



## Etymology and Definition of Maths

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**Abstract:** This article describes mathematical terms and their etymology, definitions, and the importance of mathematics as a science and in business life.

**Keywords:** mathematics, astrology, Algorithm, algebra.

The word mathematics comes from the Greek μάθημα (máthēma), which, in the ancient Greek language, means “what one learns”, “what one gets to know”, hence also “study” and “science”, and in modern Greek just “lesson”. The word máthēma is derived from μανθάνω (manthano), while the modern Greek equivalent is μαθαίνω (mathaino), both of which mean “to learn”. In Greece, the word for “mathematics” came to have the narrower and more technical meaning “mathematical study”, even in Classical times. Its adjective is μαθηματικός (mathēmatikós), meaning “related to learning” or “studious”, which likewise further came to mean “mathematical”. In particular, μαθηματικὴ τέχνη (mathēmatikḗ tékhnē), Latin: ars mathematica, meant “the mathematical art”.

In Latin, and in English until around 1700, the term mathematics more commonly meant “astrology” (or sometimes “astronomy”) rather than “mathematics”; the meaning gradually changed to its present one from about 1500 to 1800. This has resulted in several mistranslations: a particularly notorious one is Saint Augustine’s warning that Christians should beware of mathematici meaning astrologers, which is sometimes mistranslated as a condemnation of mathematicians.

The apparent plural form in English, like the French plural form les mathématiques (and the less commonly used singular derivative la mathématique), goes back to the Latin neuter plural mathematica (Cicero), based on the Greek plural τα μαθηματικά (ta mathēmatiká), used by Aristotle (384–322 BC), and meaning roughly “all things mathematical”; although it is plausible that English borrowed only the adjective mathematic(al) and formed the noun mathematics anew, after the pattern of physics and metaphysics, which were inherited from the Greek. In English, the noun mathematics takes singular verb forms. It is often shortened to maths or, in English-speaking North America, math.

Aristotle defined mathematics as “the science of quantity”, and this definition prevailed until the 18th century. Starting in the 19th century, when the study of mathematics increased in rigor and began to address abstract topics such as group theory and projective geometry, which have no clear-cut relation to quantity and measurement, mathematicians and philosophers began to propose a variety of new definitions. Some of these definitions emphasize the deductive character of much of mathematics, some emphasize its abstractness, some emphasize certain topics within mathematics. Today, no consensus on the definition of mathematics prevails, even among professionals. There is not even consensus on whether mathematics is an art or a science. A great many professional mathematicians take no interest in a definition of mathematics, or consider it undefinable. Some just say, “Mathematics is what mathematicians do.”

Three leading types of definition of mathematics are called logicist, intuitionist, and formalist, each reflecting a different philosophical school of thought. All have severe problems, none has widespread acceptance, and no reconciliation seems possible.

An early definition of mathematics in terms of logic was Benjamin Peirce's "the science that draws necessary conclusions" (1870). In the *Principia Mathematica*, Bertrand Russell and Alfred North Whitehead advanced the philosophical program known as logicism, and attempted to prove that all mathematical concepts, statements, and principles can be defined and proven entirely in terms of symbolic logic. A logicist definition of mathematics is Russell's "All Mathematics is Symbolic Logic" (1903).

Intuitionist definitions, developing from the philosophy of mathematician L.E.J. Brouwer, identify mathematics with certain mental phenomena. An example of an intuitionist definition is "Mathematics is the mental activity which consists in carrying out constructs one after the other." A peculiarity of intuitionism is that it rejects some mathematical ideas considered valid according to other definitions. In particular, while other philosophies of mathematics allow objects that can be proven to exist even though they cannot be constructed, intuitionism allows only mathematical objects that one can actually construct.

Formalist definitions identify mathematics with its symbols and the rules for operating on them. Haskell Curry defined mathematics simply as "the science of formal systems". A formal system is a set of symbols, or tokens, and some rules telling how the tokens may be combined into formulas. In formal systems, the word axiom has a special meaning, different from the ordinary meaning of "a self-evident truth". In formal systems, an axiom is a combination of tokens that is included in a given formal system without needing to be derived using the rules of the system.

