x 5 x 5 = 125.

Cube root
Cube root: The factor of a number that, when it is cubed (i.e., x3) gives that number.

cubic equation:
a polynomial having a degree of 3 (i.e. the highest power is 3), of the form ax3 + bx2 + cx + d= 0, which can be solved by factorization or formula to find its three roots

Cuboid
A 3D shape with all sides made from rectangles.

Cumulative frequency
A running total of the frequencies, added up as you go along.

Curve
Curve: A line that is continuously bent.

Day
A time period of 24 hours. There are 7 days in a week.

Debit

To take out money from a bank account. For example, £400 was debited from my account.

Decagon
A ten sided polygon.

Decimal
Decimal: A fraction having a power of ten as denominator, such as 0.34 = 34/100 (102) or 0.344 = 344/1000 (103). In the continent, a comma is used as the decimal point (between the unit figure and the numerator).

Decimal
Not a whole number or integer. For example, 3.6 or 0.235.

decimal number:
a real number which expresses fractions on the base 10 standard numbering system using place value,
e.g. 37⁄100 = 0.37

Decrease
To make an amount smaller.

deductive reasoning or logic:
a type of reasoning where the truth of a conclusion necessarily follows from, or is a logical consequence of, the truth of the premises (as opposed to inductive reasoning)

Degree of an angle
Degree of an angle: A unit of angle equal to one ninetieth of a right angle. Each degree (0) may be further subdivided into 60 parts, called minutes (60’), and in turn each minute may be subdivided into another 60 parts,
called seconds (60’’). Different types of angles are called acute (<900)< right (900) < obtuse (900-1800) < reflex (1800-3600). See also radian (the SI unit of angle).

Denominator
Denominator: The bottom number in a fraction.

Denominator
The bottom part of a fraction.

Derivative
Derivative: The derivative at a point on a curve is the gradient of the tangent to the curve at the given point. More technically, a function (f'(x0)) of a function y = f(x), representing the rate of change of y and the gradient of the graph at the point where x = x0, usually shown as dy/dx. The notation dy/dx suggests the ratio of two numbers dy and dx (denoting infinitesimal changes in y and x), but it is a single number, the limit of a ratio (k/h) as they both approach zero. Differentiation is the process of calculating derivatives. The derivatives of all commonly occurring functions are known. See Derivative Calculator; Calculus Calculators; Calculus Graphics; Mathlets: Derivative Calculator.

derivative:
a measure of how a function or curve changes as its input changes, i.e. the best linear approximation of the function at a particular input value, as represented by the slope of the tangent line to the graph of the function at that point, found by the operation of differentiation

descriptive geometry:
a method of representing three-dimensional objects by projections on the two-dimensional plane using a specific set of procedures

Diameter

Diameter: A straight line that passes from side to side thorough the centre of a circle.

Diameter
The distance across a circle which passes through the centre.

Difference
Subtract the smaller value from the larger value to find the difference between two numbers.

Differential calculus
Differential calculus: Differentiation is concerned with rates of change and calculating the gradient at any point from the equation of the curve, y = f(x).

Differential equation
Differential equation: Equations involving total or partial differentiation coefficients and the rate of change; the difference between some quantity now and its value an instant into the future. See also Wikipedia:Mathematics: Differential Equations; Mathlets: Differential Equation Applet; Alternative Differential Equation Applet.

differential equation:
an equation that expresses a relationship between a function and its derivative, the solution of which is not a single value but a function (has many applications in engineering, physics economics, etc)

Differential Equations
Differential Equations: Equations containing one or more derivatives (rate of change). As such these equations represent the relationships between the rates of change of continuously varying quantities. The solution contains

constant terms (constant of integration) that are not present in the original differential equation. Two general types of differential equations are ordinary differential equations (ODE) and partial differential equations (PDE). When the function involved in the equation depends upon only a single variable, the differential equation is an ODE. If the function depends on several independent variables (so that its derivatives are partial derivatives) then the differential equation is a PDE. See Internet Resources for Differential Equations; S.O.S Mathematics Review: Differential Equations.

differential geometry:
a field of mathematics that uses the methods of differential and integral calculus (as well as linear and multilinear algebra) to study the geometry of curves and surfaces

differentiation:
the operation in calculus (inverse to the operation of integration) of finding the derivative of a function or equation

Digit
Digit: In the decimal system, the numbers 0 through 9.

Dimension
Dimension: Either the length and/or width of a flat surface (two-dimensional); or the length, width, and/or height of a solid (three-dimensional).

Diophantine equation:
a polynomial equation with integer coefficients that also allows the variables and solutions to be integers only

Distance

How far away an object is. For example, it is a distance of 3 miles to the city centre.

Distribution
How data is shared or spread out.

Distributive property
Distributive property: A binary operation (*) is distributive over another binary operation (^) if, a*(b^c) = (a*b)^(a*c). For example, the operation of multiplication is distributive over the operations of addition and subtraction in the set of natural numbers.

distributive property:
property whereby summing two numbers and then multiplying by another number yields the same value as multiplying both values by the other value and then adding them together, e.g. a(b + c) = ab + ac

Division
Division: The operation of ascertaining how many times one number, the divisor, is contained in another, the dividend. The result is the quotient, and any number left over is called the remainder. The dividend and divisor are also called the numerator and denominator, respectively.

Dynamics
Dynamics: The branch of mathematics, which studies the way in which force produces motion.

e
e: Symbol for the base of natural logarithms (2.7182818285...), defined as the limiting value of (1 + 1/m)m.

element:

a member of, or an object in, a set

ellipse:
a plane curve resulting from the intersection of a cone by a plane, that looks like a slightly flattened circle (a circle is a special case of an ellipse)

elliptic geometry:
a non-Euclidean geometry based (at its simplest) on a spherical plane, in which there are no parallel lines and the angles of a triangle sum to more than 180°

empty (null) set:
a set that has no members, and therefore has zero size, usually represented by {} or ø

Equal
Used to show two quantities have the same value.

Equation
Two expressions which have the same value, separated by an '=' sign. E.g. 3y = 9 + y

Equilateral triangle
A triangle with all sides and angles the same size.

Equilibrium
Equilibrium: The state of balance between opposing forces or effects.

Estimate
To find an approximate answer to a more difficult problem. E.g. 31.2 x 5.94 is roughly equal to 30 x 6 = 180.

Euclidean geometry:

“normal” geometry based on a flat plane, in which there are parallel lines and the angles of a triangle sum to 180°

Even number
Any number which is a multiple of 2. Even numbers always end in 2, 4, 6, 8 or 0.

Even number
Even number: A natural number that is divisible by two.

