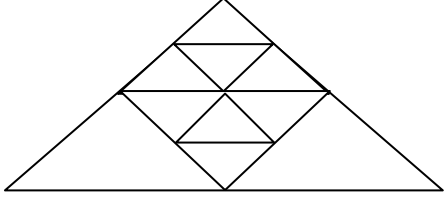


# Mathematics Standard Articulated by Grade Level

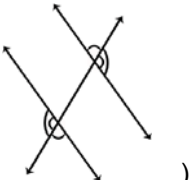
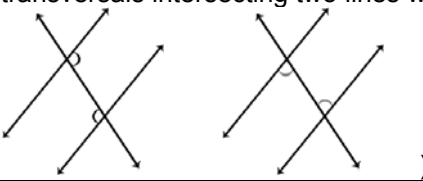
## GLOSSARY

The purpose of this glossary is to help the user better understand and implement the Mathematics Standard. It is not intended to be a study guide for the AIMS and is not a comprehensive list of all mathematics terms.

The definitions in the glossary are general in nature. For specific information about grade level expectations, consult the explanations and examples column in the grade level documents.

<b>absolute value</b>	a number's distance from zero on a number line (e.g., the absolute value of $-4$ is 4, the absolute value of 4 is 4; symbolically, $ -4  = 4$ and $ 4  = 4$ )
<b>absolute value function</b>	a rule that defines a relationship between two sets of numbers that for each value of the independent variable set there is only one value in the dependent value set where $f(x) =  x $ , where $f(x) \geq 0$ ; for all values of $x$
<b>accuracy (mathematical)</b>	the extent to which a solution or measurement matches a standard or expected result
<b>acute angle</b>	an angle with measure between zero degrees and ninety degrees
<b>addend</b>	a number used in the mathematical operation of addition (e.g., $6 + 8 = 14$ , 6 and 8 are addends)
<b>addition</b>	a mathematical operation that combines two or more numbers to calculate a sum
<b>addition principle of counting</b>	<p>a principle that allows for the efficient counting of the total number of ways a task can be accomplished when each part of the task consists of counting items from separate groups that do not overlap. For example, how many triangles are in the figure below? The task is to recognize there are three types of triangles (small, medium, and large) where each group does not overlap with another group; i.e., where each type of triangle appears as a member of one and only one group.</p>  <p>elementary school: If you want to count the total number of triangles in the figure above, count the number of small-sized triangles (8), count the number of medium-sized triangles (4), and count the number of large-sized triangles (1) and add them together (<math>8 + 4 + 1 = 13</math>). So there are a total of 13 triangles in the figure.</p> <p>If you have a task that can be accomplished through counting a collection of items among disjoint groups, and you count <math>m</math> items in the first group, <math>n</math> items in a second group, and <math>g</math> items in a third group (etc.) then you can efficiently count the total number of items in the task by using the addition principle of counting. In this example, we would add <math>m</math> plus <math>n</math> plus <math>g</math> or <math>(m + n + g)</math>.</p> <p>high school: let <math>A_1</math> and <math>A_2</math> be separate events that may occur at the same time with <math>n_1</math> and <math>n_2</math> possible outcomes for each event, respectively; then the total number of possible outcomes for the two events occurring are <math>n_1 + n_2</math>.</p>

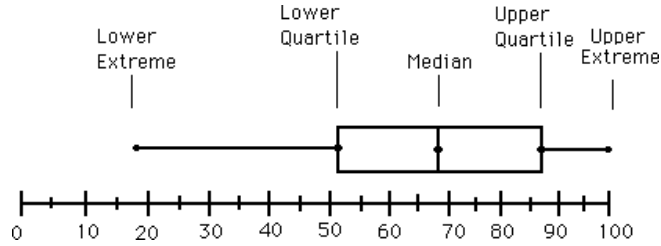
## Mathematics Standard Articulated by Grade Level

<b>adjacency matrix</b>	the arrangement of rows and columns labeled by graph vertices, with a 1 or 0 in position $(v_i, v_j)$ according to whether or not $v_i$ and $v_j$ are adjacent. For a simple graph with no self-loops, the adjacency matrix must have zeros on the diagonal while the adjacency matrix for an undirected graph is symmetrical
<b>adjacent vertices</b>	vertices joined by an edge or neighboring vertices in a vertex-edge graph
<b>algebraic expression</b>	a group of numbers, symbols, and variables that express a single or series of mathematical operations (e.g., $2x + 4 - 16y$ )
<b>algebraic form/notation</b>	an algebraic description written in terms of numbers, symbols, and variables
<b>algorithm</b>	a set of step-by-step instructions for completing a task that can be generalized to other tasks, problems, or situations
<b>alternate exterior angles</b>	<p>angles formed by one or more transversals intersecting two lines whose interiors are not between two lines and on different sides of the transversal (e.g., )</p>
<b>alternate interior angles</b>	<p>angles formed by one or more transversals intersecting two lines whose interiors are between the two lines and on different sides of the transversal (e.g., )</p>
<b>altitude of a geometric figure</b>	a perpendicular segment from a base to a vertex or between bases
<b>amplitude</b>	a measure of one half the difference between the largest and smallest value of a function
<b>analog clock</b>	a device for the measurement of time that has numbers 1 to 12 around a face, with an hour, minute, and second hand that shows a continuous sweep of time
<b>analyze</b>	a process of dividing a composite into its parts for the purpose of examination
<b>angle</b>	a geometric figure consisting of the union of two rays that share a common endpoint (vertex)
<b>angle bisector</b>	a line, line segment, or ray that divides an angle into two congruent parts
<b>angle measure</b>	the measure (in degrees or radians) of the arc formed by two rays with a common endpoint (vertex)
<b>annuity</b>	a purchased investment contract between a person and an insurance company that defines payments to the insurer, in lump sum or in a series of payments, in exchange for benefits paid back to the insured at a designated date or series of dates

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<b>appropriate</b>	the reasonable use of an attribute, unit, or tool within the context of a problem (e.g., using a ruler to measure dimensions of a tissue box but not the dimensions of a building, using meters as the unit measure for the dimensions of a house but not the dimensions of a picture frame)
<b>appropriate measure of accuracy</b>	the degree of accuracy required for a mathematical task (e.g., approximating the lengths of lumber in framing carpentry requires less accuracy than the lengths of molding in finish carpentry)
<b>approximation</b>	a value or quantity that is close to, but not the same as, the desired value or quantity for a specified purpose
<b>area</b>	a two dimensional space measured by the number of non-overlapping unit squares or parts of unit squares that can fit into the space
<b>arithmetic sequence</b>	an ordered set of items in which the difference between each consecutive item is constant
<b>arrangement</b>	possible order of a set of events or items
<b>array</b>	a rectangular arrangement of objects or elements organized into rows and columns, or a set of objects or elements organized into a specific pattern
<b>associative property</b>	addition: changing the grouping of terms in a sum without changing the sum multiplication: changing the grouping of factors in a product without changing the product
<b>asymptote</b>	a line that a graph approaches
<b>attribute of a figure</b>	a property or common feature of a sets of objects or elements
<b>attribute of a function or graph</b>	a characteristic or distinct feature
<b>average</b>	the result of the sum of all the numbers in a data set divided by the number of elements in that data set
<b>axis (axes: plural) (in two-dimensions)</b>	one of two perpendicular number lines used to form a coordinate system
<b>bar graph</b>	a representation of the length of either vertical or horizontal bars used to enumerate and compare data
<b>base</b>	exponent: a term used to indicate a factor for repeated multiplication (e.g., in $4^7$ , 4 is the base) logarithm: the quantity $a$ in the equation $x = \log_a y$
<b>base of a polyhedron</b>	the face of a geometric figure that identifies its type
<b>base of a polygon</b>	a side of a polygon that is perpendicular to its height
<b>benchmark</b>	a commonly known point of reference from which measurements may be made (e.g., four quarters make a whole)
<b>benchmark fraction</b>	a commonly known fraction that serves as a meaningful reference point for measurement comparison

# Mathematics Standard Articulated by Grade Level

<b>bias</b>	sampling: a segment of data that is not representative of the original set of data statistical: an effect which deprives a statistical result of representativeness by systematically distorting it
<b>binomial</b>	an algebraic expression consisting of two terms (e.g., $x + 3$ , $4a - 6$ )
<b>binomial theorem</b>	a description of the coefficients of the expansion of the binomial $a + b$ raised to the $n$ th power
<b>bisect</b>	to divide an object or term into two congruent parts
<b>bisector</b>	a point, segment, line, ray or plane which divides a segment, angle or figure into two parts of equal measure
<b>box and whisker plot</b>	a method for displaying the median, quartiles, and extremes of a data set  
<b>brokerage fee</b>	a fee in the form of a commission charged to the buyer by the brokerage firm for acting on behalf of the investor with the bond, commodities, or stock market
<b>calculation</b>	an action, process, or result of a mathematical computation
<b>capacity</b>	the amount of space in units or cubes that can fit into a solid (note: also referred to as volume)
<b>Cartesian coordinate system</b>	a plane containing points identified by their distance from the origin in ordered pairs along two perpendicular lines referred to as axes (note: also referred to as coordinate plane and rectangular coordinate plane)
<b>causation</b>	an agency or action that produces an effect
<b>Celsius</b>	a metric scale for the measurement of temperature based on the properties of water
<b>central angle</b>	an angle whose vertex is the center of a circle and whose sides (rays) are radii
<b>chord of a circle</b>	a segment whose endpoints are on a given circle
<b>chromatic number</b>	fewest number of colors needed to color a vertex-edge graph
<b>circle</b>	a set of points in a plane that are equidistant from a given point called the center
<b>circle graph</b>	a display of data as sections of a circle that represent all the data (note: formerly called pie graph or pie chart)
<b>circuit</b>	a path in a graph that starts and ends at the same vertex
<b>circular arc</b>	a fraction of the circumference of a circle
<b>circumcenter</b>	the point where the three perpendicular bisectors of the sides of a triangle meet
<b>circumference</b>	the total distance around a closed curve like a circle
<b>coefficient</b>	the number part of a term and variable combination (e.g., the coefficient for $7x$ is 7)
<b>coincident</b>	lines or shapes that have all points in common