This is a glossary of common mathematical terms used in arithmetic, geometry, algebra, and statistics.

**Abacus:** An early counting tool used for basic arithmetic.

**Absolute Value:** Always a positive number, absolute value refers to the distance of a number from 0.

**Acute Angle:** An angle whose measure is between  $0^\circ$  and  $90^\circ$  or with less than  $90^\circ$  (or  $\pi/2$ ) radians.

**Addend:** A number involved in an addition problem; numbers being added are called addends.

**Algebra:** The branch of mathematics that substitutes letters for numbers to solve for unknown values.

**Algorithm:** A procedure or set of steps used to solve a mathematical computation.

**Angle:** Two rays sharing the same endpoint (called the angle vertex).

**Angle Bisector:** The line dividing an angle into two equal angles.

**Conic Section:** The section formed by the intersection of a plane and cone.

**Constant:** A value that does not change.

**Coordinate:** The ordered pair that gives a precise location or position on a coordinate plane.

**Congruent:** Objects and figures that have the same size and shape. Congruent shapes can be turned into one another with a flip, rotation, or turn.

**Cosine:** In a right triangle, cosine is a ratio that represents the length of a side adjacent to an acute angle to the length of the hypotenuse.

**Cylinder:** A three-dimensional shape featuring two circle bases connected by a curved tube.

**Decagon:** A polygon/shape with ten angles and ten straight lines.

**Decimal:** A real number on the base ten standard numbering system.

**Denominator:** The bottom number of a fraction. The denominator is the total number of equal parts into which the numerator is being divided.

**Degree:** The unit of an angle's measure represented with the symbol  $^{\circ}$ .

**Diagonal:** A line segment that connects two vertices in a polygon.

**Diameter:** A line that passes through the center of a circle and divides it in half.

**Difference:** The difference is the answer to a subtraction problem, in which one number is taken away from another.

**Digit:** Digits are the numerals 0-9 found in all numbers. 176 is a 3-digit number featuring the digits 1, 7, and 6.

**Dividend:** A number being divided into equal parts (inside the bracket in long division).

**Divisor:** A number that divides another number into equal parts (outside of the bracket in long division).

**Edge:** A line is where two faces meet in a three-dimensional structure.

**Ellipse:** An ellipse looks like a slightly flattened circle and is also known as a plane curve. Planetary orbits take the form of ellipses.

**End Point:** The "point" at which a line or curve ends.

**Equilateral:** A term used to describe a shape whose sides are all of equal length.

**Equation:** A statement that shows the equality of two expressions by joining them with an equals sign.

**Even Number:** A number that can be divided or is divisible by 2.

**Event:** This term often refers to an outcome of probability; it may answers question about the probability of one scenario happening over another.

**Evaluate:** This word means "to calculate the numerical value".

**Exponent:** The number that denotes repeated multiplication of a term, shown as a superscript above that term. The exponent of  $3^4$  is 4.

**Expressions:** Symbols that represent numbers or operations between numbers.

**Face:** The flat surfaces on a three-dimensional object.

**Factor:** A number that divides into another number exactly. The factors of 10 are 1, 2, 5, and 10 ( $1 \times 10$ ,  $2 \times 5$ ,  $5 \times 2$ ,  $10 \times 1$ ).

**Factoring:** The process of breaking numbers down into all of their factors.

**Factorial Notation:** Often used in combinatorics, factorial notations requires that you multiply a number by every number smaller than it. The symbol used in factorial notation is ! When you see  $x!$ , the factorial of  $x$  is needed.

**Factor Tree:** A graphical representation showing the factors of a specific number.

**Fibonacci Sequence:** A sequence beginning with a 0 and 1 whereby each number is the sum of the two numbers preceding it. "0, 1, 1, 2, 3, 5, 8, 13, 21, 34..." is a Fibonacci sequence.

**Figure:** Two-dimensional shapes.

**Finite:** Not infinite; has an end.

**Flip:** A reflection or mirror image of a two-dimensional shape.

**Formula:** A rule that numerically describes the relationship between two or more variables.

**Fraction:** A quantity that is not whole that contains a numerator and denominator. The fraction representing half of 1 is written as  $\frac{1}{2}$ .