Expand
To multiply out brackets in an expression. For example, 2(3x + 7) = 6x + 14.

expected value:
the amount predicted to be gained, using the calculation for average expected payoff, which can be calculated as the integral of a random variable with respect to its probability measure (the expected value may not actually be the most probable value and may not even exist, e.g. 2.5 children)

Exponent
Exponent (power, index): A number denoted by a small numeral placed above and to the right of a numerical quantity, which indicates the number of times that quantity is multiplied by itself. In the case of Xn, it is said that X is raised to the power of n. When a and b are non-zero real numbers and p and q are integers, the following rules of power apply: ap x aq = ap+q; (ap)q = apq; (a1/n)m = am/n; a1/2 x b1/2 = (ab)1/2.

Exponential function
Exponential function: A function in the form of f(x) = ax where x is a real number, and a is positive and not 1. One exponential function is f(x) = ex.
See Mathlets: Exponential Functions.

exponentiation:
the mathematical operation where a number (the base) is multiplied by itself a specified number of times (the exponent), usually written as a superscript an, where a is the base and n is the exponent, e.g. 43 = 4 x 4 x 4

Expression
A collection of terms which can contain variables (letters) and numbers. E.g. 4pq - q + 7

Extrapolation
Extrapolation: Estimating the value of a function or a quantity outside a known range of values. See also interpolation.

Factor
A number that divides another number exactly. E.g. 4 is a factor of 12.

Factor
Factor: When two or more natural numbers are multiplied, each of the numbers is a factor of the product. A factor is then a number by which another number is exactly divided (a divisor).

factor:
a number that will divide into another number exactly, e.g. the factors of 10 are 1, 2 and 5

Factorial
Factorial: The product of a series of consecutive positive integers from 1 to a given number (n). It is expressed with the symbol (!). For example, 5! = 5x4x3x2x1 = 120. As a rule (n!+n) is evenly divisible by n.

factorial:
the product of all the consecutive integers up to a given number (used to give the number of permutations of a set of objects), denoted by n!, e.g. 5! = 1 x 2 x 3 x 4 x 5 = 120

Factorisation:
Factorisation: Writing a number as the product of its factors which are prime numbers.

Factorise
To put an expression into brackets by taking out a common factor. For example, 20x + 15y = 5(4x + 3y).

Fermat prime
Fermat prime: Any prime number in the form of 22n + 1 (see also Mersenne prime).

Fermat prime
Mersenne prime: A Mersenne number, Mp, has the form 2p-1, where p is a prime. If Mp itself a prime, then it is called a Mersenne prime. There are 32 such primes known (i.e., not all primes yield a Mersenne prime). (See also Fermat prime.)

Fermat primes:
prime numbers that are one more than a power of 2 (and where the exponent is itself a power of 2), e.g. 3 (21 + 1), 5 (22 + 1), 17 (24 + 1), 257 (28 + 1), 65,537 (216 + 1), etc

Fermat's little theorem:
Fermat's little theorem: If p is a prime number and b is any whole number, then bp-b is a multiple of p (23 - 2 = 6 and is divisible by 3).

Fibonacci numbers (series):
a set of numbers formed by adding the last two numbers to get the next in the series: 0, 1, 1, 2, 3, 5, 8, 13, 21, 34, 55,

89, ...

Fibonacci sequence
Fibonacci sequence: Sequence of integers, where each is the sum of the two preceding it. 1,1,2,3,5,8,13,21,... The number of petals of flowers forms a Fibonacci series.

Figures
Another name for numbers. For example one thousand and fifty in figures is 1050.

finite differences:
a method of approximating the derivative or slope of a function using approximately equivalent difference quotients (the function difference divided by the point difference) for small differences

Formula
An equation used to describe a relationship between two or more variables.

formula:
a rule or equation describing the relationship of two or more variables or quantities, e.g. $A = \pi r2$

Fourier series:
an approximation of more complex periodic functions (such as square or saw-tooth functions) by adding together various simple trigonometric functions (e.g. sine, cosine, tangent, etc)

fractal:
a self-similar geometric shape (one that appears similar at all levels of magnification) produced by an equation that undergoes repeated iterative steps or recursion

Fractals
Fractals: Geometrical entities characterised by basic patterns that are repeated at ever decreasing sizes. They are relevant to any system involving self-similarity repeated on diminished scales (such as a fern's structure) as in the study of chaos.

Fraction (quotient)
Fraction (quotient): A portion of a whole amount. The term usually applies only to ratios of integers (like 2/3, 5/7). Fractions less than one are
called common, proper or vulgar fractions; and those greater than 1 are called improper fraction.

fraction:
a way of writing rational numbers (numbers that are not whole numbers), also used to represent ratios or division, in the form of a numerator over a denominator, e.g. 3⁄5 (a unit fraction is a fraction whose numerator is 1)

Frequency
How many times something happens. Another word for 'total'.

Frequency density
The frequency divided by the class width.

Function (
Function (f): The mathematical operation that transforms a piece of data into a different one. For example, f(x) = x2 is a function transforming any number to its square.

function:
a relation or correspondence between two sets in which one element of the second (codomain or range) set ƒ(x) is assigned to each element of the first (domain) set x, e.g.

ƒ(x) = x2 or y = x2 assigns a value to ƒ(x) or y based on the square of each value of x

game theory:
a branch of mathematics that attempts to mathematically capture behaviour in strategic situations, in which an individual's success in making choices depends on the choices of others, with applications in the areas of economics, politics, biology, engineering, etc

Gaussian curvature:
an intrinsic measure of the curvature of a point on a surface, dependent only on how distances are measured on the surface and not on the way it is embedded in space

Geometric mean
Geometric mean: G = (x1.x2...xn)1/n where n is the sample size. This can also be expressed as antilog ((1/n) S log x). See Applications of the Geometric Mean; Spizman, 2008: Geometric Mean in Forensic Economy.

Geometric sequence
Geometric sequence: A sequence of numbers in which each term subsequent to the first is generated by multiplying its predecessor by a fixed constant (the common ratio).

geometry:
the part of mathematics concerned with the size, shape and relative position of figures, or the study of lines, angles, shapes and their properties

Goldbach conjecture
Goldbach conjecture: Every even number greater than 4 is the sum of two odd primes (32 = 13 + 19). Every odd number greater than 7 can be expressed as the sum of three odd prime numbers (11 = 3 + 3 + 5).

golden ratio (golden mean, divine proportion):
the ratio of two quantities (equivalent to approximately 1 : 1.6180339887) where the ratio of the sum of the quantities to the larger quantity equals the ratio of the larger quantity to the smaller one, usually denoted by the Greek letter phi φ (phi)

Gradient
Gradient: The slope of a line. The gradient of two points on a line is calculated as rise (vertical increase) divided by run (horizontal increase), therefore, the gradient of a line is equal to the tangent of the angle it makes with the positive x-axis (y/x). See Mathlets: Lines and Slopes; Curve Bank: Slope.

Gradient
How steep a line is. Found by dividing the distance up by the distance across.

