

## NYS Mathematics Glossary\* – Algebra 2/Trig

\*This glossary has been amended from the full SED Commencement Level Glossary of Mathematical Terms (available at <http://www.emsc.nysed.gov/ciai/mst/math/glossary/home.html>) to list only terms indicated to be at the Algebra 2/Trig level.)

This Glossary, intended for teacher use only, provides an understanding of the mathematical terms used in the Regents-approved course entitled Algebra 2/Trig (as reflected in the NYS Mathematics Core Curriculum).

### A

**a + bi form** The form of a complex number where  $a$  and  $b$  are real numbers, and  $i = \sqrt{-1}$ .

**abscissa** The horizontal or  $x$ -coordinate of a two-dimensional coordinate system.

**absolute value** The distance from 0 to a number  $n$  on a number line. The absolute value of a number  $n$  is indicated by  $|n|$ .

**Example:**  $|-3| = 3$ ,  $|+3| = 3$ , and  $|0| = 0$ .

**absolute value equation** An equation containing the absolute value of a variable.

**Example:**  $|x + 3| = 9$

**absolute value function** A function containing the absolute function of a variable.

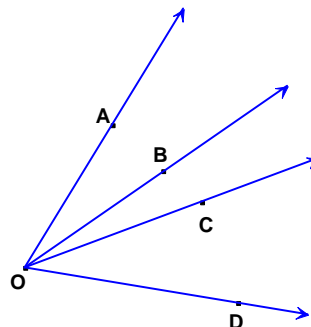
**Example:**  $f(x) = |x| = \begin{cases} x, & x \geq 0 \\ -x, & x < 0 \end{cases}$

**absolute value inequality** An inequality containing the absolute value of a variable.

**Example:**  $|x + 3| < 9$

**adjacent angles** Two coplanar angles that share a common vertex and a common side but have no common interior points.

**Example:** In the figure,  
 $\angle AOB$  and  $\angle BOC$  are a pair of adjacent angles, but  
 $\angle AOC$  and  $\angle BOD$  are not adjacent.



**adjacent sides** Two sides of any polygon that share a common vertex.

**algebraic equation** A mathematical statement that is written using one or more variables and constants which contains an equal sign.

**Examples:**

$$3y + 5 = 1$$

$$\sqrt{2x - 5} = 11$$

$$\log_5(x - 3) = 2$$

$$2^x = \frac{1}{8}$$

**algebraic expression** A mathematical phrase that is written using one or more variables and constants, but which does not contain a relation symbol ( $<$ ,  $>$ ,  $\leq$ ,  $\geq$ ,  $=$ ,  $\neq$ )

**Examples:**

$$3y + 5$$

$$\sqrt{2x - 5}$$

$$\log_5(x - 3)$$

$$2^x$$

**algebraic representation** The use of an equation or algebraic expression to model a mathematical relationship.

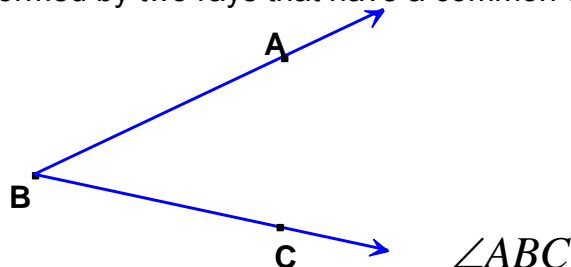
**algorithm** a defined series of steps for carrying out a computation or process.

**ambiguous case** The case where the number of triangles found can vary from zero to two, when given two sides of a triangle and the measure of the angle opposite one of the sides.

**amplitude** The magnitude of the oscillation of a sinusoidal function; the absolute value of one-half of the difference between the maximum and minimum function values of a sinusoidal function.

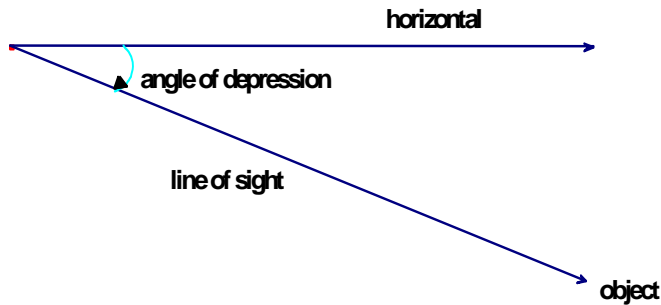
**analyze** to examine methodically by separating into parts and studying their relationships.

**angle** A geometric figure formed by two rays that have a common endpoint.



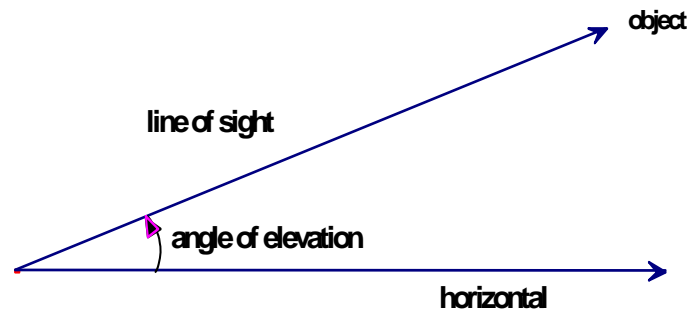
**angle in standard position** An angle with a vertex at the origin; the initial ray is on the positive x-axis, and the terminal side falls in one of the four quadrants or on one of the axes.

**angle of depression** The angle formed by the horizontal and the line of sight when looking downward.



**angle of elevation** The angle formed by the horizontal and the line of sight when looking upward.

**Example:**



**antilogarithm** The inverse function of a logarithm; to find a number given its logarithm.

**Example:** If  $\log_{10} 100 = 2$  then, 2 is the antilogarithm of 100.

**approximate value** A value for some quantity, accurate to a specified degree.

**Example:** A board that measures 4 feet 2 inches has an approximate length to the nearest foot of 4 feet.

**arc length** The distance on the circumference of a circle from one endpoint of an arc to the other endpoint, measured along the arc.

**arccosine** The inverse of the cosine function, denoted by  $\cos^{-1} x$  or  $\arccos x$ .

*Note:*  $\cos^{-1} x \neq \frac{1}{\cos x}$

**arcsine** The inverse of the sine function, denoted by  $\sin^{-1} x$  or  $\arcsin x$ .

*Note:*  $\sin^{-1} x \neq \frac{1}{\sin x}$

**arctangent** The inverse of the tangent function, denoted by  $\arctan x$  or  $\tan^{-1} x$ .

*Note:*  $\tan^{-1} x \neq \frac{1}{\tan x}$

**argument** The communication, in verbal or written form, of the reasoning process that leads to a valid conclusion.

**arithmetic sequence** A set of numbers in which the common difference between each term and the preceding term is constant.

