

COMMON TERMS IN MATHEMATICS

Abscissa: The first coordinate in an ordered pair. For the point $(8, -2)$ the abscissa is 8.

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: A number with no associated units.

Acute angle: An angle with degree measure less than 90.

Acute triangle: A triangle for which all interior angles are acute.

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

Additive inverse of a number: The opposite of a number. For example, the additive inverse of 12 is -12 . Formally, the additive inverse of x is $-x$.

Adjacent angles: Two angles in a plane which share a common vertex and a common side but do not overlap.

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

Altitude/Height: The shortest distance between the base of a geometric figure and its top, whether that top is an opposite vertex, an apex, or another base.

Apothem: The line segment from the center of a regular polygon to the midpoint of a side, or the length of this segment. Same as the inradius; that is, the radius of a regular polygon's inscribed circle.

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

Associative property: A binary operation is defined as associative if the order in which the operations are performed does not matter as long as the sequence of the operands is not changed. For example, the operations addition and multiplication of natural numbers are associative, but subtraction and division are not.

Asymptote: A straight line that a curve approaches but never meets or crosses. The curve is said to meet the asymptote at infinity.

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

Axis of reflection: The "mirror line" of a reflection. That is, the line across which a reflection takes place.

Axis of rotation: A line about which a plane figure is rotated in three dimensional space to create a solid or surface.

Axis of symmetry: A line of symmetry for a graph. The two sides of a graph on either side of the axis of symmetry look like mirror images of each other.

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

Base: In plane geometry or solid geometry, the bottom of a figure. If the top is parallel to the bottom (as in a trapezoid or prism), both the top and bottom are called bases.

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

Bisector: A line segment, line, or plane that divides a geometric figure into two congruent halves.

Braces (Set braces): The symbols { and } which are used to indicate sets.

Brackets: The symbols [and].

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.

Cardinal numbers: The numbers 1, 2, 3, . . . as well as some types of infinity. Cardinal numbers are used to describe the number of elements in either finite or infinite sets.

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. A Cartesian plane is the plane formed by the x-axis and y-axis.

Centers of a triangle: circumcenter (concurrent lines are the perpendicular bisectors of the sides), incenter (concurrent lines are the angle bisectors), centroid (concurrent lines are the medians), orthocenter (concurrent lines are the altitudes).

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

Circle: A circle is defined as the set of points at a given distance (or radius) from its centre. 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).

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

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

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: 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: Logarithm with a base of 10 shown as \log_{10} .

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

Commutative property: A binary operation has the commutative property if changing the order of the operands does not change the result. For example, the operations addition and multiplication of natural numbers are commutative, but subtraction and division are not.

Complementary angles: Two angles whose sum is 90° .

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

Concave: A geometric figure is concave if there is at least one line segment connecting interior points which passes outside of the figure.

Congruent: Alike in all relevant respects.

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

Convex: A geometric figure is convex if every line segment connecting interior points is entirely contained within the figure's interior.

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

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

Cube root: The factor of a number that, when it is cubed (i.e., x^3) gives that number.

Curve: A word used to indicate any path, whether actually curved or straight, closed or open. A curve can be on a plane or in three-dimensional space. Lines, circles, arcs, parabolas, polygons, and helixes are all types of curves.

Decimal: A fraction having a power of ten as denominator. In the continent, a comma is used as the decimal point (between the unit figure and the numerator).

Degree of an angle: A unit of angle equal to one ninetieth of a right angle. Each degree ($^\circ$) 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 ($<90^\circ$) < right (90°) < obtuse ($90^\circ-180^\circ$) < reflex ($180^\circ-360^\circ$).

Denominator: The bottom number in a fraction.

Derivative: The derivative at a point on a curve is the gradient of the tangent to the curve at the given point.

Differential equations: Equations containing one or more derivatives. 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.

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

Difference: The result of subtracting two numbers or expressions. For example, the difference between 7 and 12 is $12 - 7$, which equals 5.

Differential calculus: Differentiation is concerned with rates of change and calculating the gradient at any point from the equation of a curve.

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

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).

Disjoint sets/Non-overlapping sets: Two or more sets which have no elements in common.

Distributive property: A binary operation is distributive over another binary operation if it lets you multiply a sum by multiplying each addend separately and then add the products. For example, the operation of multiplication is distributive over the operations of addition and subtraction in the set of natural numbers.