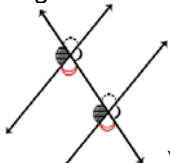
## Mathematics Standard Articulated by Grade Level

<b>collinear</b>	points that lie on the same line
<b>coloring of a graph</b>	assigning colors to the vertices of a vertex-edge graph so that adjacent vertices are assigned different colors
<b>coloring of a picture or map</b>	assigning colors to the regions of a picture or map so that regions that share a common border are assigned different colors
<b>combination</b>	The number of ways of choosing or selecting $k$ unordered outcomes from $n$ possibilities. ${}^n C_k = \binom{n}{k} = \frac{n!}{k!(n-k)!}$
<b>common algorithm</b>	a set of step by step instructions that are well known by most practitioners and are frequently used (e.g., borrowing, carrying)
<b>common denominator</b>	a number divisible by all of the denominators in a set of fractions
<b>common factor</b>	a whole number that divides without remainder into two or more non-zero numbers
<b>common irrational numbers</b>	a grouping of well known real numbers that cannot be expressed as a ratio of two integers (e.g., $\pi$ , $\frac{\pi}{2}$ , $\frac{\pi}{4}$ , $\sqrt{3}$ , $\sqrt{2}$ , $e$ )
<b>common multiple</b>	a whole number multiple of two or more given numbers (e.g., 48 is a common multiple of 2, 3, and 4)
<b>commutative property</b>	addition: the addition of terms in any order obtains the same sum (e.g., $a + b + c = d$ , $a + c + b = d$ ) multiplication: the multiplication of terms in any order obtains the same product (e.g., $a * b * c = d$ , $b * c * a = d$ )
<b>comparative language</b>	words used to describe the differences in terms and objects (e.g., bigger, smaller, less than, more than, not equal to)
<b>complementary angles</b>	any two angles whose measures have a sum of ninety degrees
<b>complementary events</b>	two events whose probabilities of occurring sum to one; mutually exclusive events (e.g., when flipping a coin, getting a head and getting a tail are complementary events)
<b>complete graph</b>	a vertex-edge graph in which every vertex is adjacent to every other vertex
<b>complex fraction</b>	a fraction that has a fractional numerator, denominator, or both (e.g., $\frac{7}{31y^5x^6s}$ )
<b>complex number</b>	a number that can be written in the form $a + bi$ where $a$ and $b$ are real numbers and $i$ is an imaginary number (e.g., $2+3i$ which is equivalent to $2 + \sqrt{-3}$ )

## Mathematics Standard Articulated by Grade Level

<b>complex solution</b>	a solution to a problem or equation that is <u>not</u> a real number
<b>compose</b>	to create by putting together
<b>composite figure</b>	a geometric figure that is composed of two or more simple polygons
<b>composite number</b>	a number that has factors other than one and itself
<b>composition of function</b>	a function comprised of more than one function arranged such that the output of one function becomes the input of the next function
<b>compound interest</b>	a percentage of an amount that accrues based on the product of the interest rate and the sum of the principal and any previously earned interest
<b>compound probability</b>	the likelihood that an event will occur based on whether another event has occurred
<b>compound probability experiment</b>	an organized process that examines the likelihood of two events occurring simultaneously, or the likelihood of one event occurring, instead of other possible outcomes, in conjunction with another event
<b>computational estimation</b>	the method of determining an approximate solution to a numerical problem
<b>computational fluency</b>	the efficient automatic recall of addition, subtraction, multiplication, and division facts; the efficient and automatic recall and use of standard algorithms for addition, subtraction, multiplication, and division
<b>compute</b>	to determine or calculate by mathematical means
<b>conclusion</b>	the <i>then</i> clause in an <i>if-then</i> conditional statement; a statement based on a reasonable judgment of two or more proposals
<b>concrete materials</b>	physical objects and manipulatives used for the purpose of instruction to represent mathematical situations
<b>concrete situation</b>	a condition derived from real-world examples and applications (note: also called contextual situation)
<b>conditional probability</b>	the likelihood that an event will occur based on an event that has already occurred
<b>conditional statement</b>	a statement with a hypothesis and conclusion in the form, <i>if</i> hypothesis, <i>then</i> conclusion (e.g., <i>if</i> a closed figure has exactly three sides, <i>then</i> the figure is a triangle)
<b>cone</b>	a three-dimensional figure generated by rotating a triangle about one of its legs to form a solid with one circular base
<b>conflict</b>	vertex-edge graphs can be used to model entities which are in conflict
<b>congruent</b>	having the same shape and exactly the same size
<b>conic section</b>	the intersection of a plane and two right conical surfaces that have the same vertex and whose angles are opposite rays (e.g., ellipse, parabola, hyperbola, circle)
<b>conjecture</b>	an unproven statement based on observations
<b>Conjugate Root Theorem</b>	if $a+bi$ is a root for polynomial $P$ , then $a-bi$ is also a root for polynomial $P$

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<b>connected vertex-edge graph</b>	a vertex-edge graph is connected if there is a path between all pairs of vertices (if a path does not exist between all pairs of vertices then the graph is disconnected)
<b>consecutive</b>	to follow in order one after the other
<b>consecutive exterior angles</b>	angles formed when one or more transversals intersect two parallel lines, that are <u>not</u> located between the two parallel lines, and are located on either side of a transversal
<b>consecutive interior angles</b>	angles formed when one or more transversals intersect two parallel lines, that are located between the two parallel lines, and are located on either side of a transversal
<b>consecutive vertices</b>	vertices that share a side of a polygon
<b>constancy</b>	the attribute of being unchanging, consistent, and regular
<b>constant (of an expression)</b>	a term with a degree of zero
<b>constant (rate of change)</b>	a fixed incremental increase or decrease over an interval
<b>construct</b>	arithmetic: the formation of a conclusion or the derivation of a result by joining or organizing forms geometry: to draw a geometric figure using appropriate tools to meet a given set of constraints
<b>contextual situation</b>	real-life scenarios or circumstances that illustrate mathematical problems (note: also called concrete situation)
<b>contrapositive</b>	a conditional statement that is the logical equivalent to the original statement exchanging the hypothesis with the conclusion and negating both of them
<b>converse</b>	a conditional statement that exchanges the hypothesis ( <i>if</i> ) and conclusion ( <i>then</i> ) components of an <i>if-then</i> statement
<b>conversion factor</b>	the ratio of two equal quantities that are measured in different units
<b>convex polygon</b>	a polygon with each interior angle measuring less than 180 degrees and whose diagonals lie inside the polygon
<b>coordinate plane</b>	a plane containing points identified by their distance from the origin in ordered pairs along two perpendicular lines referred to as axes (note: also referred to as Cartesian coordinate system and rectangular coordinate plane)
<b>coordinates of a point</b>	an ordered pair of real numbers that locate a point in a plane
<b>correlation</b>	the relationship between two or more data sets or variables
<b>correlation coefficient</b>	a value between 1 and -1 that determines if two lines have a linear relationship
<b>corresponding angles</b>	<p>a pair of angles that occupy the same location at each intersection when two lines are intersected by one or more transversals</p>  <p>(e.g., )</p>

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<b>cosine</b>	in a right triangle, the ratio of the length of the leg adjacent to a given acute angle to the length of the hypotenuse
<b>counterexample</b>	an example used to contradict or disprove a given statement
<b>counting number</b>	a number from the set of numbers consisting of 1, 2, 3, 4, 5, 6, ... (note: also referred to as natural numbers)
<b>counting problem</b>	a type of problem that determines the number of arrangements, possibilities, or outcomes of events
<b>cross-section</b>	a plane section that intersects a solid
<b>cube</b>	exponents: the third power of a number geometry: a regular 3-dimensional figure having six congruent square faces
<b>cube root</b>	one of only three equal factors of a given number (e.g., the cube root of 27 is 3, $3 \times 3 \times 3 = 27$ )
<b>cubic function</b>	a rule containing the cube of a variable (e.g., $f(x)=x^3$ )
<b>cycle graph</b>	a vertex-edge graph where the vertices can be arranged in a circle so that each vertex is adjacent to the vertices that come before and after it
<b>cylinder</b>	a 3-dimensional figure composed of two congruent and parallel circular regions joined by a curved surface
<b>data</b>	quantitative and/or qualitative information within a context gathered through observation, questioning, and/or measurement
<b>data set</b>	a defined group of quantitative and/or qualitative information within a context gathered through observations, questioning, and/or measurement
<b>De Moivre's theorem</b>	a method to find the exponential value of an imaginary number; given any nonzero complex number $z$ and any integer $n$ , the $n^{\text{th}}$ power of $z$ , $r\text{CiS}(\theta)=r(\cos \theta+i\sin \theta)$ is $Z^M = (r(\cos \theta + i\sin \theta))^M = r^M((\cos n\theta + i\sin n\theta) = r^M \text{CiS}(n\theta)$
<b>decimal point</b>	a demarcation mark used in a base ten numbering system to designate values that are less than one
<b>decompose</b>	to break down into smaller units to simplify computation
<b>deductive proof</b>	a formal use of deductive reasoning using logical steps in the form of axioms, theorems, and given information
<b>deductive reasoning</b>	a series of logical steps in which a conclusion is drawn directly from a set of statements (premises) that are assumed to be true
<b>degree</b>	algebra: the degree of a term is the sum of the powers of each variable in the term geometry: a unit of measure based on dividing a circle into 360 equal parts, and used to measure angles, arcs and rotations temperature: the unit of measure for temperature
<b>degree of a polynomial</b>	the degree of the highest term of the polynomial
<b>degree of a vertex</b>	the number of edges that meet at a vertex in a vertex-edge graph
<b>degree of accuracy</b>	a standardized mathematic set of rules for rounding using significant figures that allows for the consistent handling of different scales of measurement
<b>denominator</b>	the bottom part of a fraction that indicates the number of equal parts into which the whole is divided (e.g., 4 in the fraction $\frac{3}{4}$ )
<b>density</b>	the ratio of the amount of matter in an object compared to its volume; calculated as mass (m) per unit volume (v)
<b>density property</b>	a statement that says there is always a rational number between any two rational numbers