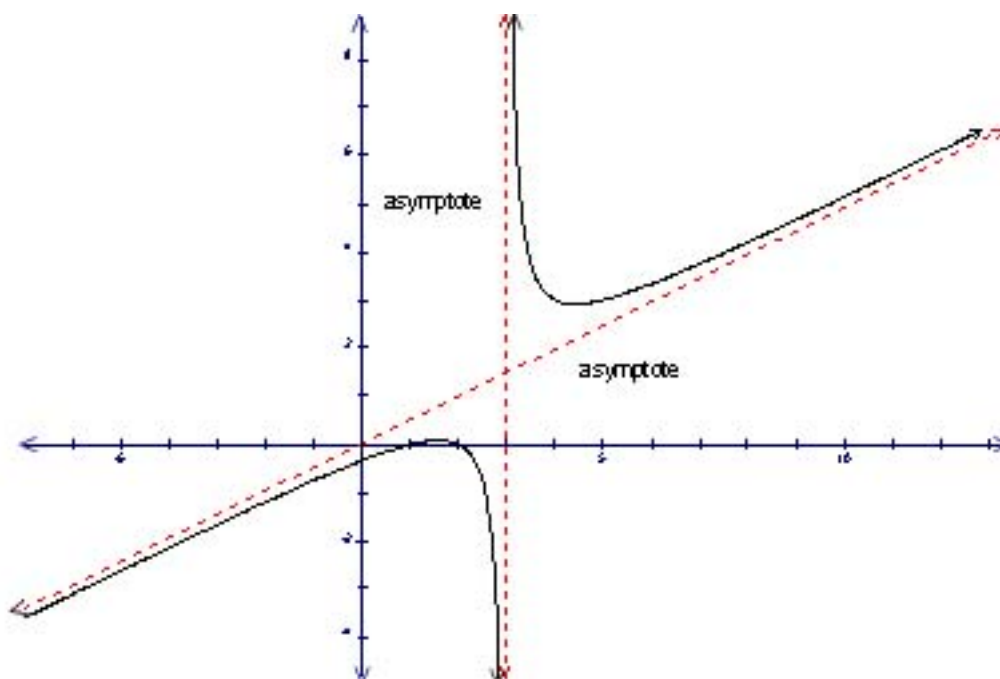
**Example:** In the arithmetic sequence 2, 5, 8, 11, 14, ... the common difference between each term and the preceding term is 3.

**arithmetic series** The indicated sum of an arithmetic sequence.

**Example:**  $1 + 3 + 5 + 7 + \dots$  is the indicated sum of the positive odd integers.

**asymptote** A straight line or curve that is the limiting value of a curve.

**Example:**



## B

**base of a logarithmic function** The number  $b$  in the logarithmic function  $\log_b x = y$  where  $b > 0$  and  $b \neq 1$  if and only if  $b^y = x$ .

**base of an exponential function** The number  $b$  in the exponential function  $y = ab^x$ , where  $a \neq 0, b > 0$ , and  $b \neq 1$ .

**Bernouli experiments** Probability experiments that can be described in terms of just two outcomes; an experiment that meet the following conditions: the experiment consists of  $n$  trials whose outcomes are either successes or failures, and the trials are identical and independent with a constant probability of success,  $p$ , and a constant probability of failure,  $q = 1 - p$ .

**biased sample** A sample having a distribution that is determined not only by the population from which it is drawn, but also by some property that influences the distribution of the sample.

**Example:** A poll to determine whether a stop sign is needed at a school crossing might be biased if the sample polled consisted only of parents who dropped their children off at school.

**bimodal** A data set that has two modes.

**binomial expansion** The expansion of some power of a binomial expression.

**Example:** The expansion of  $(x + y)^5 = x^5 + 5x^4y + 10x^3y^2 + 10x^2y^3 + 5xy^4 + y^5$ .

**binomial probability formula** A formula for determining the probability of a Bernoulli experiment.

**binomial theorem** A method for expanding a binomial expression raised to some power.

$$(a + b)^n = \binom{n}{0}a^n + \binom{n}{1}a^{n-1}b + \binom{n}{2}a^{n-2}b^2 + \dots + \binom{n}{n-1}ab^{n-1} + \binom{n}{n}b^n = \sum_{k=0}^n \binom{n}{k}a^{n-k}b^k$$

$$(a + b)^n = {}_n C_0 a^n + {}_n C_1 a^{n-1}b + {}_n C_2 a^{n-2}b^2 + \dots + {}_n C_{n-1} ab^{n-1} + {}_n C_n b^n = \sum_{k=0}^n {}_n C_k a^{n-k} b^k$$

**bivariate data** Data involving two variables.

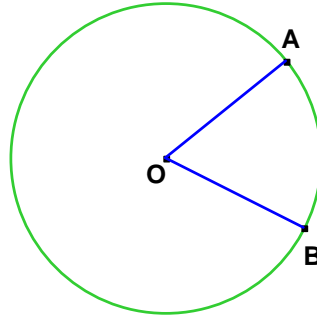
## C

**center-radius equation of a circle** The form of the equation of a circle with center  $(h, k)$  and radius  $r$  given by the formula  $(x - h)^2 + (y - k)^2 = r^2$ .

**Example:** If the coordinates of the center of the circle are  $(3, -4)$  and the length of the radius is 5, then the equation of the circle is  $(x - 3)^2 + (y + 4)^2 = 5^2$ .

**central angle** An angle in a circle with vertex at the center of the circle and sides that are radii.

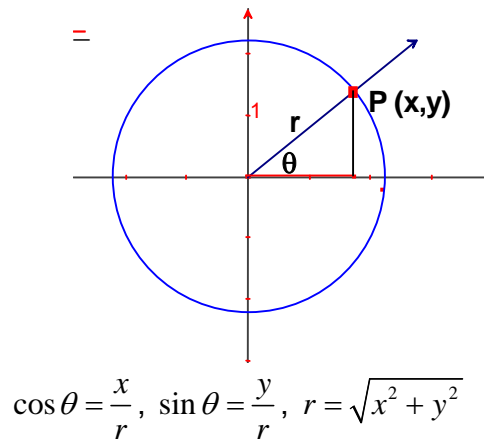
**Example:** Central angle  $AOB$



**circle** The set of all points (or locus of points) in a plane that are a fixed distance, (called the radius) from a fixed point, (called the center).

**circular function** A function that relates the coordinates of a point on a circle to the distance from the point to the origin. These functions are called circular functions because the coordinates of a point on a circle are related to the line values of trigonometric functions.

**Example:**



**coefficient** The numerical factor of a term in a polynomial.

**Example:** 14 is the coefficient in the term  $14x^3y$ .

**cofunction** The trigonometric function based on the *complement* of an angle. The value of a trigonometric function of an angle equals the value of the cofunction of the complement of the angle.

**Example:**

**Cofunctions, radians**

**Cofunctions, degrees**

$$\sin\left(\frac{\pi}{2} - x\right) = \cos x \quad \cos\left(\frac{\pi}{2} - x\right) = \sin x \quad \sin(90^\circ - x) = \cos x \quad \cos(90^\circ - x) = \sin x$$

$$\tan\left(\frac{\pi}{2} - x\right) = \cot x \quad \cot\left(\frac{\pi}{2} - x\right) = \tan x \quad \tan(90^\circ - x) = \cot x \quad \cot(90^\circ - x) = \tan x$$

$$\sec\left(\frac{\pi}{2} - x\right) = \csc x \quad \csc\left(\frac{\pi}{2} - x\right) = \sec x \quad \sec(90^\circ - x) = \csc x \quad \csc(90^\circ - x) = \sec x$$

**combination** An arrangement of objects in which order is not important; a collection of objects.

**common difference** The difference between any two successive terms of an arithmetic sequence

**common factor** A number, polynomial, or quantity that divides two or more numbers or algebraic expressions evenly.

**Example:**

1, 3, 5, 15, are common factors of 15 and 30

$2x$  is a common factor of  $4xy$  and  $6x^2$

$x - 2$  is a common factor of  $x^2 - x - 2$  and  $x^2 - 6x + 8$

**common logarithm** A logarithm to base 10. The common logarithm of  $x$  is written  $\log x$ . For example,  $\log 100$  is 2 since  $10^2 = 100$ .