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.

Empty set/Null set: The set with no elements. The empty set can be written \emptyset or $\{\}$.

Equiangular triangle: A triangle with three congruent angles. Note: In Euclidean geometry, all equiangular triangles are equilateral (i.e. with three congruent sides) and vice-versa. The angles of a Euclidean equiangular triangle each measure 60° .

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

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 X^n , it is said that X is raised to the power of n.

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 of an integer: Any integer which divides evenly into a given integer. For example, 8 is a factor of 24.

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

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

Function (f): The mathematical operation that transforms a piece of data into a different one.

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).

Graph of an equation or inequality: The picture obtained by plotting all the points of an equation or inequality. If there is only one variable, the graph is on a number line. If there are two variables, the graph is on the coordinate plane. If there are three variables, the graph is in three-dimensional coordinates. In general, for n variables, the graph is in n dimensions.

Greatest common factor (GCF): The largest integer that divides evenly into each of a given set of numbers. For example, 6 is the gcd of 30 and 18. Sometimes GCF is written using parentheses: $(30, 18) = 6$.

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

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

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).

Inequality: Any of the symbols $<$, $>$, \leq , or \geq . Or: A mathematical sentence built from expressions using one or more of the symbols $<$, $>$, \leq , or \geq .

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.

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 (∞).

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

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

Integral calculus: This is the inverse process to differentiation; i.e., a function which has a given derived function.

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

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

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

Interval: The set of all real numbers between two given numbers. The two numbers on the ends are the endpoints. The endpoints might or might not be included in the interval depending on whether the interval is open, closed, or half-open (same as half-closed).

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 $\sin(x)$.

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.

Isosceles triangle: A triangle with two sides that are the same length. Formally, an isosceles triangle is a triangle with at least two congruent sides.

Least common denominator: The smallest whole number that can be used as a denominator for two or more fractions. The least common denominator is the least common multiple of the original denominators.

Least common multiple (LCM): The smallest positive integer into which two or more integers divide evenly. For example, 24 is the LCM of 8 and 12. Sometimes the LCM is written using brackets: $[8, 12] = 24$.

Line segment/Segment: All points comprised between two given points (including the given points themselves).

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

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. Linear equations are closely related to a straight line.

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

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 $\log_b N$.

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

Matrix: A matrix (plural: matrices) is a rectangular table of data or array of numbers.

Median of a set of numbers: The value for which half the numbers are larger and half are smaller. If there are two middle numbers, the median is the arithmetic mean of the two middle numbers.

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

Modulus: The absolute value of a number regardless of its sign, shown as $|x|$ or $\text{mod } x$.

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

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

Negative number: A real number less than zero. Zero itself is neither negative nor positive.

Number line: A line representing the set of all real numbers. The number line is typically marked showing integer values.

Numerator: The top number in a fraction.

Obtuse angle: An angle with a degree measure between 90 and 180.

Obtuse triangle: A triangle which has an obtuse angle as one of its interior angles.

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

Ordinal numbers: Numerical words that indicate order. The ordinal numbers are: first, second, third, fourth, etc.

Ordinate: The vertical coordinate on a plane.

Origin: The point on a graph that represents the point where the x and y axes meet.

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

Parentheses: The symbols (and). Singular: parenthesis.

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.

Perfect square: Any number that is the square of a rational number. For example, 0, 1, 4, 9, 16, 25, etc. are all perfect squares.

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

Perpendicular: At right angles to a line or plane.

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.

Plane: A flat surface extending in all directions. Any three noncollinear points lie on one and only one plane. So do any two distinct intersecting lines. A plane is a two-dimensional figure.

Plane figure: A shape on a plane. It includes points, lines, polygons, polygon interiors, circles, disks, parabolas, ellipses, hyperbolas, etc. Formally, a plane figure is any set of points on a plane.

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 closed plane figure for which all sides are line segments such as triangle, quadrilateral (square, rectangle, parallelogram, trapezoid *Br.Eng.*, trapezium *Am.En.*, kite, rhombus), pentagon, hexagon, heptagon, octagon, nonagon, decagon, etc. A polygon which has all sides mutually congruent and all angles mutually congruent is called regular polygon.

Polyhedron: A solid with no curved surfaces or edges. All faces are polygons and all edges are line segments.