Gram (g)
A measure of mass. 1 gram = 1000 milligrams. (1 g = 1000 mg)

graph theory:
a branch of mathematics focusing on the properties of a variety of graphs (meaning visual representations of data and their relationships, as opposed to graphs of functions on a Cartesian plane)

group theory:
the mathematical field that studies the algebraic structures and properties of groups and the mappings between them

group:

a mathematical structure consisting of a set together with an operation that combines any two of its elements to form a third element, e.g. the set of integers and the addition operation form a group

Harmonic mean
Harmonic mean: Of a set of numbers (y1 to yi), the harmonic mean is the reciprocal of the arithmetic mean of the reciprocal of the numbers [H = N / S (1/y)]. See also Wikipedia: Mathematics: Harmonic Mean. Not to be confused with Harmonic Ratio.

HCF
Stands for 'highest common factor'. It is the largest factor common to a set of numbers. E.g. The HCF of 16 and 24 is 8.

Heptagon
A seven sided polygon.

Hexagon
A six sided polygon.

Hierarchy of operations
Hierarchy of operations: In an equation with multiple operators, operations proceed in the following order: (brackets), exponentiation, division/multiplication, subtraction/summation and from left to right.

Highest common factor (HCF)
Highest common factor (HCF): The greatest natural number, which is a factor of two or more given numbers.

Hilbert problems:
an influential list of 23 open (unsolved) problems in mathematics described by David Hilbert in 1900

Histogram
A diagram drawn with rectangles where the area is proportional to the frequency and the width is equal to the class interval.

hyperbola:
a smooth symmetrical curve with two branches produced by the section of a conical surface

hyperbolic geometry:
a non-Euclidean geometry based on a saddle-shaped plane, in which there are no parallel lines and the angles of a triangle sum to less than 180°

Hypotenuse
Hypotenuse: The longest side of a right triangle, which lies opposite the vertex of the right angle.

Hypotenuse
The longest side on a right angled triangle.

i
i: The square root of -1 (an imaginary number).

Identity element
Identity element: The element of a set which when combined with any element of the same set leaves the other element unchanged (like zero in addition and subtraction, and 1 in multiplication or division).

identity:
an equality that remains true regardless of the values of any variables that appear within it, e.g. for multiplication, the identity is one; for addition, the identity is zero

Imaginary number:
The product of a real number x and i, where i2 + 1 = 0. A complex number in which the real part is zero. In general, imaginary numbers are the square roots of negative numbers. See Types of Numbers.

imaginary numbers:
numbers in the form bi, where b is a real number and i is the “imaginary unit”, equal to √-1 (i.e. i2 = -1)

Improper fraction
Improper fraction: A fraction whose numerator is the same as or larger than the denominator; i.e., a fraction equal to or greater than 1.

Increase
To make an amount larger.

Indices
Another name for powers such as ² or ³.

inductive reasoning or logic:
a type of reasoning that involves moving from a set of specific facts to a general conclusion, indicating some degree of support for the conclusion without actually ensuring its truth

Infinite
Infinite: Having no end or limits. Larger than any quantified concept. For many purposes it may be considered as the reciprocal of zero and shown as an 8 lying on its side (∞).

infinite series:
the sum of an infinite sequence of numbers (which are usually produced according to a certain rule, formula or algorithm)

Infinitesimal
Infinitesimal: A vanishingly small part of a quantity. It equals almost zero.

infinitesimal:
quantities or objects so small that there is no way to see them or to measure them, so that for all practical purposes they approach zero as a limit (an idea used in the developement of infinitesimal calculus)

infinity:
a quantity or set of numbers without bound, limit or end, whether countably infinite like the set of integers, or uncountably infinite like the set of real numbers (represented by the symbol ∞)

Integer
A whole number.

Integer
Integer: Any whole number: positive and negative whole numbers and zero.

integers:
whole numbers, both positive (natural numbers) and negative, including zero

Integral calculus
Integral calculus: This is the inverse process to differentiation; i.e., a function which has a given derived function. For example, x2 has derivative 2x, so 2x has x2 as an integral. A classic application of integral is to calculate areas. Wikipedia: Mathematics: Calculus: Integral.

integral:

the area bounded by a graph or curve of a function and the x axis, between two given values of x(definite integral), found by the operation of integration

Integration
Integration: The process of finding a function given its derived function.

integration:
the operation in calculus (inverse to the operation of differentiation) of finding the integral of a function or equation

Intercept
Intercept: A part of a line/plane cut off by another line/plane.

Interpolation
Interpolation: Estimating the value of a function or a quantity from known values on either side of it.

Inter-quartile range (IQR)
The difference between the upper and lower quartile.

Intersection
Intersection: The intersection of two sets is the set of elements that are in both sets.

Inverse function
Inverse function: A function which 'does the reverse' of a given function. For example, functions with the prefix arc are inverse trigonometric functions; e.g. arcsin x for the inverse of sin(x). See also Wikipedia:Mathematics: Inverse Functions and Logarithmic Inverse Functions.

Irrational

A decimal which is never ending. It must also not be a recurring decimal.

Irrational number
Irrational number: A real number that cannot be expressed as the ratio of two integers, and therefore that cannot be written as a decimal that either terminates or repeats. The square root of 2 is an example because if it is expressed as a ratio, it never gives 2 when multiplied by itself. The numbers p = 3.141592645..., and e = 2.7182818... are also irrational numbers. See also transcendental numbers, real numbers, and Types of Numbers.

irrational numbers:
numbers that can not be represented as decimals (because they would contain an infinite number of non-repeating digits) or as fractions of one integer over another, e.g. π, √2, e

Iteration
Iteration: Repeatedly performing the same sequence of steps. Simply, solving an algebraic equation with an arbitrary value for the unknown and using the result to solve it again, and again.

Julia set:
the set of points for a function of the
form z2 + c (where c is a complex parameter), such that a small perturbation can cause drastic changes in the sequence of iterated function values and iterations will either approach zero, approach infinity or get trapped in loop

Justify
Another word for 'explain'. Often crops up on your maths exam. E.g. 'Calculate the mean and range for each player.

Who is the better player Justify your answer.'

Kilogram (Kg)
A measure of mass. 1 kilogram = 1000 grams. (1 kg = 1000 g)

Kilometre (Km)
A measure of distance. 1 kilometre = 1000 metres. (1 km = 1000 m)

knot theory:
an area of topology that studies mathematical knots (a knot is a closed curve in space formed by interlacing a piece of “string” and joining the ends)

LCM
Stands for 'lowest common multiple'. It is the smallest multiple common to a set of numbers. E.g. The LCM of 3 and 4 is 12.