**common ratio** The ratio of any two successive terms of a geometric sequence.

**completing the square** A process used to change an expression of the form  $ax^2 + bx + c$  into a perfect square binomial by adding a suitable constant.

**complex fraction** A fraction with another fraction in its numerator, denominator or both.

**Example:**  $\frac{\frac{2}{3x}}{\frac{1}{x}}$  or  $\frac{x - \frac{1}{x}}{x + 1}$

**complex number** Any number that can be expressed in the form  $a + bi$ , where  $a$  and  $b$  are real numbers and  $i$  is the imaginary unit.

**composition of functions** A way of combining functions in which the output of one function is used as the input of another function; the formation of a new function  $h$  from functions  $f$  and  $g$  using the rule  $h(x) = g \circ f(x) = g[f(x)]$  for all  $x$  in the domain of  $f$  for which  $f(x)$  is in the domain of  $g$ .

**compound event** An event that is derived from two or more simple events.

**Example:** If we roll two dice, then the event "getting a six on either the first or second die" is a compound event.

**compound interest** A method of calculating interest in which interest earned is added to the principal and thereafter also earns interest.

**conjecture** An educated guess; an unproven hypothesis based on observation, experimentation, data collection, etc.

**conjugate** Two binomials whose first terms are equal and last terms are opposites.

**Example:**  $a + b$  and  $a - b$ ,  $2 + 3\sqrt{5}$  and  $2 - 3\sqrt{5}$ ,  $3 + 2i$  and  $3 - 2i$

**constant function** A function where each element of the domain is mapped to the same element in the range. The graph of a constant function is a horizontal line.

**Example:**  $f(x) = 4$

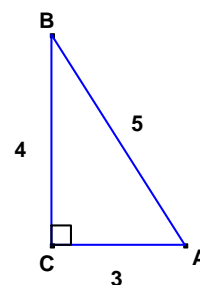
**controlled experiment** An experiment which compares the results obtained from an experimental sample against a control sample.

**correlation coefficient** A number,  $r$ , between  $-1$  and  $1$  that indicates the strength and direction of the linear relationship between two sets of numbers.

**Example:** If  $r=1$ , then the points lie on a line which has a positive slope and the two sets of numbers are said to be in perfect positive correlation. If  $r=-1$ , then the points lie on a line which has a negative slope and the two data sets are said to be in perfect negative correlation.

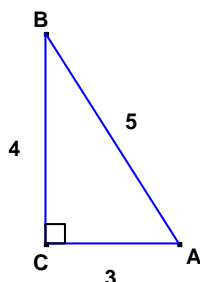
**cosecant** For a given acute angle  $\theta$  in a right triangle, the ratio of the length of the hypotenuse of the triangle to the side opposite the acute angle. Also the reciprocal of the sine ratio of the given angle, written as  $\csc$ . See also circular function.

**Example:** In this right triangle,  $\csc A = \frac{5}{4}$  and  $\csc B = \frac{5}{3}$



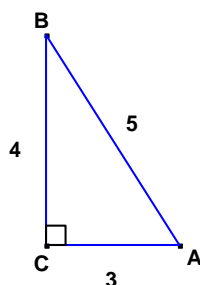
**cosine** For a given acute angle  $\theta$  in a right triangle, the ratio of the length of the side adjacent to an acute angle to the length of the hypotenuse. The cosine of an angle is written as  $\cos$ . See also circular function.

**Example:** In this right triangle,  $\cos A = \frac{3}{5}$  and  $\cos B = \frac{4}{5}$



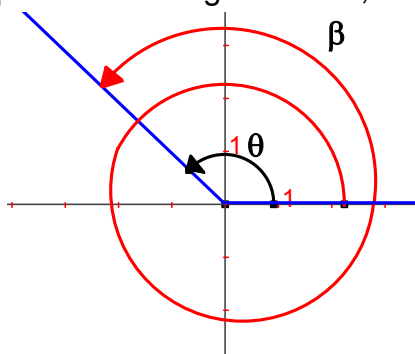
**cotangent** For a given acute angle  $\theta$  in a right triangle, the ratio of the side adjacent an acute angle to the side opposite the acute angle. The cotangent is the reciprocal of the tangent ratio of the given angle, written as  $\cot \theta$ . See also circular function.

**Example:** In this right triangle,  $\cot A = \frac{3}{4}$  and  $\cot B = \frac{4}{3}$

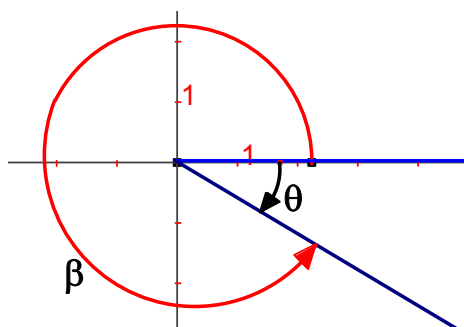


**coterminal angles** Angles in standard positions that share the same terminal side; formed by different rotations that have the same initial and terminal sides.

**Example:** In each figure below,  $\theta$  and  $\beta$  are coterminal angles.



The measure of  $\theta = 135^\circ$  and  
the measure of  $\beta = 495^\circ$



The measure of  $\theta = -45^\circ$  and  
the measure of  $\beta = 315^\circ$

**counterexample** An example that disproves a general statement.

**Example:** The statement that the sum of two numbers is less than their product could be refuted by the counterexample that  $2+1 > 2 \cdot 1$ .

## D

**degree measure** A unit of angle measure equal to  $\frac{1}{360}$  of a complete revolution.

**degree of a monomial** The sum of the exponents of the variables in the monomial.

**Example:** The degree of the monomial  $4x^3$  is three.

The degree of the monomial  $x^2y^3$  is five.

The degree of  $xy$  is two.

The degree of 7 is zero.

**degree of a polynomial** The highest degree of any monomial term in the polynomial.

**difference of two perfect squares** A binomial of the form  $a^2 - b^2$  which can be factored into  $(a - b)(a + b)$ .

**direct variation** A relationship in which the ratio of two variables is constant. A direct variation has an equation in the form  $y = kx$ , where  $x$  and  $y$  are variables and  $k$  is the constant of variation.

**discriminant** The expression  $b^2 - 4ac$  where  $a$ ,  $b$  and  $c$  are the coefficients of the quadratic equation  $ax^2 + bx + c = 0$ . The discriminant is used to determine the nature of the roots of the quadratic equation.

**domain** The set of values of the independent variable for which a given function is defined; the set of first coordinates in the ordered pairs of a relation.

**double and half angle formulas for trigonometric functions** Formulas used to determine trigonometric values for double or half of a given angle.

$$\sin 2A = 2 \sin A \cos A$$

$$\cos 2A = \cos^2 A - \sin^2 A$$

$$\cos 2A = 2 \cos^2 A - 1$$

$$\cos 2A = 1 - 2 \sin^2 A$$

$$\tan 2A = \frac{2 \tan A}{1 - \tan^2 A}$$

$$\sin \frac{1}{2} A = \pm \sqrt{\frac{1 - \cos A}{2}}$$

$$\cos \frac{1}{2} A = \pm \sqrt{\frac{1 + \cos A}{2}}$$

$$\tan \frac{1}{2} A = \pm \sqrt{\frac{1 - \cos A}{1 + \cos A}}$$

**double root** A root of an equation that occurs twice. A value  $r$  is a double root of an equation  $f(x) = 0$  if  $(x - r)^2$  is a factor of  $f(x)$ .