## Mathematics Standard Articulated by Grade Level

<b>dependent events</b>	two events such that the likelihood of the outcome of the second event is affected by the outcome of the first event
<b>dependent variable</b>	the output variable in a function which depends on the value of the input or independent variable
<b>Descartes Rule of Signs</b>	a mathematical method for the determination of both positive and negative zeros of a function; let $P(x)$ be a polynomial with real coefficients: the number of positive zeros of $P$ is either equal to the number of variations in sign of $P(x)$ or less than this by an even number, and the number of negative real zeros of $P$ is either equal to the number of variations in sign of $P(-x)$ or less than this by an even number
<b>descending</b>	a sequential organizational method from biggest to smallest, greatest to least, latest to earliest
<b>diagonal</b>	a line segment joining two non-adjacent vertices of a polygon
<b>diameter</b>	a line segment that joins two points on a circle and passes through the center of the circle
<b>difference</b>	the result obtained using the operation of subtraction
<b>digit</b>	the ten symbols, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, used in a base ten numeration system
<b>digital clock</b>	a device for telling time that shifts between discrete states instead of continuous variation
<b>dilation</b>	a transformation that either enlarges or reduces a geometric figure proportionally using a scale
<b>dimension</b>	measurement: measure of distance in a specific direction (e.g., length, width, depth) space: the number of coordinates needed to specify a location in space
<b>dimensional analysis</b>	a use of proportional analysis as a problem-solving strategy for the conversion of measurement units
<b>directed graph</b>	a series of items linked by edges that are directed with an initial and terminal vertex (note: also referred to as digraph)
<b>directrix</b>	a fixed line perpendicular to the axis of symmetry and that lies the same distance from the vertex as the focus, but in the opposite direction
<b>discount point</b>	a fee assessed that is equal to 1% of the amount of a loan (e.g., one point on a \$100,000 mortgage is equal to \$1,000)
<b>discrete</b>	a condition in which the number of possibilities are separated from each other and are distinct
<b>discrete mathematics</b>	a contemporary branch of mathematics that is used in business, industry, and daily life; topics include combinatorics, iteration and recursion, and vertex-edge graphs
<b>distance</b>	the positive value for the length of the shortest line segment joining two points
<b>distance formula</b>	a general method or rule to measure the distance between two points that are identified by ordered pairs (e.g., $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$ )
<b>distortion in data display</b>	the use of incorrect proportion, design variation in comparison of data sets, lack of context, or insignificant use of data in direct comparison with meaningful data
<b>distribution of data</b>	the values that a variable has across a spread of data
<b>distributive property</b>	a rule or method that states that every term inside grouping symbols may be multiplied by a term outside grouping symbols to yield an equivalent expression
<b>dividend</b>	the value to be divided in a division problem
<b>divisibility</b>	the ability to divide one whole number by another whole number without a remainder

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<b>divisibility rules</b>	a set of general rules that may be used to determine whether or not a number is evenly divisible by another number 2: if the number is even it is divisible by 2 3: if the sum of all of the digits is divisible by three, the number is divisible by 3 4: if the number formed by the last two digits is divisible by 4, the number is divisible by 4 5: if the last digit is a 0 or 5, the number is divisible by 5 6: if a number is divisible by both three and two, it is divisible by 6 7: if the difference of last digit doubled and the rest of the digits is divisible by seven, the number is divisible by 7 (e.g., 343: $34 - 6 = 28$ ) 8: if the last three digits of a number are divisible by 8, the number is divisible by 8 9: if the sum of the digits is divisible by nine, the number is divisible by 9 10: if the last digit of the number is 0 it is divisible by 10
<b>division</b>	the opposite operation of multiplication that separates items or values into equal parts with or without a remainder
<b>divisor</b>	the value by which another quantity is divided in a division problem
<b>documentary stamps</b>	a state tax, in the form of stamps, that must be paid when ownership of a property passes from one owner to another
<b>domain of a function</b>	the set of values for the independent variable (input value) of a function
<b>dot product</b>	a mathematical operation that calculates a scalar product using two vectors and real numbers (e.g., for vectors $A = \langle X_a, Y_a \rangle$ and $B = \langle X_b, Y_b \rangle$ the dot product $A \cdot B = (x_a)(x_b) + (y_a)(y_b)$ )
<b>down payment</b>	a portion of the full amount paid at the time of purchase or delivery
<b>durables (consumer)</b>	a product such as an automobile or appliance that has a life expectancy of at least three years
<b>e.g.</b>	the abbreviation for <i>for example</i> ; precedes a non-exhaustive list of examples provided as options; other examples may be appropriate but not included (compare to i.e.)
<b>edge (vertex-edge graph)</b>	an edge or arc that connects two vertices in a vertex-edge graph or network
<b>edge of a polyhedron</b>	a line segment where two faces of a polyhedron intersect
<b>efficiency (mathematical)</b>	the ability to determine a method for solution quickly and with little effort
<b>elapsed time</b>	the measure of actual time between two distinct events
<b>element</b>	an item or term contained within a set of items or terms
<b>ellipse</b>	the set of all points in which the sum of the distances between focal points is a constant
<b>ellipsis</b>	a series of marks, "...", to indicate the continuance of a pattern or sequence
<b>empty set</b>	a set, signified by the symbol $\emptyset$ , to indicate that the set contains no items or elements (note: also called the null set)
<b>end behavior</b>	a description of the performance of a function as it increases or decreases without boundaries
<b>endpoint</b>	a point that demarks the beginning and the end of a line segment, the initial point of a ray, or the end of an arc
<b>equal</b>	a term that indicates the same amount, measure, or quantity as another amount, measure, or quantity
<b>equation</b>	a mathematical statement divided by an equal symbol that states the two values or expressions have the same value

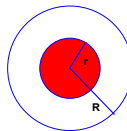
## Mathematics Standard Articulated by Grade Level

<b>equilateral polygon</b>	a polygon in which all sides are congruent
<b>equivalent</b>	two expressions or statements that always have the same truth value
<b>estimate</b>	an approximate and reasonable answer that is close to the exact answer without actually calculating the exact answer
<b>Euclid's 1st Postulate</b>	a line segment may be drawn joining any two points
<b>Euclid's 2nd Postulate</b>	any line segment can be extended indefinitely in a line
<b>Euclid's 3rd Postulate</b>	given a line segment, a circle can be drawn having the segment as a radius and one endpoint as a center
<b>Euclid's 4th Postulate</b>	all right angles are congruent
<b>Euclid's 5th Postulate</b>	only one straight line may be drawn between a given line and a point that is not on that line (note: also called the Parallel Postulate)
<b>Euclidean geometry</b>	the study of geometry based on definitions, undefined terms (point, line and plane), and the assumptions of Euclid
<b>Euler circuit</b>	a path in a vertex-edge graph that starts and ends at the same vertex and does not retrace any edges
<b>Euler path</b>	a path in a vertex-edge graph that travels every edge exactly once and the starting vertex differs from the ending vertex
<b>evaluate</b>	the use of one or more mathematical operations to calculate the value of an expression for a given input
<b>even function</b>	a function that meets the mathematical rule $f(x) = f(-x)$
<b>even number</b>	a natural number that is divisible by two without a remainder
<b>even vertex</b>	a vertex in a vertex-edge graph whose degree is even
<b>event</b>	outcomes during a probability activity
<b>expanded notation</b>	elementary: the display of digits to show the place value of each digit secondary: the display of an expression without parentheses
<b>expected value</b>	the average value distribution for a random variable
<b>experimental (empirical) probability</b>	a ratio formed by the comparison of the number of times an event occurs in an experiment to the number of times the experiment is completed
<b>explicit</b>	a statement that is expressed without ambiguity
<b>explicit formula</b>	an equation in which the dependent variable is written in terms of the independent variable (e.g., $y=2x+3$ , $f(x)=x^5-7$ , or $I=Prt$ )
<b>explicit sequence</b>	a group of terms arranged in a predictable way (pattern) with a rule that is used to generate the $n^{\text{th}}$ term of the pattern
<b>exponent</b>	a number placed to the right and above (superscript) a non-zero base that indicates the operation of repeated multiplication