Least squares method
Least squares method: A method of fitting a straight line or curve based one minimisation of the sum of squared differences (residuals) between the predicted and the observed points. Given the data points (xi, yi), it is possible to fit a straight line using a formula, which gives the y=a+bx. The gradient of the straight line b is given by [S(xi - mx)(yi-my)] / [(S(x-mx))2], where mx and my are the means for xi and yi. The intercept a is obtained by my - bmx. See Wikipedia: Least Squares.

least squares method:
a method of regression analysis used in probability theory and statistics to fit a curve-of-best-fit to observed data by minimizing the sum of the squares of the differences

between the observed values and the values provided by the model

limit:
the point towards which a series or function converges, e.g. as x becomes closer and closer to zero, (sin x)/x becomes closer and closer to the limit of 1

line:
in geometry, a one-dimensional figure following a continuous straight path joining two or more points, whether infinite in both directions or just a line segment bounded by two distinct end points

Linear
Linear: A model or function where the input and output are proportional.

linear equation:
an algebraic equation in which each term is either a constant or the product of a constant and the first power of a single variable, and whose graph is therefore a straight line, e.g. y = 4, y = 5x + 3

Linear expression
Linear expression: A polynomial expression with the degree of polynomial being 1, i.e., that does not include any terms as the power of a variable. It will be something like, f(x)=2x1+3, but not x2+2x+4 (the latter is a quadratic expression). Linear equations are closely related to a straight line.

linear regression:
a technique in statistics and probability theory for modelling scattered data by assuming an approximate

linear relationship between the dependent and independent variables

Literal numbers
Literal numbers: Letters representing numbers (as in algebraic equations).

Litre (l)
A measure of volume. 1 litre = 100 centilitres (1 l = 100 cl). 1 litre = 1000 millilitres (1l = 1000 ml).

Loci
The plural of locus.

Locus
A collection of points which are the same distance from another point or line.

Logarithm
Logarithm: The logarithm of a number N to a given base b is the power to which the base must be raised to produce the number N. Written as logb N. Naturally, logb bx = x. In any base, the following rules apply: log (ab) = log a + log b; log (a/b) = log a - log b; log (1/a) = -log a; log ab = b log a; log 1 = 0 and log 0 is undefined. See Logarithmic Transformations.

logarithm:
the inverse operation to exponentiation, the exponent of a power to which a base (usually 10 or efor natural logarithms) must be raised to produce a given number, e.g. because 1,000 = 103, the log10 100 = 3

logic:
the study of the formal laws of reasoning (mathematical logic the application of the techniques of formal logic to

mathematics and mathematical reasoning, and vice versa)

logicism:
the theory that mathematics is just an extension of logic, and that therefore some or all mathematics is reducible to logic

Lower range
The smallest value in a set of data.

Lowest common multiple (LCM)
Lowest common multiple (LCM): The smallest non-zero natural number that is a common multiple of two or more natural numbers (compare with the highest common factor).

magic square:
a square array of numbers where each row, column and diagonal added up to the same total, known as the magic sum or constant (a semi-magic square is a square numbers where just the rows and columns, but not both diagonals, sum to a constant)

Mandelbrot set:
a set of points in the complex plane, the boundary of which forms a fractal, based on all the possible c points and Julia sets of a function of the form z2 + c (where c is a complex parameter)

manifold:
a topological space or surface which, on a small enough scale, resembles the Euclidean space of a specific dimension (called the dimension of the manifold), e.g. a line and a circle are one-dimensional manifolds; a plane and the surface of a sphere are two-dimensional manifolds; etc

Matrix

Matrix: A matrix (plural: matrices) is a rectangular table of data. See Basics of Matrix Algebra; Linear Algebra Review; ‘Introduction to Matrix Algebra’ Book; Matrix Algebra Tool and Interactive Exercises.

matrix:
a rectangular array of numbers, which can be added, subtracted and multiplied, and used to represent linear transformations and vectors, solve equations, etc

Mean
A type of average found by adding up a list of numbers and dividing by how many numbers are in the list.

Median
The middle value when a list of numbers is put in order from smallest to largest. A type of average.

Mersenne number:
numbers that are one less than 2 to the power of a prime number, e.g. 3 (22 - 1); 7 (23 - 1); 31 (25 - 1); 127 (27 - 1); 8,191 (213 - 1); etc

Mersenne prime
Mechanics: Study of the forces acting on bodies, whether moving (dynamics) or stationary (statics).

Mersenne primes:
prime numbers that are one less than a power of 2, e.g. 3 (22 - 1); 7 (23 - 1); 31 (25 - 1); 127 (27 - 1); 8,191 (213 - 1); etc - many, but not all, Mersenne numbers are primes, e.g. 2,047 = 211 - 1 = 23 x 89, so 2,047 is a Mersenne number but not a Mersenne prime

method of exhaustion:

a method of finding the area of a shape by inscribing inside it a sequence of polygons whose areas converge to the area of the containing shape (a precursor to the methods of calculus)

Metre (m)
A measure of distance. 1 metre = 100 centimetres. (1 m = 1000 cm).

Millilitre (ml)
A measure of volume. 10 millimetres = 1 centilitre (10 ml = 1 cl). 1000 millilitres = 1 litre (1000 ml = 1 l).

Millimetre (mm)
A measure of distance. 10 millimetres = 1 centimetre. (10 mm = 1 cm).

Mixed number
Mixed number: A number that contains both a whole number and a fraction.

Modal
Another term for mode

Mode
The most common value in a list of numbers. If two values are tied then there is two modes. If more than two values are tied then there is no mode. A type ofaverage.

modular arithmetic:
a system of arithmetic for integers, where numbers "wrap around" after they reach a certain value (the modulus), e.g. on a 12-hour clock, 15 o’clock is actually 3 o’clock (15 = 3 mod 12)

modulus:

a number by which two given numbers can be divided by integer division, and produce the same remainder, e.g. 38 ÷ 12 = 3 remainder 2, and 26 ÷ 12 = 2 remainder 2, therefore 38 and 26 are congruent modulo 12, or (38 ≡ 26) mod 12

Modulus:
Modulus: The absolute value of a number regardless of its sign, shown as | x | or mod x. For a vector u, the modulus | u | is used to indicate its magnitude calculated using Pythagoras' theorem: | u | = (a2 + b2)1/2.

monomial:
an algebraic expression consisting of a single term (although that term could be an exponent), e.g. y = 7x, y = 2x3

Month
A time period of either 28, 30 or 31 days. There are 12 months in a year.

Multiple
A number which is part of another number's times table. E.g. 35 is a multiple of 5.

Multiplication
Multiplication: The process of finding the product of two quantities that are called the multiplicand and the multiplier.

Natural logarithm
Natural logarithm: Logarithm with a base of e, usually abbreviated ln (ln ex = x).