Polynomial: An algebraic expression constructed from variables (also called indeterminates) and constants (usually numbers, but not always) using only the operations of addition, subtraction, multiplication and non-negative integer exponents.

Positive number: A real number greater than zero. Zero itself is not positive.

Power: The result of raising a base to an exponent. For example, 8 is a power of 2 since 8 is 2^3 .

Prime factors: Prime factors of a number are a list of prime numbers the product of which is the number concerned.

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).

Product: The result of a multiplication problem.

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

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

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

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

Quadratic equation: An algebraic equation of the second degree (having one or more variables raised to the second power). The general quadratic equation is $ax^2 + bx + c = 0$, in which a , b , and c are constants (or parameters) and ' a ' is not equal to 0.

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

Radical: The $\sqrt{\quad}$ symbol, which is used to indicate square roots, cube roots or n th roots.

Radicand: The number under the $\sqrt{\quad}$ (radical) symbol. That is, a number which is having its square root taken (or cube root, 4th root, 5th root, n th root, etc.). For example, 3 is the radicand in $\sqrt{3}$.

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

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.

Rational number: A number that can be expressed as the ratio of two integers.

Ray: A part of a line starting at a particular point and extending infinitely in one direction.

Real number: Rational (fractions) and irrational (numbers with non-recurring decimal representation) numbers. The set of real numbers is denoted as 'R' for real. Basically, real numbers are all numbers except imaginary numbers (such as the square root of -1).

Reciprocal: The multiplicative inverse of a number. It can be shown with a negative index (x^{-1}).

Reduce a fraction: Simplify. That is, cancel out all common factors in the numerator and denominator until no common factors remain.

Reflex angle: An angle with a degree measure between 180 and 360.

Relatively prime: Describes two numbers for which the only common factor is 1. In other words, relatively prime numbers have a greatest common factor (gcf) of 1.

Remainder: The part left over after long division.

Right angle: An angle with a degree measure 90. An angle which is not a right angle is called oblique angle.

Right triangle: A triangle which has a right (90°) interior angle. Its sides are called legs and hypotenuse.

Root: If, when a number is raised to the power of n gives the answer a , then this number is the n th root of a .

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).

Scalene triangle: A triangle for which all three sides have different lengths.

Scientific notation (exponential notation, standard form): One way of writing very small or very large numbers.

Secant line: A line that intersects a curve. The intercept is a chord of the curve.

Set: A group of numbers, variables, geometric figures. Sets are written using set braces $\{ \}$. For example, $\{1,2,3\}$ is the set containing the elements 1, 2, and 3. Note: Order does not matter in a set. The sets $\{a,b,c\}$ and $\{c,a,b\}$ are the same set. Repetition does not matter either, so $\{a,b\}$ and $\{a,a,b,b,b\}$ are the same set.

Side/Arm of an angle: Either of the two rays making up an angle.

Side of a polygon: Any of the line segments that make up a polygon.

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.

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

Solid/Geometric solid/Solid geometric figure: The collective term for all bounded three-dimensional geometric figures. This includes polyhedra, pyramids, prisms, cylinders, cones, spheres, ellipsoids, etc.

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: A straight line is characterised by an equation ($y = a + bx$), where a is the intercept and b is the gradient/slope.

Strict inequality: An inequality that uses the symbols $<$ or $>$. The symbols \leq and \geq are not used.

Subset: Set A is a subset of set B if all of the elements (if any) of set A are contained in set B . This is written $A \subset B$. Note: The empty set is a subset of every set.

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

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 result of adding a set of numbers or algebraic expressions.

Supplementary angles: Two angles whose sum is 180° .

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. 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.

Transcendental number: A real number that does not satisfy any algebraic equation with integral coefficients. All transcendental numbers are irrational and most irrational numbers (non-repeating, non-terminating decimals) are transcendental.

Triangle: A three-sided figure that can take several shapes. The three inside angles add up to 180° . 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 $\frac{1}{2} \times$ perpendicular height \times base.

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.

Unbounded set of numbers: A set of numbers that is not bounded. That is, a set that lacks either a lower bound or an upper bound. For example, the sequence 1, 2, 3, 4,... is unbounded.

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

Unit: A standard measurement.

Variable: An amount whose value can change.

Vertex (pl. Vertices or Vertexes): The point where lines intersect.

Weighted average: A method of computing a kind of arithmetic mean of a set of numbers in which some elements of the set carry more importance (weight) than others.

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