## Mathematics Standard Articulated by Grade Level

<b>exponential form</b>	a mathematical representation of a term raised to a power or terms grouped and raised to a power (e.g., $5x^3$ or $(5x+7)^{2/5}$ )
<b>exponential function</b>	an equation format written as $f(x) = a^x$ where the base, $a$ , is a constant real number greater than zero but not equal to one.
<b>exponential growth</b>	the increase in a quantity over time represented by $y = a \cdot b^x$ where $a > 0$ and $b > 1$ (e.g., $y = 5(2)^x$ ; each time $x$ is increased by 1, $y$ increases by a factor of 2)
<b>expression</b>	a mathematical phrase containing one or more terms linked by operation symbols
<b>extraneous</b>	any data or information in a problem that is not necessary to determine a solution or to answer a question
<b>extrapolation</b>	to infer a value for an unknown variable in an interval using known values in a defined interval
<b>extreme value</b>	a maximum or minimum value of a function on a given interval
<b>face of a polyhedron</b>	each polygon that combines to construct a three-dimensional solid
<b>fact family</b>	a collection of related addition and subtraction facts, or multiplication and division facts, made from the same numbers (e.g., $\{7+2=9, 2+7=9, 9-7=2, 9-2=7\}$ and $\{7 \times 2=14, 2 \times 7=14, 14 \div 7=2, 14 \div 2=7\}$ )
<b>factor</b>	noun: the value that can be divided into another value with no remainder verb: rewrite a number or polynomial as a product of numbers, simpler polynomials, or of polynomials and monomials
<b>factorial</b>	the product of all integers from a given number down to the number one
<b>factorial notation</b>	the format and symbol (!) used to represent a factorial
<b>factoring</b>	decomposing, through division, a complicated expression into the most simple expressions possible, that when multiplied yields the original expression
<b>Fahrenheit</b>	the U.S. customary or standard scale measure of temperature
<b>fair sharing</b>	the equal opportunity for the occurrence of all possible events or being equally divided
<b>Fibonacci sequence</b>	a recursive sequence in which every number is the sum of the two preceding numbers
<b>financing</b>	extending credit or purchasing on contract
<b>finite set</b>	a set of items or values that is limited to a countable number of elements
<b>flexibility (mathematical)</b>	a student's ability to recognize strategies necessary to complete a mathematical task, and a student's ability to apply learned strategies to alternative mathematical tasks
<b>fluency</b>	the efficient automatic recall of addition, subtraction, multiplication, and division facts; the efficient and automatic recall and use of standard algorithms for addition, subtraction, multiplication, and division
<b>foci (of an ellipse)</b>	two fixed points on an ellipse from which the sum of the distances of all other points on the ellipse is a constant
<b>focus</b>	a fixed point from which all other points are equidistant
<b>formula</b>	a general mathematical equation that relates two or more terms or values
<b>Four Color Theorem</b>	given any plane or spherical surface separated into regions, such as a political map of the states of a country, the regions may be colored using no more than four colors in such a way that no two adjacent regions receive the same color
<b>fractal</b>	a rough or fragmented geometric shape that can be subdivided into parts, each of which is (approximately) a reduced-size copy of the whole



## Mathematics Standard Articulated by Grade Level

<b>fraction</b>	a number written in the form of a ratio where the top number is referred to as the numerator and the bottom number is referred to as the denominator
<b>fractional part</b>	a part of a whole or a part of a group
<b>frequency</b>	the number of occurrences of an event within a specified interval
<b>frequency table</b>	a collection of data organized to display the number of events in a specified interval or multiple intervals
<b>frieze pattern</b>	a classification of patterns on two-dimensional surfaces that repeat in one direction
<b>front-end estimation</b>	using the leading, or left-most, digits to make an estimate quickly and easily (e.g., when asked to estimate the sum of 594, 32, and 221 an original estimate would be 5+0+2 hundreds or 700)
<b>function (algebraic)</b>	a rule that defines a relationship between two sets of numbers in that for each value of the independent variable set there is only one value in the dependent variable set
<b>function notation</b>	an equation in the form of $f(x) =$ to show the output value of a function, $f$ , for an input value $x$
<b>Fundamental Theorem of Algebra</b>	an $n$ th degree polynomial has $n$ solution(s), real or complex
<b>generalize</b>	the ability to apply a solution method to many different problems and situations
<b>geometric model</b>	a representation of a geometric figure or concept
<b>geometric pattern</b>	a design representation of nonfigurative shapes including, lines, rectangles, and polygons
<b>geometric probability</b>	the likelihood of an event occurring based on geometric relationships such as area, surface area, or volume (e.g., if an arrow hits the target, the probability of hitting the red (shaded) bulls eye is $\frac{\pi r^2}{\pi R^2}$ )
	
<b>geometric sequence</b>	a finite or infinite progression of real numbers where each element is equal to the previous term multiplied by a constant referred to as the common ratio
<b>geometric solid</b>	a 3-dimensional shape bounded by surfaces (e.g., rectangular prism, pyramid, cylinder, cone, and sphere)
<b>graph</b>	a representation of an algebraic equation applied to a coordinate grid
<b>graphic organizer</b>	a visual tool designed to represent data in a format that improves understanding (e.g., Venn diagram, concept web, K-W-L chart)
<b>greatest common factor</b>	the largest natural number or monomial that divides into different natural numbers or terms without a remainder
<b>grouping symbols</b>	a variety of symbols of inclusion; parentheses, brackets, braces, or bars (i.e., ( ) , [ ] , { } , — ,     )
<b>growing pattern</b>	patterns that show an arithmetic or geometric change between pairs of elements in the pattern (e.g., numbers in decreasing order; buildings in decreasing size; or 3, 5, 8, 12, .....)
<b>Hamilton circuit</b>	a path in a vertex-edge graph that begins at a vertex, passes through every vertex exactly once, and returns to the original vertex

## Mathematics Standard Articulated by Grade Level

<b>Hamilton path</b>	a path in a vertex-edge graph that starts at some vertex in the graph and visits every other vertex of the graph exactly once.
<b>height</b>	a perpendicular segment from a base to a vertex or between bases (note: also called altitude)
<b>hexagon</b>	a polygon with six sides
<b>higher order polynomial</b>	an expression with a degree equal to or greater than two
<b>histogram</b>	a vertical bar graph with each bar representing a certain interval of data
<b>horizontal</b>	parallel to or in the plane of the horizon; in a coordinate grid, the x-axis is a horizontal line
<b>hyperbola</b>	<p>a set of all points on a plane such that the difference between the distances from the plane to the foci is a constant, and is created by the intersection of the plane and the cone</p> 
<b>hypotenuse</b>	the longest of the three sides of a right triangle; the side opposite the right angle in a right triangle
<b>hypothesis</b>	the <i>if</i> clause in an <i>if-then</i> conditional statement
<b>i.e.</b>	abbreviation for <i>that is</i> ; precedes a specific list of items in which all of the items should be used (compare to e.g.)
<b>identity element</b>	a number when used in an operation with a given number leaves the given number unchanged
<b>identity property of</b>	addition: the rule that recognizes that a given number remains unchanged after the addition of a zero multiplication: the rule that recognizes that a given number remains unchanged after multiplication with the number one
<b>image</b>	a figure produced as the result of one or more transformations
<b>imaginary numbers</b>	the square root of a negative number expressed using $i$ ( $\sqrt{-1} = i$ )
<b>implicit</b>	assumed or indirectly stated; inferred
<b>implicit formula</b>	an equation in which the dependent variable and independent variable are not separated by the equal sign, or in which the dependent variable is written in terms of the independent variable (e.g., $2x+y=3$ , or $\frac{I}{P} = rt$ )
<b>improper fraction</b>	a fraction in which the numerator is greater than the denominator
<b>income tax</b>	a monetary charge levied by an authority for public purposes that is based on monies made from employment, business, or capital gains
<b>independent events</b>	two events in which the outcome of the second event is not affected by the outcome of the first event
<b>independent variable</b>	the input value for a function
<b>indirect measurement</b>	a measurement determined without the direct application of measurement tools
<b>indirect proof</b>	a deductive reasoning strategy that uses contradiction or elimination to rule out all possible conclusions except the original statement which must be true