Natural number
A positive integer

Natural number:

Natural number: Any element of the set N = {0,1,2,3,...} (positive integers). The inclusion of zero is a matter of definition. See Types of Numbers.

natural numbers:
the set of positive integers (regular whole counting numbers), sometimes including zero

Negative
A value less than zero

negative numbers:
any integer, ration or real number which is less than 0, e.g. -743, -1.4, -√5 (but not √-1, which is an imaginary or complex number)

Nonagon
A nine sided polygon.

non-commutative algebra:
an algebra in which a x b does not always equal b x a, such as that used by quaternions

non-Euclidean geometry:
geometry based on a curved plane, whether elliptic (spherical) or hyperbolic (saddle-shaped), in which there are no parallel lines and the angles of a triangle do not sum to 180°

normal (Gaussian) distribution:
a continuous probability distribution in probability theory and statistics that describes data which clusters around the mean in a curved “bell curve”, highest in the middle and quickly tapering off to each side

number line:

a line on which all points correspond to real numbers (a simple number line may only mark integers, but in theory all real numbers to +/- infinity can be shown on a number line)

number theory:
the branch of pure mathematics concerned with the properties of numbers in general, and integers in particular

Numerator
Numerator: The top number in a fraction.

Numerator
The top part of a fraction.

Obtuse angle
An angle between 90 and 180 .

Obtuse angle
Obtuse angle: An angle with a degree measure between 90 and 180.
See MathWorld: Geometry: Trigonometry: Angles: Obtuse Angle.

Octagon
An eight sided polygon.

Odd number
A number that is not a multiple of 2. Odd numbers always end in 1, 3, 5, 7 or 9.

Odd number
Odd number: A natural number that is not divisible by 2.

Odds
Odds: The odds of a success is defined to be the ratio of the probability of a success to the probability of a failure (p/(1-

p)).

Operation
An action which when applied to one or more values gives an output value. The four most common operations are addition. subtraction, multiplication and division.

ordinal numbers:
an extension of the natural numbers (different from integers and from cardinal numbers) used to describe the order type of sets i.e. the order of elements within a set or series

Ordinate
Ordinate: The vertical coordinate on a plane.

Origin:
Origin: The point on a graph that represents the point where the x and y axes meet: (x,y) = (0,0).

parabola:
a type of conic section curve, any point of which is equally distant from a fixed focus point and a fixed straight line

paradox:
a statement that appears to contradict itself, suggesting a solution which is actually impossible

Parallel
Parallel: Lines or planes that are equidistant from each other and do not intersect.

Parallel
Two or more lines which are always the same distance apart.

Parallelogram
A quadrilateral with two pairs of parallel sides.

partial differential equation:
a relation involving an unknown function with several independent variables and its partial derivatives with respect to those variables

Pascal's Triangle:
a geometrical arrangement of the coefficients of the polynomial expansion of a binomial power of the form (x + y)n as a symmetrical triangle of numbers

Pentagon
A five sided polygon.

perfect number:
a number that is the sum of its divisors (excluding the number itself), e.g. 28 = 1 + 2 + 4 + 7 + 14

Perfect number:
Perfect number: A number which is equal to the sum of its proper divisors. 6, 28, and 496 are the three of seven known perfect numbers. [6 is a perfect number because its proper divisors (1,2, and 3) total 6.] See Types of Numbers.

Perimeter
The distance around a shape.

periodic function:
a function that repeats its values in regular intervals or periods, such as the trigonometric functions of sine, cosine, tangent, etc

Permutation

Permutation: A permutation of a sequence of objects is just a rearrangement of them.

permutation:
a particular ordering of a set of objects, e.g. given the set {1, 2, 3}, there are six permutations: {1, 2, 3}, {1, 3, 2}, {2, 1, 3}, {2, 3, 1}, {3, 1, 2}, and {3, 2, 1}

Perpendicular
Perpendicular: At right angles to a line or plane.

Perpendicular
Two or more lines which meet at right angles.

Pi (
Pi (p): The ratio of the circumference of a circle to its diameter. The value of p is 3.1415926, correct to seven decimal places. The sum of the three angles of a triangle is p radians.

pi (
π the ratio of a circumference of a circle to its diameter, an irrational (and transcendental) number approximately equal to 3.141593...

Pi (Π)
An irrational constant used when calculating the area and circumference of circles. It is approximately equal to 3.14.

place value:
positional notation for numbers, allowing the use of the same symbols for different orders of magnitude, e.g. the "one's place", "ten's place", "hundred's place", etc

plane:

a flat two-dimensional surface (physical or theoretical) with infinite width and length, zero thickness and zero curvature

Platonic solids:
the five regular convex polyhedra (symmetrical 3-dimensional shapes): the tetrahedron (made up of 4 regular triangles), the octahedron (made up of 8 triangles), the icosahedron (made up of 20 triangles), the cube (made up of 6 squares) and the dodecahedron (made up of 12 pentagons)

Poisson distribution:
Poisson distribution: The probability distribution of the number of occurrences of random (usually rare and independent) events in an interval or time or space. See a Lecture Note.

polar coordinates:
a two-dimensional coordinate system in which each point on a plane is determined by its distance r from a fixed point (e.g. the origin) and its angle θ (theta) from a fixed direction (e.g the x axis)

Polar equation
Polar equation: A system which describes a point in the plane not by its Cartesian coordinates (x,y) but by its polar coordinates: angular direction (q) and distance r from the origin (r, q).

Polygon
A shape made from straight lines.

Polygon
Polygon: A geometric figure that is bound by many straight lines such as triangle, square, pentagon, hexagon, heptagon, octagon etc.

Polynomial
Polynomial: An algebraic expression of the form a0xn + a1xn-1 + ... + an, where a0, a1, ..., an are members of a field (or ring), and n is the degree of the polynomial. See Wikipedia: Polynomial.

polynomial:
an algebraic expression or equation with more than one term, constructed from variables and constants using only the operations of addition, subtraction, multiplication and non-negative whole-number exponents, e.g. 5x2 - 4x + 4y + 7

Positive number
A number greater than zero.

Precalculus
Precalculus: A foundational mathematical discipline. Pre-calculus intends to prepare students for the study of calculus. Pre-calculus typically includes a review of algebra, as well as an introduction to exponential, logarithmic and trigonometric functions as preparation for the study of calculus. See Wikipedia: Mathematics: Precalculus.

Prime
A number which has exactly two factors. The number one and itself.

Prime factors
Prime factors: Prime factors of a number are a list of prime numbers the product of which is the number concerned. When n=1, for example, f(x)=2x1+3, this is a linear expression. If n=2, it is quadratic (for example, x2 + 2x + 4); if n=3, it is cubic, if n=4, it is quartic and if n=5, it is quintic.

Prime number
Prime number: A natural number other than 1, evenly divisible only by 1 and itself. The numbers 2,3,5,7,11,13,17,19,... Apart from 2, all primes are odd numbers and odd primes fall into two groups: those that are one less than a multiple of four (3,7,11,19) and those one more than a multiple of four (5,13,17). Every natural number greater than 1 may be resolved into a product of prime numbers; eg 8316 = 22 x 33 x 7 x 11. See Types of Numbers, Prime Numbers.

prime numbers:
integers greater than 1 which are only divisible by themselves and 1

Prism
A 3D shape with the same cross section all along its length.