**Frequency:** The number of times an event can happen in a given period of time; often used in probability calculations.

**Furlong:** A unit of measurement representing the side length of one square acre. One furlong is approximately  $\frac{1}{8}$  of a mile, 201.17 meters, or 220 yards.

**Geometry:** The study of lines, angles, shapes, and their properties. Geometry studies physical shapes and the object dimensions.

**Graphing Calculator:** A calculator with an advanced screen capable of showing and drawing graphs and other functions.

**Graph Theory:** A branch of mathematics focused on the properties of graphs.

**Greatest Common Factor:** The largest number common to each set of factors that divides both numbers exactly. The greatest common factor of 10 and 20 is 10.

**Hexagon:** A six-sided and six-angled polygon.

**Histogram:** A graph that uses bars that equal ranges of values.

**Hyperbola:** A type of conic section or symmetrical open curve. The hyperbola is the set of all points in a plane, the difference of whose distance from two fixed points in the plane is a positive constant.

**Hypotenuse:** The longest side of a right-angled triangle, always opposite to the right angle itself.

**Identity:** An equation that is true for variables of any value.

**Improper Fraction:** A fraction whose numerator is equal to or greater than the denominator, such as  $\frac{6}{4}$ .

**Inequality:** A mathematical equation expressing inequality and containing a greater than ( $>$ ), less than ( $<$ ), or not equal to ( $\neq$ ) symbol.

**Integers:** All whole numbers, positive or negative, including zero.

**Irrational:** A number that cannot be represented as a decimal or fraction. A number like pi is irrational because it contains an infinite number of digits that keep repeating. Many square roots are also irrational numbers.

**Isosceles:** A polygon with two sides of equal length.

**Kilometer:** A unit of measure equal to 1000 meters.

**Knot:** A closed three-dimensional circle that is embedded and cannot be untangled.

**Like Terms:** Terms with the same variable and same exponents/powers.

**Like Fractions:** Fractions with the same denominator.

**Line:** A straight infinite path joining an infinite number of points in both directions.

**Line Segment:** A straight path that has two endpoints, a beginning and an end.

**Linear Equation:** An equation that contains two variables and can be plotted on a graph as a straight line.

**Line of Symmetry:** A line that divides a figure into two equal shapes.

**Logic:** Sound reasoning and the formal laws of reasoning.

**Logarithm:** The power to which a base must be raised to produce a given number. If  $n^x = a$ , the logarithm of a, with n as the base, is x. Logarithm is the opposite of exponentiation.

**Mean:** The mean is the same as the average. Add up a series of numbers and divide the sum by the total number of values to find the mean.

**Median:** The median is the "middle value" in a series of numbers ordered from least to greatest. When the total number of values in a list is odd, the median is the middle entry. When the total number of values in a list is even, the median is equal to the sum of the two middle numbers divided by two.

**Midpoint:** A point that is exactly halfway between two locations.

**Mixed Numbers:** Mixed numbers refer to whole numbers combined with fractions or decimals. Example  $3\frac{1}{2}$  or 3.5.

**Mode:** The mode in a list of numbers are the values that occur most frequently.

**Modular Arithmetic:** A system of arithmetic for integers where numbers "wrap around" upon reaching a certain value of the modulus.

**Monomial:** An algebraic expression made up of one term.

**Multiple:** The multiple of a number is the product of that number and any other whole number. 2, 4, 6, and 8 are multiples of 2.

**Multiplication:** Multiplication is the repeated addition of the same number denoted with the symbol  $\times$ .  $4 \times 3$  is equal to  $3 + 3 + 3 + 3$ .

**Multiplicand:** A quantity multiplied by another. A product is obtained by multiplying two or more multiplicands.

**Natural Numbers:** Regular counting numbers.

**Negative Number:** A number less than zero denoted with the symbol  $-$ . Negative 3 = -3.

**Net:** A two-dimensional shape that can be turned into a two-dimensional object by gluing/taping and folding.

**Nth Root:** The nth root of a number is how many times a number needs to be multiplied by itself to achieve the value specified. Example: the 4th root of 81 is 3 because  $3 \times 3 \times 3 \times 3 = 81$ .