## Mathematics Standard Articulated by Grade Level

<b>Individual retirement account (IRA)</b>	an account that allows the holder to delay paying income tax and reduces the amount of taxes owed on the funds deposited
<b>inductive reasoning</b>	a reasoning process in which a conclusion is drawn from several observations
<b>inequality</b>	a statement relating two or more quantities or values that are not equal using words or symbols ( $\neq$ , $<$ , $>$ , $\leq$ , $\geq$ )
<b>inference</b>	a conclusion drawn from given information, many times in the form of data
<b>infinite set</b>	the set in which the number of elements cannot be counted
<b>input/output machine</b>	a method used to build functions by applying a rule to an input value which generates an output value
<b>inscribed angles</b>	an angle with its vertex on the circle and with sides (rays) that are chords of the circle
<b>integers</b>	the set of real numbers consisting of the whole numbers and their opposites ... -2, -1, 0, 1, 2 ...
<b>integral</b>	general: an integer calculus: a function used for the calculation of the area under a curve
<b>intercept</b>	the point at which a line or curve crosses a given axis
<b>intercepted arc</b>	that part of a circle that lies between two segments, rays, or secants that intersect the circle  (e.g.,  )
<b>interpolation</b>	a method for the estimation of the value of a function using the known values of a number above and below the unknown value
<b>interquartile range</b>	a measure of variability, that is resistant to outliers, determined by the difference between the first and third quartiles
<b>interval</b>	a set of numbers or values between, and in some cases including, two given values
<b>inverse function</b>	a function $f(y) = x$ , denoted by $f^{-1}(x)$ such that the domain of the function $f(x)$ becomes the range of the inverse function $f^{-1}(x)$ , and the range of $f(x)$ becomes the domain of $f^{-1}(x)$ ; the function will only have an inverse function if it is a one to one relation
<b>inverse matrix</b>	a rectangular array of values with columns and rows which when multiplied by the original array of values results in an array of values with a one for every diagonal element from the top left to the bottom right and a zero for all other elements in the array
<b>inverse of a statement</b>	a conditional statement obtained by negating both the hypothesis and the conclusion of a given conditional statement
<b>inverse operation</b>	a related but opposite process (i.e., multiplication is the inverse of division)
<b>inverse relationship</b>	additive: a number when added to a given number results in a sum of zero (note: also called identity property of addition) multiplicative: a number when multiplied to a given number results in a product of one (note: also referred to as the identity property of multiplication)
<b>irrational numbers</b>	a set of real numbers that cannot be expressed as a ratio of two integers (i.e., $\pi$ , $\sqrt{2}$ )

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<b>irregular polygon</b>	a polygon whose interior angles are not equal and/or its sides are not equal in length
<b>isosceles triangle</b>	a triangle that has two or more congruent sides (note: equilateral triangles are a subset of isosceles triangles)
<b>iteration</b>	the repetition of a pattern or sequence
<b>iterative pattern/sequence</b>	a pattern/sequence generated by using an initial value and repeatedly applying the same rule
<b>justify</b>	to prove or show to be true or valid using logic and/or evidence
<b>kite</b>	a quadrilateral with two distinct pairs of congruent adjacent sides and no congruent opposite sides
<b>lateral face</b>	a 2-dimensional surface that is not a base of a 3-dimensional figure
<b>lateral surface</b>	the sum of the lateral faces of a three-dimensional figure
<b>Law of cosines</b>	a law that allows for the calculation of the measurement of a side or angle of a triangle given other values for the triangle; for $a^2 = b^2 + c^2 - 2bc \cos A$ any $\triangle ABC$ : $b^2 = a^2 + c^2 - 2ac \cos B$ $c^2 = a^2 + b^2 - 2ab \cos C$
<b>Law of Large Numbers</b>	the larger the sample the closer the experimental probability will approximate the theoretical probability
<b>Law of sines</b>	a description of the relationship between the angles of a triangle and the opposite sides of the same triangle; for any $\triangle ABC$ : $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$
<b>least common multiple (LCM)</b>	the smallest value for which two or more values are factors (e.g., the LCM of 3, 4, and 6 is 12, the LCM of $x^2 - 1$ and $x^2 - 3x - 4$ is $(x+1)(x-1)(x-4)$ )
<b>limit</b>	the value, if one exists, that the dependent variable approaches as the independent variable approaches a given value
<b>line</b>	a straight set of points that extends infinitely in opposite directions (note: this is an undefined term in Euclidean geometry)
<b>line graph</b>	a representation used to show change over an interval, with the data points connected by line segments
<b>line of best fit</b>	a line drawn on a scatter plot to estimate the linear relationship among the data
<b>line of reflection</b>	the line that behaves as a mirror such that after a figure is reflected across the line all the points on the line are left unchanged by the reflection (transformation)
<b>line of symmetry</b>	a line that divides a figure into two congruent parts that are mirror images of each other
<b>line plots</b>	a sketch of data in which check marks, or other marks above a number line, shows the frequency of each value
<b>line segment</b>	two points or endpoints and all the points on the line between the endpoints
<b>linear equation</b>	an equation containing one or more terms in which the variable(s) is/are raised to the power of one but no higher
<b>linear expression</b>	a collection of numbers, symbols, operations, and two or fewer variables with a degree of one
<b>linear function</b>	a function that has a constant rate of change and can be modeled by a straight line


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<b>linear growth</b>	a model for growth that adds a fixed amount to each time period
<b>liter (L)</b>	a metric unit of capacity that is equal to the volume of a cube that measures ten centimeters on a side
<b>logarithm</b>	a power to which a positive number base greater than one must be raised to generate a given number
<b>logarithmic function</b>	functions that involve logarithms and are the opposite of the exponential function
<b>logic</b>	a system of reasoning used to validate arguments
<b>logic problem</b>	a rational and varied systematic series of steps based on sound mathematical procedures in order to arrive at the solution
<b>lowest common denominator (LCD)</b>	the least common multiple of the denominators of every fraction in a given collection of fractions
<b>magnitude</b>	size or quantity
<b>manipulatives</b>	a wide variety of physical materials or objects that students use to foster the learning of abstract ideas in mathematics (note: also referred to as concrete materials)
<b>mass</b>	the amount of matter a body contains
<b>mathematical argument</b>	the justification of a particular solution, algorithm, or method using logic, evidence, and mathematically sound reasoning
<b>mathematical fluency</b>	the use of mathematical strategies with efficiency, accuracy, and flexibility
<b>matrix</b>	a rectangular array of numbers or letters arranged in rows and columns
<b>maximum</b>	the number with the greatest value in a set of numbers; the greatest vertical value in a graph
<b>mean</b>	a measure of center where the sum of a set of numbers is divided by the number of elements in the set (also referred to as the average)
<b>meaningful context</b>	the real world application of a mathematical concept
<b>measurable attribute</b>	a common feature of a set of objects or numbers that can be measured
<b>measures of center</b>	numbers that communicate the “center” or “middle” of a set of data (i.e., mean, median, and mode)
<b>measures of spread</b>	an indication of the dispersion or variation of data values including range, quartiles, interquartile range, standard deviation, and variance
<b>median</b>	a measure of center that identifies a value such that half the data is above the value and half the data is below the value when the data is listed in order
<b>metric system of measurement</b>	a measurement system based on the base-ten numeration system (e.g., meter, liter, gram)
<b>midpoint</b>	a point on a line segment halfway between the two endpoints
<b>mid-spread</b>	the difference between the upper and lower quartiles
<b>minimum</b>	the number with the smallest value in a set of numbers; the least vertical value in a graph
<b>minuend</b>	the number from which you are subtracting
<b>mitigate</b>	to cause to become less severe

## Mathematics Standard Articulated by Grade Level

<b>mixed number</b>	a number represented by a whole number next to a fraction, and is equal to the sum of the whole number and the fraction
<b>mode</b>	a measure of center that is the value or values that occur(s) most frequently in a given set of numbers
<b>model (noun)</b>	an object, drawing, graph, expression, or equation that represents a given context
<b>Model (verb)</b>	algebra and functions: choice of an equation or function to represent a given context geometry: use of physical objects or manipulatives to show a geometric situation
<b>monomial/ monomial expression</b>	an algebraic expression consisting of a single term that does not require any addition or subtraction (e.g., $5y$ )
<b>multi-line graph</b>	a representation consisting of two or more line graphs that correspond to discrete data sets
<b>multiple of a number</b>	a number into which a given number may be divided with no remainder
<b>multiplication</b>	the operation of repeated addition
<b>multiplication principle of counting</b>	<p>a principle that allows for the efficient counting of the total number of ways a task is accomplished when some number of parts follows a first part of the task. For example, how many outfits can you make using three shirts, two pants, and four shoes? The task is to make an outfit with three parts (a shirt selection, a pants selection, and a shoes selection).</p> <p>elementary school: If you want to count the total number of ways a task can be completed that is accomplished through a series of parts, and you can select <math>m</math> ways to complete the first part, <math>n</math> ways to complete the second part, and <math>g</math> ways to complete the third part (etc.) then you can efficiently count the total number of ways to accomplish the task by using the multiplication principle of counting. In this example, we would multiply <math>m</math> times <math>n</math> times <math>g</math> or <math>(m \cdot n \cdot g)</math> In the example above, we can count the total number of outfits by <math>3 \times 2 \times 4</math> or 24 outfits.</p> <p>high school: let <math>A_1</math> and <math>A_2</math> be events with <math>n_1</math> and <math>n_2</math> possible outcomes, respectively; then the total number of outcomes for the sequence of the two events is <math>n_1 \cdot n_2</math></p>
<b>multi-variable equation</b>	an equation with three or more variables that can be graphed in three or more dimensions
<b>natural numbers</b>	the set of real numbers consisting of 1, 2, 3, 4, 5, 6, ... (note: also referred to as counting numbers)
<b>necessary information</b>	the values and statements required to find the solution to a problem
<b>negation</b>	statements meaning not or the opposite of; for any given statement $p$ , its negation is the statement $\sim p$ (not $p$ ) whose truth value is the opposite of the truth value of $p$
<b>negative number</b>	a real number that is less than zero
<b>neighboring vertices (of a vertex-edge graph)</b>	vertices that share an edge (note: also referred to as adjacent vertices)