## E

**e** The base of the natural logarithm; a number commonly encountered when working with exponential functions to model growth, decay, continuously compounded interest;  $e \approx 2.7182818284\dots$

**equation** A mathematical sentence stating that two expressions are equal.

**equivalent forms** Different ways of writing numbers or expressions that have equal values.

**Example:**  $\frac{2}{3}$  is equivalent to  $\frac{8}{12}$   
 $3 \cdot 3 \cdot 5 \cdot 5 \cdot 5 \cdot 5$  is equivalent to  $3^2 \cdot 5^4$

**exact answer** The solution to an equation that has not been rounded.

**Example:** When solving the equation  $x^2 = 3$ , the exact answer is  $x = \pm\sqrt{3}$ . An answer such as 1.73205, although correct to five decimal places, has been rounded and thus is not an exact answer.

**exact value** The value of an expression that has not been rounded.

**Example:** The exact value of  $\cos\left(\frac{\pi}{4}\right)$  is  $\frac{\sqrt{2}}{2}$ , while 0.7071 is an approximation of  $\cos\left(\frac{\pi}{4}\right)$ .

**expand a binomial** The process of creating a polynomial by raising a binomial to an integral power.

**Example:** When expanded  $(x + y)^3 = x^3 + 3x^2y + 3xy^2 + y^3$ .

**experimental probability** A probability calculated by performing an experiment, rather than by analyzing a situation mathematically; the ratio of the number of times the event occurs to the total number of trials or times the activity is performed.

**explicit formula** For a sequence  $a_1, a_2, a_3, \dots, a_n, \dots$ , a formula that is used to generate the  $n^{\text{th}}$  term of a sequence.

**exponential form** An expression or equation containing exponents.

**Examples:**

The equation  $3^2 = 9$  is the exponential form of the logarithmic equation  $\log_3 9 = 2$ .

In exponential form,  $32 = 2^5$ .

**exponential function** A function with a variable in the exponent; an equation in the form  $y = ab^x$ , where  $a \neq 0$  and  $b > 0, b \neq 1$ .

**Example:**  $A = 3(1.02)^t$  is an exponential function

**extraneous root/value** A solution of a derived equation that is not a solution of the original equation.

**extrapolate** The process of using a given data set to estimate the value of a function or measurement beyond the values already known.

## F

**factor** (noun) A whole number that is a divisor of another number; an algebraic expression that is a divisor of another algebraic expression.

**Example:** 3 is a factor of 12

**factor** (verb) Find the number of algebraic expressions that give an indicated product.

**Example:** To factor  $x^2 - x - 6$ , write  $(x-3)(x+2)$ .

**fractional exponent** An exponent that is a rational number.

**Example:**  $8^{\frac{2}{3}} = \sqrt[3]{8^2} = (\sqrt[3]{8})^2 = 4$

**frequency table** A table that shows how often each item, number, or range of numbers occurs in a set of data.

**Example:** The data {5, 7, 6, 8, 9, 5, 13, 2, 1, 6, 5, 14, 10, 5, 9} can be displayed as a frequency distribution.

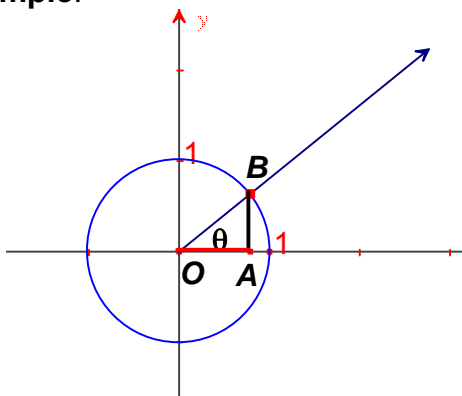
Interval	Frequency
1-5	6
6-10	7
11-15	2

**function** A rule that assigns to each number  $x$  in the function's domain a unique number  $f(x)$ .

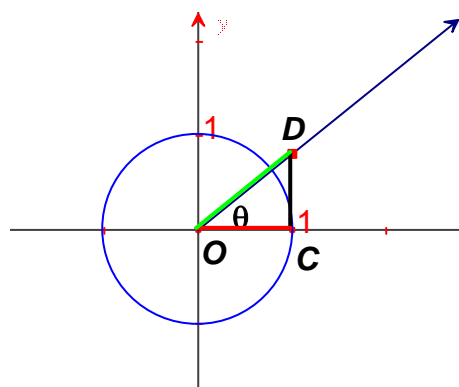
## G

**geometric representation of the circular functions** The representation of circular functions on a circle of unit radius. The trigonometric functions are called circular functions because their values are related to the lengths of specific line segments associated with a circle of unit radius.

**Example:**



$$OA = \cos \theta, AB = \sin \theta, OB = 1$$



$$CD = \tan \theta, OD = \sec \theta, OC = 1$$

**geometric sequence** A set of terms in which each term is formed by multiplying the preceding term by a nonzero constant.

**Example:**  $8, 4, 2, 1, \frac{1}{2}, \dots$

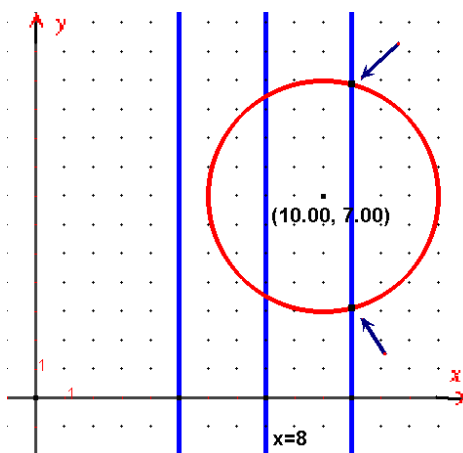
**geometric series** The indicated sum of a geometric sequence.

**Example:**  $8 + 4 + 2 + 1 + \frac{1}{2} + \dots$

**geometry** Branch of mathematics that deals with the properties, measurement, and relationships of points, lines, angles, surfaces, and solids.

**graphical representation** A graph or graphs used to model a mathematical relationship.

**Example:** The figure below is a graphical representation of the locus of all points 4 units from A(10,7) and 3 units from  $x = 8$ .



**graphical solution of a system of equations** The set of points in the plane whose coordinates are solutions to a system of equations.

**greatest common factor (GCF)** The greatest number or expression that is a factor of two or more numbers or expressions.

**Example:** 12 is the GCF of 24 and 36.  
 $5xy$  is the GCF of  $25x^2y$  and  $10xy^2$

**growth factor** The base of an exponential function.

**Example:** In the formula  $f(t) = ab^t$ , the base  $b$ , is the growth factor.

## H

**half-life** The time needed for an amount of a substance to decrease by one-half.

**horizontal-line test** A test using any horizontal line to determine whether or not a function is one-to-one. A function  $f$  is one-to-one if and only if no horizontal line intersects the graph of  $f$  more than once.

## I

**$i$**  The symbol representing the basic unit of imaginary numbers,  $i = \sqrt{-1}$

**identities** Equations that are true for all values of the variables they contain.

**Example:**  $x + 2 = x + 2$   
 $\sin^2 \theta + \cos^2 \theta = 1$

**image** The resulting point or set of points under a given transformation; in any function  $f$ , the image of  $x$  is the functional value  $f(x)$  corresponding to  $x$ .