Probability
A measure of how likely an event is to occur.

probability theory:
the branch of mathematics concerned with analysis of random variables and events, and with the interpretation of probabilities (the likelihood of an event happening)

Product
Product: The result of a multiplication problem.

Product
The answer when two values are multiplied together.

projective geometry:
a kind of non-Euclidean geometry which considers what happens to shapes when they are projected on to a non-

parallel plane, e.g. a circle may be projected into an ellipse or a hyperbola

Proper divisor
Proper divisor: Any number divides another without leaving a remainder.

Proper fraction
Proper fraction: A fraction in which the numerator is smaller than the denominator; i.e., a fraction smaller than 1.

Proportion
Proportion: A type of ratio in which the numerator is included in the denominator. It is the ratio of a part to the whole ($0.0 \leq p \leq 1.0$) that may be expressed as a decimal fraction (0.2), vulgar fraction (1/5) or percentage (20%).

Pythagoras' (Pythagorean) theorem:
the square of the hypotenuse of a right angled triangle is equal to the sum of the squares of the two sides
(a2 + b2 = c2)

Pythagoras' Theorem
Pythagoras' Theorem: For any right-angled triangle, the square on the hypotenuse equals the sum of the squares on the other two sides. See
. Wikipedia: Mathematics: Pythagoras' theorem.

Pythagorean triples:
groups of three positive integers a, b and c such that the a2 + b2 = c2 equation of Pythagoras' theorem, e.g. (3, 4, 5), (5, 12, 13), (7, 24, 25), (8, 15, 17), etc

Quadratic equation
An equation where the highest power is two. For example $x^2 + 4x + 6 = 0$ is a quadratic equation.

Quadratic equation
Quadratic equation: An algebraic equation of the second degree (having one or more variables raised to the second power). The general quadratic equation is ax2 + bx + c = 0, in which a, b, and c are constants (or parameters) and ‘a’ is not equal to 0.

quadratic equation:
a polynomial equation with a degree of 2 (i.e. the highest power is 2), of the form ax2 + bx + c = 0, which can be solved by various methods including factoring, completing the square, graphing, Newton's method and the quadratic formula

quadrature:
the act of squaring, or finding a square equal in area to a given figure, or finding the area of a geometrical figure or the area under a curve (such as by a process of numerical integration)

Quadrilateral
A four sided polygon.

quartic equation:
a polynomial having a degree of 4 (i.e. the highest power is 4), of the form ax4 + bx3 + cx2 + dx + e = 0, the highest order polynomial equation that can be solved by factorization into radicals by a general formula

quaternions:
a number system that extends complex numbers to four dimensions (so that an object is described by a real number and three complex numbers, all mutually perpendicular to each other), which can be used to represent a three-dimensional rotation by just an angle and a vector

quintic equation:
a polynomial having a degree of 5 (i.e. the highest power is 5), of the form ax5 + bx4 + cx3 + dx2 + ex + f = 0, not solvable by factorization into radicals for all rational numbers

Quotient (fraction)
Quotient (fraction): An algebraic expression in which the numerator is divided by the denominator. Turning a fraction upside down gives the fraction's reciprocal.

Radian (rad)
Radian (rad): The SI unit for measuring an angle formally defined as 'the angle subtended at the centre of a circle by an arc equal in length to the radius of the circle' (the angle of an entire circle is 2p radians; pradians equal 1800 (sum of the three angles of a triangle); this is the basis of circumference of a circle formula 2pr). Sum of angles of a triangle equals p radians. See an Animation of Radian.

Radius
Radius: The distance between the centre of a circle and any point on the circle's circumference.

Radius
The distance from the centre of a circle to its circumference. The plural of radius is radii.

Random sampling
A method of choosing people at random for a survey.

Range
The largest number take away the smallest value in a set of data.

Rate
Rate: The relationship between two measurements of different units such as change in distance with respect to time (miles per hour).

Ratio
Ratio: The relationship between two numbers or measurements, usually with the same units like the ratio of the width of an object to its length. The ratio a:b is equivalent to the quotient a/b.

Rational
A decimal number which ends or is recurring.

Rational number:
Rational number: A number that can be expressed as the ratio of two integers, e.g. 6/7. The set of rational numbers is denotes as ‘Q’ for quotient. See Types of Numbers.

rational numbers:
numbers that can be expressed as a fraction (or ratio) a/b of two integers (the integers are therefore a subset of the rationals), or alternatively a decimal which terminates after a finite number of digits or begins to repeat a sequence

Real number
Real number: Rational (fractions) and irrational (numbers with non-recurring decimal representation) numbers. The set of real numbers is denoted as ‘R’ for real. In computing, any number with a fractional (or decimal) part. Basically, real numbers are all numbers except imaginary numbers (such as the square root of -1). See Types of Numbers.

real numbers:
all numbers (including natural numbers, integers, decimals, rational numbers and irrational numbers) which do not

involve imaginary numbers (multiples of the imaginary unit i, or the square root of -1), may be thought of as all points on an infinitely long number line

Reciprocal
Reciprocal: The multiplicative inverse of a number (i.e., 1/x). It can be shown with a negative index (x-1).

Reciprocal
The reciprocal of any number is 1 divided by the number. E.g. the reciprocal of 3 is 1/3., the reciprocal of 3/4 is 4/3.

reciprocal:
a number which, when multiplied by x yields the multiplicative identity 1, and can therefore be thought of as the inverse of multiplication, e.g. the reciprocal of x is 1⁄x, the reciprocal of 3⁄5 is 5⁄3

Recurring
A decimal which never ends but repeats all or parts of the sequence of numbers after the decimal point. E.g 0.333333 or 0.141414.

Reflex angle
An angle greater than 180 .

Reflex angle
Reflex angle: An angle with a degree measure between 180 and 360.
See MathWorld: Geometry: Trigonometry: Angles: Reflex Angle.

Regular
A shape with all sides and angles the same size.

Remainder

The amount left over when a number cannot be divided exactly. For example, 21 divided by 4 is 5 remainder 1.

Repeating decimal
Repeating decimal: A decimal that can be written using a horizontal bar to show the repeating digits.

Riemannian geometry:
a non-Euclidean geometry that studies curved surfaces and differentiable manifolds in higher dimensional spaces

Right angle
An angle of 90 .

Right angle
Right angle: An angle with a degree measure 90. An angle which is not an right angle is called oblique angle.
See MathWorld: Geometry: Trigonometry: Angles: Right Angle.

right triangle:
a triangle (three sided polygon) containing an angle of 90°

Root
Root: If, when a number is raised to the power of n gives the answer a, then this number is the nth root of a (a1/n).

Rotation
To turn a shape using an angle, direction and centre of rotation.

Round
To reduce the amount of significant figures or decimal places a number has. For example £178 rounded to the nearest £10 is £180.

Rounding
Rounding: To give a close approximation of a number by dropping the least significant numbers. For example 15.88 can be rounded up to 15.9 (or 16) and 15.12 can be rounded down to 15.1 (or 15).