## Mathematics Standard Articulated by Grade Level

<b>net of a polyhedron</b>	a two-dimensional representation of the surface of a three-dimensional figure
<b>network</b>	A network or vertex-edge graph consists of a collection of vertices and edges where each edge connects two of the vertices
<b>non-contextual problem</b>	a problem given without an application/story
<b>non-Euclidean geometry</b>	a geometry that contains an axiom which is equivalent to the negation of the Euclidean parallel postulate (e.g., Riemannian geometry is a non-Euclidean geometry using the statement, "If $l$ is any line and $P$ is any point not on $l$ , then there are no lines through $P$ that are parallel to $l$ " as its parallel postulate (also called elliptic geometry); and Hyperbolic geometry is a non-Euclidean geometry using the statement, "If $l$ is any line and $P$ is any point not on $l$ , then there exists at least two lines through $P$ that are parallel to $l$ " as its parallel postulate
<b>non-random sample</b>	a sample selected using a biased method
<b>non-routine problem</b>	word problems that include a model of a real life situation, focus on higher levels of interpretation, are organized with no obvious solution, and that may require multiple problem solving strategies
<b>non-standard shapes</b>	geometric figures that are not in common usage but fulfill a given definition (e.g.,  )
<b>non-standard units of measurement</b>	measurement units that are not commonly accepted as standard but are applied uniformly when measuring (e.g., paperclips, pencils, a tennis shoe, and cubes)
<b>normal curve</b>	the symmetric statistical distribution of data evenly spread along a bell-shaped curve that reaches its maximum height at the mean
<b>normal distribution</b>	the spread of data that is symmetric in a given interval, has a median and mean that are equal, and can be fit with a normal curve
<b>number line</b>	a model that represents real numbers as points on a line with a uniform scale
<b>numerator</b>	the number of equal parts of a total number of parts in a fraction; it is found above the fraction bar (e.g., 4 in the fraction $\frac{4}{7}$ )
<b>numerical expression</b>	any combination of constants, operators, and/or words that result in a number (note: also referred to as an arithmetic expression)
<b>observable attribute</b>	a common feature of a set of objects or numbers that is noticeable (can be observed)
<b>observational study</b>	a study attempting to infer the effects of an action in which the assignment of subjects to the group receiving the action and the group not receiving the action is outside the control of the observer
<b>obtuse angle</b>	an angle whose measure is greater than 90 degrees and less than 180 degrees
<b>octagon</b>	a polygon with eight sides
<b>odd function</b>	a function that meets the mathematical rule $f(-x) = -f(x)$
<b>odd number</b>	an integer that is <u>not</u> divisible by two
<b>odd vertex</b>	a vertex in a vertex-edge graph whose degree is odd

## Mathematics Standard Articulated by Grade Level

<b>one-to-one correspondence</b>	a relationship that pairs each element in a set with one element in another set
<b>one-variable data</b>	the data generated by one input cell used with a formula
<b>operation</b>	the process or execution of a specific rule on a set of numbers
<b>order of operations</b>	the sequence in which specific rules of mathematics are performed when evaluating an expression or equation
<b>ordered pair</b>	a pair of numbers used to locate and describe points in the coordinate plane in the form $(x, y)$
<b>ordinal number</b>	a whole number that names the position of an object in a set
<b>ordinal position</b>	numbers used to specify position in a sequence (e.g., first, second, third, fourth)
<b>organized list</b>	an orderly table of numeric or descriptive data used to solve a problem or an ordered plan to solve a problem
<b>orientation</b>	the arrangement of the points or objects, relative to one another, after a transformation; the direction traversed (clockwise or counterclockwise) when traveling around a geometric figure
<b>origin</b>	the intersection of the axes in a coordinate grid, often defined as $(0, 0)$ in two-dimensions
<b>origination fee</b>	a charge levied by a lending institution for setting up a loan
<b>outcome</b>	a possible result for a probability experiment or simulation
<b>outcome set</b>	a set of all possible results for a probability experiment or simulation
<b>outliers</b>	numerical data that are significantly larger or smaller than the rest of the data in a set
<b>parabola</b>	the set of all points equidistant from the focus and the directrix
<b>parallel lines</b>	lines in the same plane that never intersect and are always equidistant
<b>parallelism</b>	a parallel relationship; the relation of opposition between things that will never intersect
<b>parallelogram</b>	a quadrilateral in which both pairs of opposite sides are parallel
<b>parameter</b>	algebraic/geometric: a quantity or constant whose value varies with the circumstances of its application statistical: a single number that describes some aspect of an entire population
<b>Pascal's triangle</b>	a triangular arrangement of numbers in which each row starts and ends with 1, and each other number is the sum of the two numbers above it  $  \begin{array}{ccccccc}  & & & & 1 & & & & \\  & & & & & 1 & & 1 & \\  & & & & & & 1 & 2 & 1 \\  & & & & & & & 1 & 3 & 3 & 1 \\  & & & & & & & & 1 & 4 & 6 & 4 & 1 \\  & & & & & & & & & 1 & 5 & 10 & 10 & 5 & 1  \end{array}  $
<b>path (vertex-edge graph)</b>	a connected sequence of edges that starts at a vertex and ends at a vertex
<b>pattern</b>	a set or sequence of figures or numbers that are repeated in a predictable manner
<b>pentagon</b>	a polygon with five sides

## Mathematics Standard Articulated by Grade Level

<b>percent</b>	a ratio that calculates the parts per hundred (e.g; 20% is 20 parts of 100)
<b>perfect square</b>	a whole number whose square root is a whole number
<b>perimeter</b>	the sum of all lengths of a polygon
<b>period</b>	the repeating interval of a periodic function
<b>periodic function</b>	a function that repeats itself at regular intervals
<b>permutation</b>	an ordered arrangement of a set of events or items
<b>perpendicular lines</b>	two lines that intersect to form right angles
<b>perpendicularity</b>	a perpendicular relationship; the relation of opposition between things at right angles
<b>phase shift</b>	the horizontal translation of a periodic graph
<b>pi (<math>\pi</math>)</b>	the ratio of the circumference of a circle to its diameter
<b>pictograph</b>	a representation that uses pictures or symbols to represent data
<b>piece-wise defined function</b>	a function that uses different rules for the number $x$ depending on the element of the domain
<b>place value</b>	the value of a numeral based on the position of each digit in the number
<b>plane</b>	a 2-dimensional surface that extends infinitely in all directions (note: this is an undefined term in Euclidean geometry)
<b>plane figure</b>	a two-dimensional figure or shape formed by straight lines or a curve
<b>point</b>	a location in space that has no dimension (note: this is an undefined term in Euclidean geometry)
<b>point of rotation</b>	the point about which a figure is rotated or turned
<b>points of discontinuity</b>	a point where a function is not continuous, noted by an open circle on the graph of the function
<b>polar coordinate system</b>	a system in which a point on a coordinate plane is identified using its distance from the origin ( $r$ ) and the positive angle ( $q$ ) required to reach the point from $0^\circ$ [e.g., $(2, 40^\circ)$ ]
<b>polygon</b>	a closed two-dimensional figure made up of segments which intersect only at the segment endpoints
<b>polyhedron</b>	a closed three-dimensional figure or shape in which all the surfaces are polygons
<b>polynomial/ polynomial expression</b>	an expression containing more than one monomial connected by addition or subtraction
<b>population</b>	an entire set of objects that have something in common (e.g; animals with four legs, quadrilaterals, male students in Mr. R's class)
<b>postulate</b>	a mathematical statement that is accepted as true without proof
<b>power</b>	a quantity with a base and an exponent (e.g; $x^5$ , where $x$ is the base and 5 is the exponent)
<b>precision</b>	an indicator of how finely a measurement is made; it is related to the unit of measurement and the calibration of the tool
<b>predictions</b>	the use of base information to produce an approximation of change or result
<b>pre-image</b>	an object before it undergoes a transformation
<b>premise</b>	a statement that is given to be true

## Mathematics Standard Articulated by Grade Level

<b>prime factor</b>	all the factors of a quantity that are only divisible by the number one and itself (e.g; the prime factors of 42 are 7, 3, and 2; the prime factors of $6x^2y$ are 2, 3, x, x, and y)
<b>prime factorization</b>	the representation of the prime factors of a quantity
<b>prime number</b>	a number that has exactly two different factors, one and itself
<b>prism</b>	a three-dimensional figure made up of two parallel congruent faces and lateral faces that are parallelograms
<b>probability</b>	the measure of the likelihood of the occurrence of an event
<b>product</b>	the result obtained when two or more quantities are multiplied
<b>proof</b>	a sequence of logical arguments that prove a conjecture to be true
<b>proper fraction</b>	a fraction whose numerator is smaller than its denominator
<b>properties of equality</b>	rules for producing equivalent expressions (e.g., identity, transitive, reflexive, addition property of equality, to name a few)
<b>properties of: operations, real number operations, real number system</b>	mathematical principles that are always true (e.g., commutative, associative, distributive, identity, and inverse, to name a few)
<b>proportion</b>	the statement of equality between two ratios
<b>proportional relationship</b>	a relationship between two variables in which one is a constant (the constant of proportionality) times the other
<b>proportionality</b>	the concept of having equivalent ratios
<b>proposition</b>	a statement of truth that has yet to be proven
<b>proximity</b>	distance from an object
<b>pyramid</b>	a three-dimensional figure whose base is a polygon and whose lateral faces are triangles that share a common vertex
<b>Pythagorean theorem</b>	the statement that in a right triangle, the sum of the squares of the lengths of the legs is equal to the square of the length of the hypotenuse ( $a^2+b^2= c^2$ )
<b>quadrant</b>	one of the four sections into which the coordinate plane is divided by the x- and y-axes
<b>quadratic equation</b>	a polynomial equation containing one or more terms in which the variable is raised to the second power but no higher
<b>quadratic formula</b>	the formula used to find the roots (solutions) of a quadratic equation (i.e., $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ )
<b>quadratic function</b>	a function in the form: $f(x) = ax^2 + bx + c$ , $a \neq 0$
<b>quadrilateral</b>	a polygon with four sides
<b>quartiles</b>	the four equally sized groups of data set
<b>quotient</b>	the answer to a division problem