**Examples:** In transformational geometry if  $R_{P,90}(A) = A'$ , then point  $A'$  is the image of point  $A$  under the rotation,  $R_{P,90}$ .  
 In the function  $f(x) = x^2 + 3$ , 7 is the image of 2 under  $f$ .

**imaginary number** A number in the form  $bi$ , where  $b$  is a non-zero real number and  $i$  is the imaginary unit.

**index of a radical** The letter  $n$  in the expression  $\sqrt[n]{k}$

**Example:** 5 is the index in the expression  $\sqrt[5]{32} = 2$

**inductive reasoning** The process of observing data, recognizing patterns and making generalizations about those patterns.

**interpolate** The process of using a given data set to estimate the value of a function or measurement between the values already known.

**interquartile range** The difference between the first and third quartiles; a measure of variability resistant to outliers.

**inverse function** If the inverse of a function is also a function it is then an inverse function.

**inverse of a function** The relation formed when the independent variable is exchanged with the dependent variable in a given relation.

**inverse trigonometric functions** Given the value of a trigonometric function for an angle  $\theta$ , the inverse trigonometric function outputs the measure of angle  $\theta$ . The inverses of the six basic trigonometric functions are written as  $\sin^{-1}$ ,  $\cos^{-1}$ ,  $\tan^{-1}$ ,  $\csc^{-1}$ ,  $\sec^{-1}$ , and  $\cot^{-1}$ .

**inverse variation** A relationship in which the product of two variables is constant. An inverse variation has an equation in the form  $y = \frac{k}{x}$ , where  $x$  and  $y$  are variables and  $k$  is a constant.

**irrational number** A number that cannot be expressed as the ratio of two integers. An irrational number, in decimal form, is non-repeating and non-terminating.

**Example:** The numbers  $\pi$  and  $\sqrt{2}$  are irrational numbers.

**J** There are no J terms in the commencement-level sections.

**K** There are no K terms in the commencement-level sections.

## L

**Law of cosines** In any triangle, the square of one side is equal to the sum of the squares of the other two sides diminished by the product of those two sides and the cosine of the included angle.

**Examples for  $\triangle ABC$ :**

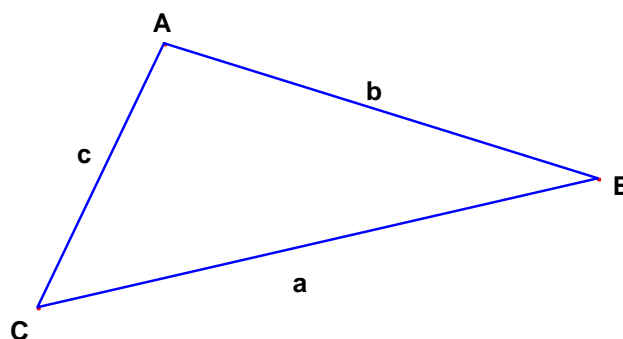
$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$c^2 = a^2 + b^2 - 2ab \cos C$$

**Law of sines** In any triangle the ratio of one side to the sine of its opposite angle is equal to the ratio of any other side and the sine of its opposite angle.

**Examples for any  $\triangle ABC$ :**  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$



**laws of exponents** Rules involving operations on expressions with like bases.

**Example:** Multiplication law:  $x^a \cdot x^b = x^{a+b}$   
 Division law:  $x^a \div x^b = x^{a-b}$ ,  $x \neq 0$   
 Power law:  $(x^a)^b = x^{ab}$

**laws of logarithms** The rules of logarithmic expressions having like bases.

**Examples:**

Product rule:  $\log_b AB = \log_b A + \log_b B$ ,  $b > 0$  and  $b \neq 1$

Quotient rule:  $\log_b \frac{A}{B} = \log_b A - \log_b B$ ,  $b > 0$  and  $b \neq 1$

Power rule:  $\log_b A^B = B \log_b A$ ,  $b > 0$  and  $b \neq 1$

**least squares regression line** The line that fits data points such that the sum of the squares of the vertical distances between the predicted values on the line and the actual values is minimized.

**linear equation** A first degree equation.

**Examples:**  $y = 6x + 8$   
 $12n - 19 = 23 + 7n$

**linear regression** A line constructed using the least-squares method.

**linear system** A set of two or more linear equations with common variables.

**logarithm** The exponent,  $n$ , to which the base  $b$  must be raised to equal  $a$ , written as  $\log_b a = n$ .

**Example:**  $\log_2 8 = 3$  since  $2^3 = 8$ .

**logarithmic form** The expression or an equation containing logarithms.

**Example:** The equation  $\log_3 y = x$  is the logarithmic form of the exponential equation  $3^x = y$

## M

**mean** A measure of central tendency denoted by  $\bar{x}$ , read “x bar”, that is calculated by adding the data values and then dividing the sum by the number of values. Also known as the arithmetic mean or arithmetic average.

**measure of central angle** The measure equal to the degree measure or radian measure of the arc intercepted by the angle.

**measure of central tendency** A summary statistic that indicates the typical value or center of an organized data set. The three most common measures of central tendency are the mean, median, and mode.

**measures of dispersion** An indication of the spread, or variation, of data values about the mean. Some common measures of dispersion are range, quartiles, interquartile range, standard deviation and variance.

**median** A measure of central tendency that is, or indicates, the middle of a data set when the data values are arranged in ascending or descending order. If there is no middle number, the median is the average of the two middle numbers.

**Examples:**

The median of the set of numbers:  $\{2, 4, 5, 6, 7, 10, 13\}$  is 6  
 The median of the set of numbers:  $\{6, 7, 9, 10, 11, 17\}$  is 9.5

**minute** A unit of degree measure equal to  $\frac{1}{60}$  of a degree.

**mode** A measure of central tendency that is given by the data value(s) that occur(s) most frequently in the data set.

**Examples:**

The mode of the set of numbers {5, 6, 8, 6, 5, 3, 5, 4} is 5.

The modes of the set of numbers {4, 6, 7, 4, 3, 7, 9, 1, 10} are 4 and 7.

The mode of the set of numbers {0, 5, 7, 12, 15, 3} is none or there is no mode.

**multiple representations** Various ways, i.e., graphically, numerically, algebraically, geometrically, and verbally, to present, interpret, communicate, and connect mathematical information and relationships.

## N

**nature of the roots** A classification of the roots of a quadratic equation, The discriminant,  $b^2 - 4ac$ , indicates the nature of the roots of a quadratic equation,  $ax^2 + bx + c = 0$  where  $a$ ,  $b$ , and  $c$  are rational numbers and  $a \neq 0$ . i.e. whether the roots are real or imaginary, rational or irrational, equal or unequal.

**negative exponent** An exponent that is a negative number. In general,  $x^{-a} = \frac{1}{x^a}$ ,  $x \neq 0$ .

**normal curve** The graph of a normal probability density function. This graph is bell-shaped and symmetric about the mean

**normal distribution** A distribution of data that varies about the mean in such a way that the graph of its probability density function is a normal curve. The height of the curve is specified by the mean and standard deviation of the distribution

**$n$ th root** The solution of  $x^n = c$  when  $n$  is odd or the nonnegative solution of  $x^n = c$  when  $n$  is even and nonnegative. For any real number  $c$  and any positive integer  $n$ , the  $n$ th root of  $c$  is denoted by either  $\sqrt[n]{c}$  or  $c^{\frac{1}{n}}$ .