Scalar
Scalar: A real number and also a quantity that has magnitude but no direction, such as mass and density. See Wikipedia: Scalar.

Scale factor
How many times larger or smaller an enlarged shape will be.

Scientific notation (exponential notation, standard form
Scientific notation (exponential notation, standard form): One way of writing very small or very large numbers. In this notation, numbers are shown as (0<n

</n
Secant line
Secant line: A line that intersects a curve. The intercept is a chord of the curve. Wikipedia: Mathematics: Secant Line; Mathlets: Secant Line; CTK Glossary: Secant.

Segment
An area of a circle enclosed by a chord.

self-similarity:
object is exactly or approximately similar to a part of itself (in fractals, the shapes of lines at different iterations look like smaller versions of earlier shapes)

Sequence

A list of numbers which follows a pattern. For example 6, 11, 16, 21, ...

Sequence
Sequence: An ordered set of numbers derived according to a rule, each member being determined either directly or from the preceding terms. See Real Analysis Glossary: Sequences & Context.

sequence:
an ordered set whose elements are usually determined based on some function of the counting numbers, e.g. a geometric sequence is a set where each element is a multiple of the previous element; an arithmetic sequence is a set where each element is the previous element plus or minus a number

set:
a collection of distinct objects or numbers, without regard to their order, considered as an object in its own right

Sigma (S, s):
Sigma (S, s): Represents summation (S, s). See Greek Letters.

significant digits:
the number of digits to consider when using measuring numbers, those digits that carry meaning contributing to its precision (i.e. ignoring leading and trailing zeros)

Significant figure (s.f.)
Significant figure (s.f.): The specific degree of accuracy denoted by the number of digits used. For example 434.64 has five s.f. but at 3 s.f. accuracy it would be shown as ‘435 (to 3 s.f.)’. From the left, the first nonzero digit in a number is the first significant figure, after the first significant

number, all digits, including zeros, count as significant numbers (Both 0.3 and 0.0003 have 1 s.f.; both 0.0303 and 0.303000 have 3 s.f.). If a number has to be reduced to a lower s.f., the usual rounding rules apply (2045.678 becomes 2046 to 4 s.f. and 2045.7 to 5 s.f.). The final zero even in a whole number is not a s.f. as it only shows the order of magnitude of the number (2343.2 is shown as 2340 to 3 s.f.).

Simplify
To write a sum, expression or ratio in its lowest terms. For example 4:10:6 can be simplified to 2:5:3.

simultaneous equations:
a set or system of equations containing multiple variables which has a solution that simultaneously satisfies all of the equations (e.g. the set of simultaneous linear equations $2x + y = 8$ and $x + y = 6$, has a solution $x = 2$ and $y = 4$)

Sine law
Sine law: For any triangle, the side lengths a, b, c and corresponding opposite angles A, B, C are related as follows: $\sin A / a = \sin B / b = \sin C / c$. The law of sines is useful for computing the lengths of the unknown sides in a triangle if two angles and one side are known. See Wikipedia: Law of Sines.

Skew lines
Skew lines: Two lines in three-dimensional space, which do not lie in the same plane (and do not intersect).

slope:
the steepness or incline of a line, determined by reference to two points on the line, e.g. the slope of the line $y = mx + b$ is m, and represents the rate at which y is changing per unit of change in x

Solid
A 3D shape.

Solve
To find the missing value in an equation.

Speed
How fast an object is moving. Average speed = Total distance divided by time taken.

spherical geometry:
a type of non-Euclidean (elliptic) geometry using the two-dimensional surface of a sphere, where a curved geodesic (not a straight line) is the shortest paths between points

spherical trigonometry:
a branch of spherical geometry which deals with polygons (especially triangles) on the sphere, and the relationships between their sides and angles

Square number
The product when an integer is multiplied by itself. For example, 1, 4, 9, 16, 25, 36, 49, 64, 81, 100.

Stationary point
Stationary point: Point at which the derivative of a function is zero. Includes maximum and minimum turning points, but not all stationary points are turning points.

Straight line
Straight line: A straight line is characterised by an equation ($y = a + bx$), where a is the intercept and b is the gradient/slope. One of the methods for fitting a straight line is the least squares method.

subset:
a subsidiary collection of objects that all belong to, or is contained in, an original given set, e.g. subsets of {a, b} could include: {a}, {b}, {a, b} and {}

Subtend
Subtend: To lie opposite and mark out the limits of an angle.

Subtraction
Subtraction: The inverse operation of addition. In the notation a - b = c, the terms a, b, and c are called the minuend, subtrahend and difference, respectively.

Sum
The answer when two or more values are added together.

supplementary angles
Complex numbers: A combination of real and imaginary numbers of the form a + bi where a and b are real numbers and i is the square root of -1 (see imaginary number). While real numbers can be represented as points on a line, complex numbers can only be located on a plane. See Types of Numbers.

Supplementary angles
Supplementary angles: Two angles whose sum is 180o. See also complementary angles.

surd:
the n-th root a number, such as √5, the cube root of 7, etc

Surface area
To total area of all sides on a 3D shape.

Symmetrical
A shape which has at least one line of symmetry.

symmetry:
the correspondence in size, form or arrangement of parts on a plane or line (line symmetry is where each point on one side of a line has a corresponding point on the opposite side, e.g. a picture a butterfly with wings that are identical on either side; plane symmetry refers to similar figures being repeated at different but regular locations on the plane)

Tally
A system of counting where every group of four vertical lines is followed by a horizontal line to easily count in steps of five.

Tangent
A straight line that just touches a point on a curve. A tangent to a circle is perpendicular to the radius which meets the tangent.

Tangent
Tangent: The tangent of an angle in a right-angled triangle is the ratio of the lengths of the side opposite to the side adjacent [tan(x) = sin(x) / cos(x)]. A tangent line is a line, which touches a given curve at a single point. The slope of a tangent line can be approximated by a secant line. See Wikipedia: Tangent; MathWorld: Tangent; Mathlets: Tangent Lines.

Tangent law:
Tangent law: For any triangle, the side lengths a, b, c and corresponding opposite angles A, B, C are related as follows: (a+b) / (a-b) = {tan[1/2(A+B)]} / {tan[1/2(A-B)]}.
See Wikipedia: Law of Tangents.