## Mathematics Standard Articulated by Grade Level

<b>radian/ radian measure</b>	the measure of an angle formed by taking the radius of a circle and wrapping it along the circumference of the circle, the measure of an entire circle is $2\pi$ radians
<b>radical</b>	a symbol used to refer to the root of a number or term
<b>radical expression</b>	a mathematical expression containing one or more radicals
<b>radical form</b>	a term, expression, or equation that uses a radical instead of a fractional exponent(s) (e.g., writing the expression $(\sqrt[4]{2x})^7$ instead of $(2x)^{\frac{7}{4}}$ )
<b>radius of a circle</b>	the distance from the center of a circle to a point on the circle (plural: radii)
<b>random sample</b>	a sample in which each item or element of the population has an equal chance of being chosen as part of a sample of the population
<b>randomized experiment</b>	an experiment attempting to infer the effects of an action in which subjects are randomly assigned either to a group receiving the action or a group not receiving the action
<b>range</b>	the set of all possible output values for a function
<b>range (of a data set)</b>	the difference between the greatest and least value in a set of data
<b>rate</b>	a ratio comparing different types of measures (e.g., miles per gallon)
<b>rate of change</b>	the amount the function's output increases or decreases for each unit of change in the input
<b>ratio</b>	a comparison of two quantities by division that can be expressed as $a$ to $b$ , $\frac{a}{b}$ , or $a:b$
<b>rational expression</b>	the quotient of two polynomials in the form $\frac{A}{B}$ , where $A$ and $B$ are polynomials (e.g., $\frac{2x+1}{3x^2-9}$ , $3x^2-9 \neq 0$ )
<b>rational number</b>	a number that can be expressed as a quotient of two integers
<b>Rational Root Theorem</b>	for a polynomial with integer coefficients, the only possible rational numbers that can be roots of the polynomial are ones of the form $a/b$ , where $a$ is a factor of the constant term and $b$ is a factor of the leading coefficient
<b>ray</b>	a line segment that extends infinitely in one direction from one of its endpoints
<b>real numbers</b>	the set of rational and irrational numbers
<b>re-allotment of square units</b>	the application of the idea that what is changed in one place must be made up elsewhere in measurement problems involving square units
<b>reasonable</b>	within likely or sensible boundaries
<b>reasonable estimations</b>	approximations based on mathematical reasoning that are within the desired degree of accuracy (e.g., in the problem $35+43$ a reasonable estimation would be 75 or 80)
<b>reasoning (mathematical)</b>	the justification of a particular solution, algorithm, or solution method using logical and mathematically sound arguments

## Mathematics Standard Articulated by Grade Level

<b>reciprocal function</b>	the function $f(x) = 1/ax$ , where $a$ is a constant and $a \neq 0$
<b>reciprocals</b>	two numbers whose product is equal to one (note also referred to as multiplicative inverses)
<b>rectangle</b>	a quadrilateral with two pairs of congruent parallel sides and four right angles
<b>rectangular coordinate plane</b>	a plane containing two perpendicular lines referred to as axes (note: also referred to as Cartesian coordinate system and coordinate system)
<b>recursion</b>	an inherently repetitive process by which the terms of a sequence can be computed from some or all of the preceding terms by an algorithmic procedure
<b>recursive formula</b>	a formula used to determine the next term in a sequence by using an algorithm with one or more of the preceding terms
<b>recursive pattern</b>	a pattern that uses the solution from previous steps to generate the solution to the next step (i.e., 2, 2, 4, 6, 10, 16...)
<b>reflection</b>	a transformation creating a mirror image of the original figure on the opposite side of the line of reflection
<b>reflex angle</b>	an angle that is greater than $180^\circ$ and less than $360^\circ$
<b>reflexive property</b>	a property that states a quantity or figure is equal or congruent to itself
<b>refute</b>	to prove false by argument or evidence
<b>regression equation</b>	the equation for the line of best fit to a set of data points in the plane
<b>regular polygon</b>	a convex polygon which is equiangular and equilateral
<b>relative magnitude</b>	the value of numbers relative to a given value or number
<b>Remainder Theorem</b>	a theorem stating, "If $f(x)$ is a polynomial, then the remainder obtained by dividing $f(x)$ by $x-r$ equals $f(r)$ "
<b>repeating decimal</b>	a decimal in which one or more digits repeats in a pattern without termination
<b>repeating pattern</b>	a sequence of figures or numbers that repeat in a predictable manner
<b>representation</b>	verb: the act of capturing a mathematical concept in some form noun: the form expressing a mathematical concept (e.g., equation, graph, model, written description, sketch, table, construction, manipulative)
<b>revise</b>	to change or modify based on evaluation
<b>rhombus</b>	a quadrilateral with four congruent sides (plural: rhombi)
<b>right angle</b>	an angle whose measure is $90^\circ$
<b>right triangle</b>	a triangle that contains a right angle
<b>root</b>	the solution (zeros) of a function
<b>rotation</b>	a transformation in which a figure is turned a given degree and direction around a point (the point of rotation)
<b>ROTH account</b>	an individual retirement arrangement that can be an account or annuity whose contributions are not tax deferred

## Mathematics Standard Articulated by Grade Level

<b>round</b>	to approximate the value of a number to a specified place value
<b>sample</b>	a part of the total population used in statistics to make predictions about the characteristics of the entire group
<b>sample space</b>	a list of all possible outcomes of an activity
<b>scalar</b>	a constant used in operations on matrices and vectors, distinguished from a vector or matrix in that it has size but not direction
<b>scale</b>	measuring: a tool or system used for the determination of weight graphing: a system of marks at fixed intervals
<b>scale drawing</b>	a reduced or enlarged drawing which is mathematically similar to the object which it represents
<b>scale factor</b>	the ratio between the lengths of corresponding sides of two similar figures
<b>scalene triangle</b>	a triangle with no congruent sides
<b>scatterplot</b>	a graph of the points representing a collection of data
<b>scientific notation</b>	a representation of a very large or very small number expressed as the product of a power of ten and a decimal number greater than or equal to one and less than ten
<b>secant</b>	a line that intersects a circle or some other curve at two points
<b>sector of a circle</b>	a region bounded by a central angle and its arc
<b>sequence</b>	a set of numbers in a defined order
<b>series</b>	the sum or difference of a sequence of numbers
<b>shortest path</b>	the path in a weighted vertex-edge graph from one vertex to another that has the least total weight
<b>side</b>	the segment joining two adjacent vertices in a figure
<b>side length</b>	the measure of the segment joining two adjacent vertices in a figure
<b>sigma notation (<math>\Sigma</math>)</b>	the Greek letter sigma used to indicate summation
<b>similar figures</b>	two or more figures that have the same shape and are related in size by a scale factor
<b>simple interest</b>	a fixed percent calculated on a principal amount without regard to accrued interest
<b>simple polygon</b>	a closed 2-dimensional figure that cannot be decomposed into closed figures with fewer sides without adding segments; a 2-dimensional figure whose sides do not cross through the interior of the figure
<b>simplest form</b>	fractional: a fraction that has no common factor for the numerator and denominator polynomial: an expression that has no common factors for all terms and no like terms radical: there are no perfect square factors contained in the radicand and there are no like terms
<b>simplify</b>	the act of writing a quantity in simplest form
<b>simulation</b>	an experiment to model a real-life situation for the purpose of examining a problem
<b>sine</b>	in a right triangle, the ratio of the length of the side opposite the given acute angle to the length of the hypotenuse
<b>single event</b>	one occurrence that can take place during a probability simulation that is not in conjunction with another occurrence
<b>skip counting</b>	the method of counting by equal intervals
<b>slant height</b>	pyramid: the altitude of a lateral face of a pyramid cone: the length of a line segment drawn on the lateral surface of a cone from its vertex to a point on its circular base