**$n$ th term** The final term of a finite sequence of elements  $a_1, a_2, \dots, a_n$ , or an arbitrary term of an infinite sequence.

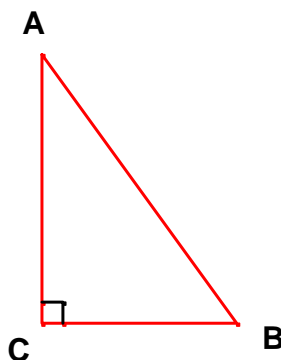
## O

**one-to-one function** A function where the inverse is also a function.

**onto function** A mapping,  $f : A \rightarrow B$  in which each element of set  $B$  is the image of at least one element in set  $A$ .

**opposite side in a right triangle** The side across from an angle. In a right triangle the hypotenuse is opposite the right angle and each leg is opposite one of the acute angles.

**Example:** With respect to  $\angle A$ ,  $\overline{BC}$  is the opposite side, and  $\overline{AC}$  is the adjacent side. With respect to side  $\overline{AC}$ ,  $\angle B$  is the opposite angle.



**ordinate** The vertical coordinate of a two-dimensional rectangular coordinate system; usually denoted by  $y$ .

**outlier** A data value that is far removed from the body of the data.

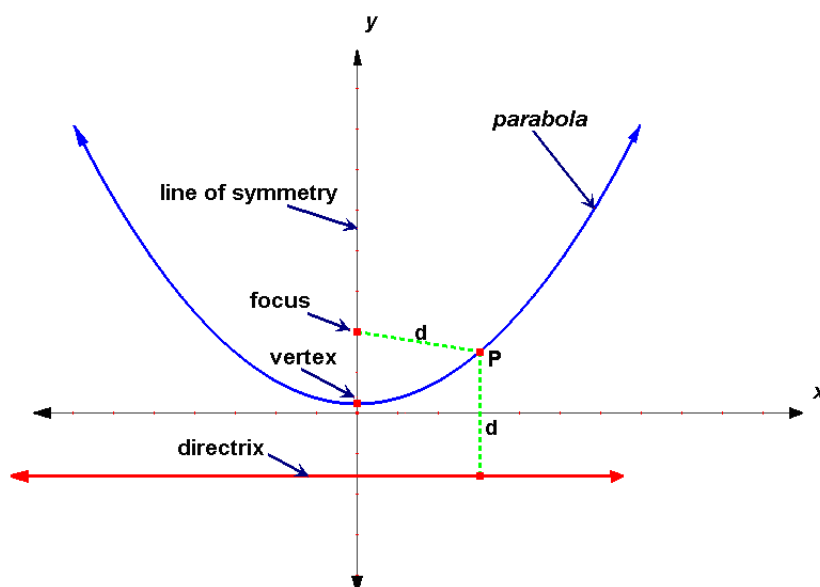
**Example:** Given the data set  $\{2, 4, 5, 16, 22, 112\}$ , 112 is the outlier. The value of the outlier will greatly effect on the value of the mean but not the median.

## P

**parabola** The locus of points equidistant from a given point (called the focus) and a given line (called the directrix). A common form of an equation of a parabola with vertical line symmetry is

$y = ax^2 + bx + c$ , where  $a$ ,  $b$ , and  $c$  are real numbers and  $a \neq 0$ .

**Example:**



**parameter** A quantity or constant whose value varies with the circumstances of its application.

**Example:** In  $y = ax^2$   $a$  is a parameter

**Pascal's Triangle** A triangular array of numbers composed of the coefficients of  $(x + y)^n$  where  $n$  is any whole number. Each row begins and ends with 1. The other values are found by adding the two numbers that are above and on either side of that value.

$$\begin{array}{ccccccc}
 & & & & 1 & & & & \\
 & & & & 1 & & 1 & & \\
 & & & 1 & 2 & & 1 & & \\
 & & 1 & 3 & 3 & & 1 & & \\
 & 1 & 4 & 6 & 4 & & 1 & & \\
 1 & 5 & 10 & 10 & 5 & & 1 & & \\
 & & & & \text{etc} & & & & 
 \end{array}$$

**Example:** The coefficients of  $(x + y)^4$  are the numbers in the 4<sup>th</sup> row of Pascal's Triangle.

$$(x + y)^4 = 1x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + 1y^4$$

**percentile** A score below which a certain percentage of the scores in a distribution fall.

**Example:** If a test score of 87 is the 75<sup>th</sup> percentile of a distribution, then 75% of the scores are less than 87 and 25% of the scores are greater than or equal to 87.

**period (of a function)** The horizontal distance after which the graph of a function starts repeating itself. The smallest value of  $k$  in a function  $f$  for which there exists some constant  $k$  such that  $f(t) = f(t+k)$  for every number  $t$  in the domain of  $f$ .

**periodic function** An oscillating function that repeats its values at regular intervals; a function  $f$  for which there exists some constant  $k$  such that  $f(t) = f(t+k)$  for every number  $t$  in the domain of  $f$ .

**permutation** An arrangement of objects in a specific order.

**phase shift** The horizontal translation of a periodic graph.

**pi** The irrational number equal to the length of the circumference of a circle divided by the length of its diameter.

**polynomial expression** A polynomial expression in terms of  $x$  that can be written in the form  $a_nx^n + a_{n-1}x^{n-1} + \dots + a_2x^2 + a_1x + a_0$  where  $n$  is a nonnegative integer and  $a_i$  is a real number.

**polynomial function** A function that can be written in the form  $f(x) = a_nx^n + a_{n-1}x^{n-1} + \dots + a_2x^2 + a_1x + a_0$ , where  $n$  is a nonnegative integer and  $a_i$  is a real number.

**powers of  $i$**  The repetitive pattern when the imaginary unit,  $i$ , is raised to sequential powers.  
 $i^2 = -1$ ,  $i^3 = -i$ ,  $i^4 = 1$ ,  $i^5 = i$ ,  $i^6 = -1$ ,  $i^7 = -i$ , etc.

**principal square root** The positive square root of a number.

**Example:** The principal square root of 4 is 2.

**Pythagorean identities** The trigonometric identities based on the Pythagorean Theorem. The identity  $\sin^2 x + \cos^2 x = 1$  and the identities derived from it.

**Examples:**  $\sin^2 x + \cos^2 x = 1$   
 $1 + \tan^2 x = \sec^2 x$   
 $1 + \cot^2 x = \csc^2 x$

## Q

**quadrantal angle** An angle in standard position whose terminal side falls on an axis.

**Example:**  $0^\circ, 90^\circ, 180^\circ, 270^\circ, 360^\circ$

**quadratic equation** An equation that can be written in the form  $ax^2 + bx + c = 0$ , where  $a$ ,  $b$ , and  $c$  are real constants and  $a \neq 0$ .

**quadratic formula** The formula used to determine the roots of the quadratic equation  $ax^2 + bx + c = 0$ ;  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ .

**quadratic inequality** A second degree inequality.

**Example:**  $2x^2 - 5x - 3 \geq 0$

**quartiles** Values that divide an ordered data set into fourths. The median, or second quartile  $Q_2$ , divides the data into a lower half and an upper half; the first quartile  $Q_1$  is the median of the lower half; and the third quartile  $Q_3$  is the median of the upper half

## R

**radian** An angle measure in which one full rotation is  $2\pi$  radians. One radian is the measure of an arc or the measure of the central angle that intercepts that arc such that the arc's length is the same as the radius of that circle.