**Norm:** The mean or average; an established pattern or form.

**Normal Distribution:** Also known as Gaussian distribution, normal distribution refers to a probability distribution that is reflected across the mean or center of a bell curve.

**Numerator:** The top number in a fraction. The numerator is divided into equal parts by the denominator.

**Number Line:** A line whose points correspond to numbers.

**Numeral:** A written symbol denoting a number value.

**Obtuse Angle:** An angle measuring between  $90^\circ$  and  $180^\circ$ .

**Obtuse Triangle:** A triangle with at least one obtuse angle.

**Octagon:** A polygon with eight sides.

**Odds:** The ratio/likelihood of a probability event happening. The odds of flipping a coin and having it land on heads are one in two.

**Odd Number:** A whole number that is not divisible by 2.

**Operation:** Refers to addition, subtraction, multiplication, or division.

**Ordinal:** Ordinal numbers give relative position in a set: first, second, third, etc.

**Order of Operations:** A set of rules used to solve mathematical problems in the correct order. This is often remembered with acronyms BEDMAS and PEMDAS.

**Outcome:** Used in probability to refer to the result of an event.

**Parallelogram:** A quadrilateral with two sets of opposite sides that are parallel.

**Parabola:** An open curve whose points are equidistant from a fixed point called the focus and a fixed straight line called the directrix.

**Pentagon:** A five-sided polygon. Regular pentagons have five equal sides and five equal angles.



**Variable:** A letter used to represent a numerical value in equations and expressions. Example: in the expression  $3x + y$ , both  $y$  and  $x$  are the variables.

**Venn Diagram:** A Venn diagram is usually shown as two overlapping circles and is used to compare two sets. The overlapping section contains information that is true of both sides or sets and the non-overlapping portions each represent a set and contain information that is only true of their set.

**Volume:** A unit of measure describing how much space a substance occupies or the capacity of a container, provided in cubic units.

**Vertex:** The point of intersection between two or more rays, often called a corner. A vertex is where two-dimensional sides or three-dimensional edges meet.

**Weight:** The measure of how heavy something is.

**Whole Number:** A whole number is a positive integer.

**X-Axis:** The horizontal axis in a coordinate plane.

**X-Intercept:** The value of  $x$  where a line or curve intersects the  $x$ -axis.

**X:** The Roman numeral for 10.

**$x$ :** A symbol used to represent an unknown quantity in an equation or expression.

**Y-Axis:** The vertical axis in a coordinate plane.

**Y-Intercept:** The value of  $y$  where a line or curve intersects the  $y$ -axis.

**Yard:** A unit of measure that is equal to approximately 91.5 centimeters or 3 feet.

The word mathematics comes from Ancient Greek *máthēma* (μάθημα), meaning "that which is learnt", "what one gets to know", hence also "study" and "science". The word came to have the narrower and more technical meaning of "mathematical study" even in Classical times.

Its adjective is *mathēmatikós* (μαθηματικός), meaning "related to learning" or "studious", which likewise further came to mean "mathematical". In particular, *mathēmatikḗ tékhnē* (μαθηματικὴ τέχνη; Latin: *ars mathematica*) meant "the mathematical art".

Similarly, one of the two main schools of thought in Pythagoreanism was known as the *mathēmatikoi* (μαθηματικοί)—which at the time meant "learners" rather than "mathematicians" in the modern sense. The Pythagoreans were likely the first to constrain the use of the word to just the study of arithmetic and geometry. By the time of Aristotle (384–322 BC) this meaning was fully established.

In Latin, and in English until around 1700, the term mathematics more commonly meant "astrology" (or sometimes "astronomy") rather than "mathematics"; the meaning gradually changed to its present one from about 1500 to 1800. This change has resulted in several mistranslations: For example, Saint Augustine's warning that Christians should beware of *mathematici*, meaning "astrologers", is sometimes mistranslated as a condemnation of mathematicians.

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