## Mathematics Standard Articulated by Grade Level

<b>slope of a line</b>	the measure of steepness of a line calculated as the change in $y$ divided by the change in $x$ (the rise over the run)								
<b>solid</b>	a closed 3-dimensional figure								
<b>solution</b>	the value or values for a variable that makes an equation or inequality true								
<b>solution methods</b>	the strategy or set of strategies employed to solve a contextual or non-contextual problem								
<b>solution set</b>	all the values that make an equation or inequality true								
<b>solve</b>	to find a solution for a problem								
<b>space</b>	the set of all points in three or more dimensions								
<b>spanning tree</b>	a subgraph of a vertex-edge graph that is a tree and includes every vertex of the graph								
<b>sphere</b>	a three-dimensional figure made up of all points in space equidistant from a given point called the center								
<b>spherical geometry</b>	geometry applied to the surface of a sphere (note: this is a type of non-Euclidean geometry)								
<b>square</b>	geometry: a parallelogram with four congruent sides and four right angles exponent: the result of multiplying a number by itself								
<b>square root</b>	one of the two equal factors of a number								
<b>standard deviation</b>	a statistical calculation of the dispersion of the data								
<b>standard notation</b>	a number written with one digit for each place value in a base ten numeric system								
<b>statistics</b>	the collection, organization, description, and analysis of quantitative data								
<b>stem-and-leaf plot</b>	a display of data in which digits with larger place values (10's or greater) are "stems" and digits with smaller place values (1's) are "leaves" (e.g., <table style="margin-left: 20px; border-collapse: collapse;"> <tr><td style="padding-right: 5px;">0</td><td style="border-left: 1px solid black; padding-left: 5px;">0015888</td></tr> <tr><td style="padding-right: 5px;">1</td><td style="border-left: 1px solid black; padding-left: 5px;">23445569</td></tr> <tr><td style="padding-right: 5px;">2</td><td style="border-left: 1px solid black; padding-left: 5px;"></td></tr> <tr><td style="padding-right: 5px;">3</td><td style="border-left: 1px solid black; padding-left: 5px;">014</td></tr> </table> represents {0,0,1,5,8,8,8,12,13,14,14,15,15,16,19,30,31,34})	0	0015888	1	23445569	2		3	014
0	0015888								
1	23445569								
2									
3	014								
<b>straight angle</b>	an angle whose measure is $180^\circ$								
<b>subdivide</b>	to decompose into smaller parts								
<b>subgraph</b>	a portion of a vertex-edge graph that includes some of its vertices and some (or all) of its edges that connect those vertices								
<b>subscript</b>	a number written to the right of and slightly below a term, usually used for indexing								
<b>subsets of a population</b>	organizational groupings within a population								
<b>subsets of the real number system</b>	organizational groupings of real numbers (e.g., rational numbers, irrational numbers, integers, whole numbers, natural numbers)								
<b>substitution property</b>	the mathematical rule that allows equal values to replace each other								
<b>subtraction</b>	a mathematical operation that calculates the difference between two numbers								

## Mathematics Standard Articulated by Grade Level

<b>subtrahend</b>	the number being subtracted in a subtraction problem
<b>sum</b>	the result of addition
<b>summary statistics</b>	<p>statistics used to summarize a set of observations, in order to communicate as much as possible as simply as possible; statisticians commonly try to describe the observations in three ways:</p> <ul style="list-style-type: none"> <li>• a measure of center, such as the arithmetic mean, median, mode, or interquartile mean;</li> <li>• a measure of statistical dispersion like standard deviation, variance, range, or interquartile range; and</li> <li>• a measure of the shape of the distribution like a normal curve</li> </ul>
<b>summation</b>	the process of adding terms in a sequence for a given interval
<b>supplementary angles</b>	two angles whose measures have a sum of 180 degrees
<b>surface area</b>	a measure of the amount of area in a three-dimensional solid
<b>symbol</b>	shorthand marks that represent math concepts (e.g., $\leq, 4, \pm, \epsilon, \angle, \pi$ )
<b>symmetric property</b>	the mathematical rule that states for real numbers $a$ and $b$ , if $a = b$ , then $b = a$
<b>symmetry</b>	a one-to-one correspondence in size, form, and arrangement of parts, related to a plane, line, or point
<b>synthesize</b>	the use of reasoning to combine sometimes diverse concepts or statements
<b>system of equations</b>	a set of two or more equations that must all be true for the same value(s) (note: also referred to as simultaneous equations)
<b>systematic lists</b>	an orderly listing of all possibilities for a given situation
<b>table of values</b>	a chart that organizes data (values) in rows and columns to illustrate facts and figures
<b>tallies</b>	a method of counting using marks usually in groups of five
<b>tally chart</b>	a method for recording occurrences of an event and for the development of frequency distribution tables
<b>tangent</b>	<p>geometry: a line in the plane of a circle that intersects a circle at exactly one point</p> <p>trigonometry: in a right triangle, the ratio of the length of the leg opposite a given acute angle to the leg adjacent to the same angle</p>
<b>t-chart</b>	a two column organizational tool used to display and record data, patterns, and functions/rules
<b>term</b>	a product or quotient of numerals, variables, or both; often separated by addition or subtraction operations in an expression
<b>terminating decimal</b>	a decimal that contains a finite number of digits
<b>tessellation</b>	one or more types of congruent figures that completely cover a plane without overlapping
<b>theorem</b>	a mathematical statement or proposition proven using previously accepted results
<b>theoretical probability</b>	the likelihood an event will occur under ideal circumstances divided by the total possible outcomes
<b>tolerance</b>	the allowable error in a given measurement
<b>transformation</b>	an operation that creates an image from a pre-image (e.g., translation, reflection, rotation, dilation, and glide-reflection)
<b>transitive property</b>	<p>the rule stating that for real numbers <math>a</math>, <math>b</math>, and <math>c</math>:</p> <ul style="list-style-type: none"> <li>• if <math>a = b</math> and <math>b = c</math>, then <math>a = c</math>;</li> <li>• if <math>a &gt; b</math> and <math>b &gt; c</math> then, <math>a &gt; c</math>; and</li> <li>• if <math>a &lt; b</math> and <math>b &lt; c</math>, then <math>a &lt; c</math></li> </ul>

## Mathematics Standard Articulated by Grade Level

<b>translate</b>	the act of moving a figure in the coordinate plane preserving shape, size, and orientation
<b>translation</b>	a transformation that moves every point on a figure a given distance in a given direction
<b>transversal</b>	in a plane, a line that intersects two or more lines at different points
<b>trapezoid</b>	a quadrilateral that has exactly one pair of parallel sides
<b>tree diagram</b>	a representation used to find all the possible permutations for a set of items or the prime factorization of a number
<b>trend</b>	the general drift, tendency, or direction of data
<b>triangle</b>	a polygon with three sides
<b>triangle inequality property</b>	a property stating that, in a triangle, the sum of the lengths of two sides is greater than the length of the third side
<b>trigonometric form</b>	the form $r(\cos(\theta) + i \sin(\theta))$ , where $r$ is the magnitude of the complex number and $\theta$ is the angle it makes with the positive real axis
<b>trigonometric functions</b>	the functions sine, cosine, tangent, cotangent, secant and cosecant
<b>trigonometric identities</b>	equalities that are helpful for the simplification of complex trigonometric functions and that are true for every value of the variables (e.g., $\sin^2 \theta + \cos^2 \theta = 1$ )
<b>trigonometric ratios</b>	the ratios of the lengths of pairs of sides in a right triangle (e.g., sine, cosine and tangent)
<b>truth value</b>	a value indicating whether a statement is true or false (note: typically written as sometimes true, always true, never true)
<b>two-variable data</b>	the data generated by two input cells used with one formula
<b>unimodality</b>	a function with one maximum during a defined interval
<b>unit circle</b>	the circle with a radius of one and center at the origin
<b>unit fraction</b>	a fraction with a numerator of one
<b>unit rate</b>	the ratio of a quantity to one unit of another quantity (e.g., unit price)
<b>unnecessary information</b>	information that does not assist with the solution to a problem
<b>U.S. Customary system of measurement</b>	a measuring system used most often in the United States (e.g., inches, pounds, gallons) (note: also called the standard system of measurement)
<b>valid argument</b>	an argument that is correctly inferred or deduced from a premise
<b>variable</b>	a symbol that represents a quantity

## Mathematics Standard Articulated by Grade Level

<b>variance</b>	<p>population: a measure of variability given by the average of squared deviations if the data is taken from an entire population            (i.e., <math>V_P = \frac{\sum(x_i - \bar{x})^2}{n}</math>)</p> <p>sample: a measure of variability given by the average of squared deviations if data is taken from a sample instead of an entire population (i.e., <math>V_S = \frac{\sum(x_i - \bar{x})^2}{n-1}</math>)</p>
<b>vector</b>	a quantity that has magnitude (length) and direction
<b>Venn diagram</b>	a representation that uses circles to show relationships between two or more sets
<b>verify</b>	the process of demonstrating or proving that a response is correct
<b>vertex</b>	<p>geometry: the point at which the rays of an angle, two sides of a polygon, or the edges of a polyhedron meet (plural: vertices)</p> <p>vertex-edge graph: vertices (singular “vertex”) are elements or nodes of a graph or network that may or may not be joined by edges</p>
<b>vertex-edge graph</b>	a graph or network that consists of a collection of vertices and edges where each edge connects two of the vertices
<b>vertical</b>	at right angles to the plane of the horizon or to a horizontal axis
<b>vertical angles</b>	the opposite angles formed when two lines intersect
<b>volume</b>	the measure of the capacity of a three-dimensional figure (measured in cubic units)
<b>weight</b>	a measure of the heaviness of, or the force of gravity on, an object
<b>weight on an edge</b>	value (or some number of objects) placed along an edge in a vertex-edge graph to represent some quantity such as distance, time, cost, or number of traffic lights
<b>whole</b>	the entire object, collection of objects, or quantity being considered
<b>whole numbers</b>	the set of numbers consisting of the natural numbers and zero
<b>x-intercept</b>	the coordinate at which the graph of a line intersects the x-axis
<b>y-intercept</b>	the coordinate at which the graph of a line intersects the y-axis
<b>zero property</b>	<p>addition: the mathematical rule stating that the sum of a term and zero is equal to the original term</p> <p>subtraction: the mathematical rule stating that the difference of a term and zero is equal to the original term</p> <p>multiplication: the mathematical rule stating that the product of a term and zero is zero</p> <p>division: the mathematical rule stating that division of a term by zero is undefined</p>
<b>zeros (of a function)</b>	the points at which the value of a function is zero (note: also called the roots of a function and the solutions for a function)