Taylor Expansions

Taylor Expansions: A special kind of power series used as a basis of approximation. A Taylor expansion (series) is the sum of functions based on continually increasing derivatives (till one gets a zero value) if they exist. The accuracy of the approximation improves as the order of the approximation is increased (like fourth derivative or fifth). As the nonlinearity of the function increases the higher order terms become more important (i.e., the error increases as fewer terms of the Taylor series are included in the approximation). The main use of Taylor polynomial approximations is not to estimate the value of a function at a given point (this can be done by a calculator) but to approximate functions over an interval (representing complicated nonlinear functions as series 'infinite polynomials' makes life easier; see for example: Applications of Taylor Series). Maclaurin's expansion is a special case of Taylor's expansion. Wikipedia: Taylor Series; MathWorld: Taylor Series; a Lecture Note on Taylor Expansions by Luca Sbano; Taylor Polynomials Quizzes; Taylor Series Applet; Taylor Polynomials Applet; Mathlets: Taylor Polynomials; Visual Calculus: Taylor Polynomials.

tensor:
a collection of numbers at every point in space which describe how much the space is curved, e.g. in four spatial dimensions, a collection of ten numbers is needed at each point to describe the properties of the mathematical space or manifold, no matter how distorted it may be

Term
A number, variable or combination of both which forms part of an expression.

term:
in an algebraic expression or equation, either a single number or variable, or the product of several numbers and

variables separated from another term by a + or - sign, e.g. in the expression 3 + 4x + 5yzw, the 3, the 4x and the 5yzw are all separate terms

theorem:
a mathematical statement or hypothesis which has been proved on the basis of previously established theorems and previously accepted axioms, effectively the proof of the truth of a statement or expression

topology:
the field of mathematics concerned with spatial properties that are preserved under continuous deformations of objects (such as stretching, bending and morphing, but not tearing or gluing)

transcendental number:
an irrational number that is “not algebraic”, i.e. no finite sequence of algebraic operations on integers (such as powers, roots, sums, etc.) can be equal to its value, examples being π and e. For example, √2 is irrational but not transcendental because it is the solution to the polynomial x2 = 2.

Transcendental number:
Transcendental number: A real number that does not satisfy any algebraic equation with integral coefficients, such as x3 - 5x + 11 = 0. All transcendental numbers are irrational and most irrational numbers (non-repeating, non-terminating decimals) are transcendental. Transcendental functions (such as exponential, sine and cosine functions) can burst into chaos under certain circumstances. See Types of Numbers.

transfinite numbers:

cardinal numbers or ordinal numbers that are larger than all finite numbers, yet not necessarily absolutely infinite

Transformation
The collective name for reflections, rotations, translations and enlargements.

Translation
To move a shape from one position to another by sliding in the x-axis followed by the y-axis.

Trapezium
A quadrilateral with one pair of parallel sides.

Tree diagram
A method of solving probability questions by listing all the outcomes of an event. Probabilities are calculated by multiplying down the branches.

Triangle
A three sided polygon.

Triangle
Triangle: A three-sided figure that can take several shapes. The three inside angles add up to 180o. Triangles are divided into three basic types: obtuse, right and acute; they are also named by the characteristics of their sides: equilateral, isosceles, and scalene. The area of a triangle is 1/2 x perpendicular height x base.

Triangular number
A sequence of numbers generated by adding one more than was added to find the previous term. For example, 1, 3, 6, 10, 15, 21, ...

triangular number:

a number which can be represented as an equilateral triangle of dots, and is the sum of all the consecutive numbers up to its largest prime factor - it can also be calculated as n(n + 1)/2, e.g. 15 = 1 + 2 + 3 + 4 + 5 = 5(5 + 1)/2

Trigonometry
Trigonometry: The branch of mathematics that is concerned with the trigonometric functions. Trigonometric identities are the results that hold true for all angles. Sin, Cos and Tan are trigonometric ratios; Cosec, Sec and Cot are reciprocal of trigonometric ratios; Arcsin (sin-1), Arccos (cos-1) and Arctan (tan-1) are inverse of trigonometric functions.
See Syvum Math: Trigonometric Functions; CTK: Trigonometric Functions; Trigonometry Realms; S.O.S. Math: Trigonometric Identities Table; Wikipedia: Mathematics: Trigonometric Functions / Uses of Trigonometry; MathWorld: Geometry: Trigonometry; Dave's Short Trig Course (JAVA).

trigonometry:
the branch of mathematics that studies the relationships between the sides and the angles of right triangles, and deals with and with the trigonometric functions (sine, cosine, tangent and their reciprocals)

trinomial:
an algebraic equation with 3 terms, e.g. 3x + 5y + 8z; 3x3 + 2x2 + x; etc

type theory:
an alternative to naive set theory in which all mathematical entities are assigned to a type within a hierarchy of types, so that objects of a given type are built exclusively from

objects of preceding types lower in the hierarchy, thus preventing loops and paradoxes

Union
Union: The union of two sets is the set of elements that are in either of the two sets (compare with intersection).

Unit
Unit: A standard measurement.

Units
A quantity used to describe a measurement. Examples are kilograms, metres and centilitres.

Upper range
The largest value in a set of data.

Value
A numerical amount or quantity.

Variable
A letter which we don't know the value of.

Variable
Variable: An amount whose value can change.

Vector
Vector: A quantity characterised by a magnitude and a direction represented by (1) column form: two numbers (components) in a 2x1 matrix; (2) geometric form: by arrows in the (x,y)-plane; or (3) component form: the Cartesian unit vectors i (x-axis unit vector) and j (y-axis unit vector). The magnitude of a vector | u | is the length of the corresponding arrow and the direction is the angle (θ) the vector makes with the positive x-axis. When a1 and a2 are the components of the vector a (magnitude | a | = (a12 +

a22)1/2), it equals to a = a1i + a2j in component form, which equals to a = | a | cos(θ)i + | a | sin(θ)j. The angle (θ) can be found as arctan (a2 / a1). Cosine rule and sine rule are used for conversion of vectors from one form to another. See Wikipedia: Algebra: Vector, Vector Calculus; Eigenvector.

vector space:
a three-dimensional area where vectors can be plotted, or a mathematical structure formed by a collection of vectors

vector:
a physical quantity having magnitude and direction, represented by a directed arrow indicating its orientation in space

Venn diagram:
a diagram where sets are represented as simple geometric figures (often circles), and overlapping and similar sets are represented by intersections and unions of the figures

Vertex
Vertex: The point where lines intersect.

Volume
The amount an object can hold. E.g. a bottle of cola has a volume of 2 litres.

Week
A time period of 7 days.

Whole number
Whole number: Zero or any positive number with no fractional parts.

Wide

Used to describe the width of something

Width
The distance from side to side. E.g. 'The swimming pool is 10 metres wide.'

X-Axis
The horizontal axis on a graph. The line going across the page.

Y-Axis
The vertical axis on a graph. The line going from top to bottom.

Y-Intercept
The value of the y-coordinate when a graph crosses the y-axis.

Z-Axis
Represents the depth of an object when working with 3D coordinates.

Zermelo-Fraenkel set theory:
the standard form of set theory and the most common foundation of modern mathematics, based on a list of nine axioms (usually modified by a tenth, the axiom of choice) about what kinds of sets exist, commonly abbreviated together as ZFC

Zeta function:
A function based on an infinite series of reciprocals of exponents (Riemann’s zeta function is the extension of Euler’s simple zeta function into the domain of complex numbers)