**Example:**  $\pi$  radians = 180 degrees

**radian measure** For an angle in standard position, the length of the arc along the unit circle from the point (1,0) on the initial side to the point P where the terminal side intersects the unit circle.

**radical** The root of a quantity as indicated by the radical sign.

**radical equation** An equation that contains at least one term under a radical sign.

**radical expression** An expression that contains at least one term under a radical sign.

**radical form** The use of a radical sign to express a number with a fractional exponent.

**Example:**  $x^{\frac{2}{3}} = \sqrt[3]{x^2}$

**radicand** The quantity under a radical sign; a number or expression from which a root is extracted.

**Example:** 3 is the radicand of  $\sqrt{3}$ .

**Example:** In the expression  $\sqrt[n]{k}$ , the radicand is  $k$ .

**random sample** A sample in which all members of the population and all groups of a given size have an equal chance of being selected for the sample.

**range (of a function)** The set of values of the dependent variable of a given function; the set of second coordinates in the ordered pairs of a function.

**rational coefficient** A coefficient that is a rational number.

**rational equation** An equation that contains at least one rational expression.

**rational expression** The quotient of two polynomials in the form  $\frac{A}{B}$ ,

where  $A$  and  $B$  are polynomials and  $B \neq 0$ .

**Example:**  $\frac{2x+1}{3x^2-9}$ ,  $3x^2-9 \neq 0$

**rational inequality** An inequality which contains a rational expression.

**Example:**  $\frac{2x}{x+4} \leq 2x-5$ ,  $x+4 \neq 0$

**rational number** Any number that can be expressed as a ratio in the form  $\frac{a}{b}$  where  $a$  and  $b$  are integers and  $b \neq 0$ . A rational number is either a terminating or repeating decimal.

**rationalize a denominator** The process of changing the irrational denominator of a fraction to a rational expression.

**Example:**  $\frac{2}{\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{2\sqrt{3}}{3}$  or  $\frac{2+3i}{1-i} \cdot \frac{1+i}{1+i} = \frac{-1+5i}{2}$

→

**reciprocal trigonometric functions** The six functions:

$$\sin x = \frac{1}{\csc x}$$

$$\cos x = \frac{1}{\sec x}$$

$$\tan x = \frac{1}{\cot x}$$

$$\cot x = \frac{1}{\tan x}$$

$$\sec x = \frac{1}{\cos x}$$

$$\csc x = \frac{1}{\sin x}$$

**rectangular coordinates** An ordered pair of real numbers that establishes the location of a point in a coordinate plane using the distances from two perpendicular intersecting lines called the coordinate axes. (See also Cartesian coordinates.)

**recursive rule** For a sequence  $a_1, a_2, a_3, \dots, a_n, \dots$ , a formula that requires the computation of all previous terms in order to find the value of  $a_n$ .

**Example:**

$$a_1 = 2$$

$$a_2 = 5$$

$$a_3 = 11$$

...

$$a_n = 2a_{n-1} + 1$$

**reference angle** The positive acute angle formed by the x-axis and the terminal side of an angle  $\theta$  in standard position.

**regression model** A function (e.g., linear, exponential, power, logarithmic) that fits a set of paired data. The model may enable other values of the dependent variable to be predicted.

**relation** A correspondence between two sets; a set of ordered pairs

**Examples:**

$$\{(P, Q)\} = \{(4,5), (2,20), (7,5), (-4,6)\}$$

**replacement set** The set whose members can be substituted for the variable(s) in an open sentence.

**restricted domain** The domain resulting from a restriction placed on a function, based on the context of the problem.

**resultant** The vector that is produced from the addition of two or more other vectors.

**root of an equation** A solution to an equation of the form  $f(x) = 0$ .

**Example:** A root of the equation  $y = 6x - 18$  is 3 because when 3 is substituted in for  $x$ , the value of  $y = 0$ .

**Example:** The roots of  $x^2 - x - 2 = 0$  are  $x = 2$  and  $x = -1$ . The equation is true if we substitute either  $x = 2$  or  $x = -1$  into the equation.

**S**

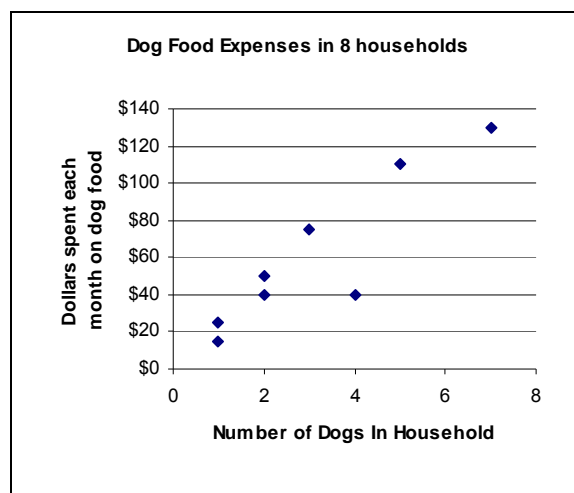
**sample space** The set of all possible outcomes for a given event.

**Example:** The sample space for tossing two coins is:  
 $\{(H,H), (H,T), (T,H), (T,T)\}$ .

**scatter plot** A graphical display of statistical data plotted as points on a coordinate plane to show the correlation between two quantities.

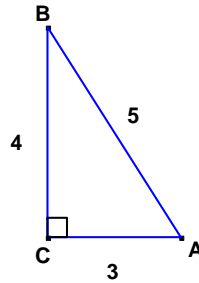
**Example:** Below is a table of paired quantitative data and its scatter plot.

Household	Number of dogs	Dollars spent each month on dog food
Perez	3	75
Jones	2	40
Balcovich	5	110
Parson	1	15
Montego	1	25
Schwartz	7	130
Barton	2	50
Walker	4	40



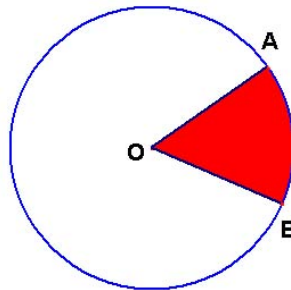
**secant (of an angle)** For a given acute angle  $\theta$  in a right triangle,  $\sec \theta$ , is the ratio of the length of the hypotenuse to the length of the side adjacent to the acute angle  $\theta$ ; the reciprocal of the cosine ratio of the given angle. See also circular function.

**Example:** In this right triangle,  $\sec A = \frac{5}{3}$  and  $\sec B = \frac{5}{4}$



**sector of a circle** A region bounded by an arc of the circle and the two radii to the endpoints of the arc.

**Example:** The shaded area in the circle below is a sector of circle O.

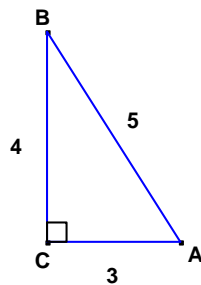


**sigma notation ( $\sum$ )** A shorthand way of writing a sum by using the Greek letter sigma.

**Example:**  $3 + 6 + 9 + \dots + 99 = \sum_{n=1}^{33} 3n$

**sine** For a given acute angle  $\theta$  in a right triangle,  $\sin \theta$ , is the ratio of the length of the side opposite the acute angle  $\theta$  to the length of the hypotenuse. See also circular function.

**Example:** In this right triangle,  $\sin A = \frac{4}{5}$  and  $\sin B = \frac{3}{5}$



**slope** The measure of the steepness of a line; the ratio of vertical change to horizontal change; if point P is  $(x_1, y_1)$  and point Q is  $(x_2, y_2)$  the slope of  $\overline{PQ}$  is  $\frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$ .

**Example:** The slope of the line containing the points A(-3,7) and B(5, -2) is  $\frac{(-2)-(7)}{(5)-(-3)} = \frac{-9}{8}$

**solution set** Any and all value(s) of the variable(s) that satisfy an equation, inequality, system of equations, or system of inequalities.

**standard deviation (population)** A measure of variability. Standard deviation measures the average distance of a data element from the mean. If data is taken from the entire population, divide by  $n$  when averaging the squared deviations. The following is the formula for population standard deviation:

$$\sigma = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n}}$$

**standard deviation (sample)** A measure of variability. Standard deviation measures the average distance of a data element from the mean. If data is taken from a sample instead of the entire population, divide by  $n-1$  when averaging the squared deviations. The following is the formula for sample standard deviation:

$$s = \sqrt{\frac{\sum(x_i - \bar{x})^2}{n-1}}$$

**standard position (of an angle)** An angle in the coordinate plane with its vertex at the origin and its initial side on the positive x-axis.

**subset** A set consisting of elements from a given set; it may be the empty set.

Example: if  $B = \{1,2,3,4,5,6,7\}$  and  $A = \{1,2,5\}$ , then  $A$  is a subset of  $B$ .

**substitution property** Any quantity can be replaced by an equal quantity.

Example: If  $a + x = b$  and  $x = c$  then  $a + c = b$ .

**subtraction property of equality** If the same or equal quantities are subtracted from same or equal quantities, then the results are equal.

Example: If  $a = b$  then  $a - c = b - c$ .

**sum and product of roots of a quadratic equation** For a quadratic equation  $ax^2 + bx + c = 0$ ,  $a \neq 0$ , whose roots are  $x_1$  and  $x_2$ , the sum of the roots is  $x_1 + x_2 = -\frac{b}{a}$ , and the product of the roots is  $x_1 \cdot x_2 = \frac{c}{a}$ .

**sum of a finite geometric series** To determine the sum of the first  $n$  terms of a geometric series,  $S_n = \frac{a_1(1-r^n)}{1-r}$ ,  $r \neq 1$ , where  $a_1$  is the first term and  $r$  is the common ratio.

**sum of a finite arithmetic series** To determine the sum of the first  $n$  terms of an arithmetic series,  $S_n = \frac{n}{2}(a_1 + a_n)$ , where  $a_1$  is the first term, and  $a_n$  is the  $n^{\text{th}}$  term.

**sum or difference formulas for trigonometric functions** Formulas used to determine trigonometric values of the sum or difference of two angles.

$$\sin(A + B) = \sin A \cos B + \cos A \sin B$$

$$\sin(A - B) = \sin A \cos B - \cos A \sin B$$

$$\cos(A + B) = \cos A \cos B - \sin A \sin B$$

$$\cos(A - B) = \cos A \cos B + \sin A \sin B$$

$$\tan(A + B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$$

$$\tan(A - B) = \frac{\tan A - \tan B}{1 + \tan A \tan B}$$

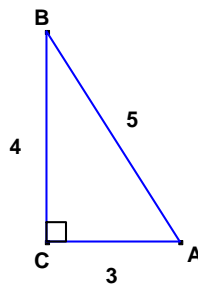
**survey** A gathering of facts or opinions by asking people questions through an interview or questionnaire.

**system of equations/inequalities** A set of two or more equations/inequalities. The solution set contains those values that satisfy all of the equations/inequalities in the system.

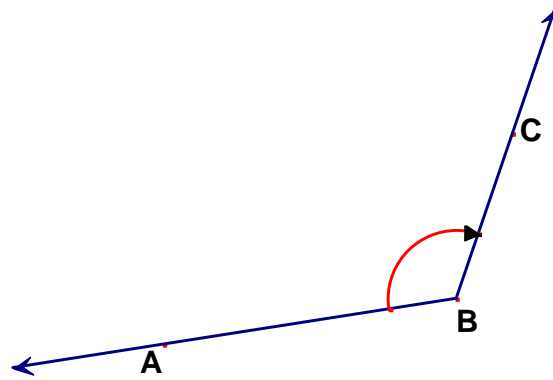
## T

**tangent (of an angle)** For a given acute angle  $\theta$  in a right triangle,  $\tan \theta$  is the ratio of the length of the side opposite the acute angle  $\theta$  to the length of the side adjacent to the angle  $\theta$ . See also circular function.

**Example:** In this right triangle,  $\tan A = \frac{4}{3}$  and  $\tan B = \frac{3}{4}$



**terminal side of an angle** If  $\angle ABC$  is the directed angle from  $\overrightarrow{BA}$  to  $\overrightarrow{BC}$  then  $\overrightarrow{BC}$  is the terminal side.



**theoretical probability** The chances of events happening as determined by calculating results as they would occur under ideal circumstances.

**Example:** When you roll a die, one of the six possible outcomes is a 2, so the theoretical probability of rolling a 2 is  $\frac{1}{6}$ . Three of the six possible outcomes are odd numbers, so the theoretical probability of rolling an odd number is  $\frac{3}{6}$ .

**transformation** A one-to-one mapping of points in the plane to points in the plane.

**transformations of functions and relations** A new function that results from the application of a transformation to a given function.

**Examples:** The function  $y = (x-3)^2$  is a translation of the graph of  $y = x^2$  three units to the right, while the function  $y = (x+3)^2$  is a translation of the graph of  $y = x^2$  three units to the left.

**trigonometric equation** An equation that uses variables expressed in terms of trigonometric functions.

**Example:** While  $x = 3x + 1$  is an algebraic equation,  $\sin \theta = 3 \sin \theta + 1$  is a trigonometric equation.

**trigonometric functions** The functions, sine, cosine, tangent, cotangent, secant and cosecant.

**undefined** An expression in mathematics which does not have meaning and therefore is not assigned a value.

**Example:** When  $x=4$ , the expression  $\frac{x+3}{x-4}$  is undefined.

When  $x < 2$ , the expression  $\sqrt{x-2}$  is undefined in the Real numbers.

When  $x < 0$ , the expression  $\log_5 x$  is undefined.

**unit circle** The circle of radius 1 with center at the origin.

**univariate** A set of data involving one variable.

## V

**variable** A quantity whose value can change or vary; in algebra, letters often represent variables.

**variance (population)** A measure of variability given by the average of squared deviations. If data is taken from the entire population, divide by  $n$  when averaging the squared deviations.

$$\text{Population variance} = \frac{\sum(x_i - \bar{x})^2}{n}.$$

**variance (sample)** A measure of variability given by the average of squared deviations. If data is taken from a sample instead of the entire population, divide by  $n-1$  when averaging the

squared deviations. Sample variance =  $\frac{\sum(x_i - \bar{x})^2}{n-1}$ .

**vector**, A quantity that has both magnitude and direction; represented geometrically by a directed line segment.

**vertical line test** A vertical line drawn to determine whether or not a relation is a function. A relation is a function if and only if no vertical line intersects the graph of the relation more than once.

**X, Y** have no terms at this level.

## Z

**zero of a function** Any value of the independent variable that makes the value of the function equal to 0.

**zero product property** If  $a$  and  $b$  are real numbers, then  $ab = 0$  if and only if  $a = 0$  or  $b = 0$ , or  $a$  and  $b = 0$ .