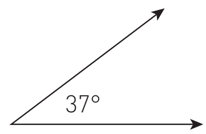
Glossary

5-D Process An organized method to solve problems. The 5 D's stand for Describe/Draw, Define, Do, Decide, and Declare. This is a problem-solving strategy for which solving begins by making a prediction about the answer or one element of it (a trial), and then confirming whether the result of the trial is correct. If not, information is gained about how close the trial is to the correct value, so that adjustments to the trial value may be made. Being organized is extremely important to the success of this method, as well as writing a usable table. The 5-D Process leads to writing equations to represent word problems.

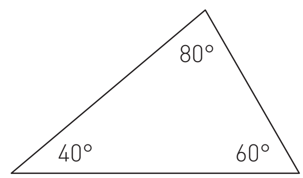
AA ~ (Triangle Similarity) If two angles of one triangle are congruent to the two corresponding angles of another triangle, then the triangles are similar. For example, given ΔABC and $\Delta A'B'C'$ with $\angle A \cong \angle A'$ and $\angle B \cong \angle B'$, then $\Delta ABC \sim \Delta A'B'C'$. You can also show that two triangles are similar by showing that *three* pairs of corresponding angles are congruent (which would be called AAA ~), but two pairs are sufficient to demonstrate similarity.

absolute value The absolute value of a number is the distance of the number from zero. Since the absolute value represents a distance, without regard to direction, absolute value is always non-negative. Thus, the absolute value of a negative number is its opposite, while the absolute value of a non-negative number is just the number itself. The absolute value of x is usually written "$|x|$." For example, $|-5| = 5$ and $|22| = 22$.

acute angle An angle with a measure greater than 0° and less than 90°. An example is shown.



acute triangle A triangle where all three angles measure less than 90°.



additive identity The number 0 is called the additive identity because adding 0 to any number does not change the number. For example, $7 + 0 = 7$.

Additive Identity Property The Additive Identity Property states that adding zero to any expression leaves the expression unchanged. That is, $a + 0 = a$. For example, $-2 + 0 = -2$.

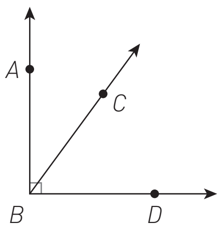
additive inverse The number you need to add to a given number to get a sum of 0. For example, the additive inverse of −3 is 3. It is also called the opposite.

Additive Inverse Property The Additive Inverse Property states that for every number a there is a number $-a$ such that $a + (-a) = 0$. For example, the number 5 has an additive inverse of −5; $5 + (-5) = 0$. The additive inverse of a number is often called its opposite. For example, 5 and −5 are opposites.

adjacent angles For two angles to be adjacent, they must satisfy these three conditions:

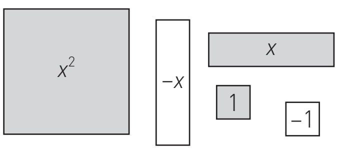
- The two angles must have a common side;
- They must have a common vertex; and
- They can have no interior points in common. This means that the common side must be between the two angles; no overlap between the angles is permitted.

In the example shown, $\angle ABC$ and $\angle CBD$ are adjacent angles.



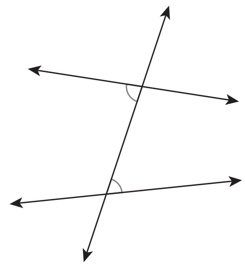
algebra A branch of mathematics that uses variables to generalize the rules of numbers and numerical operations.

algebra tiles An algebra tile is a manipulative whose area represents a constant or variable quantity. The algebra tiles used in this course consist of large squares with dimensions x-by-x; rectangles with dimensions x-by-1; and small squares with dimensions 1-by-1. These tiles are named by their areas: x^2, x, and 1, respectively. The smallest squares are called "unit tiles." In this text, shaded tiles will represent positive quantities while unshaded tiles will represent negative quantities.

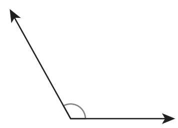


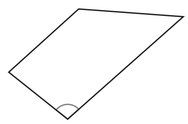
algebraic expression See *expression*.

alternate interior angles Angles between a pair of lines that switch sides of a third intersecting line (called a transversal). For example, in the following diagram the marked angles are alternate interior angles. If the lines intersected by the transversal are parallel, the alternate interior angles are congruent. Conversely, if the alternate interior angles are congruent, then the two lines intersected by the transversal are parallel.



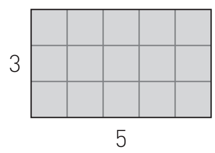
angle Generally, an angle is formed by two rays that are joined at a common endpoint (such as the obtuse angle in the diagram). Angles in geometric figures are usually formed by two segments that have a common endpoint (such as the angle marked in the quadrilateral shown). See *acute angle*, *obtuse angle*, and *right angle*.





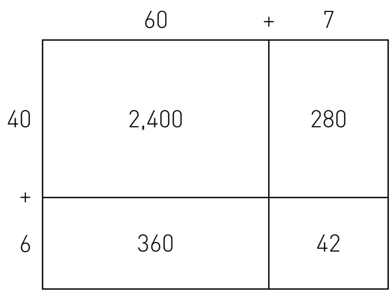
annual Occurring once every year.

area For this course, area is the number of square units needed to fill up a region on a flat surface. In later courses, the idea will be extended to cones, spheres, and more complex surfaces. In the example shown, the area of the figure is 15 square units. See *surface area*.



area model An area model is a way to visually represent and solve problems that involve multiplication and division. It can also represent and calculate probabilities. The total area of the rectangle is equal to the sum of the areas of the parts. That is, the larger problem can be broken down into smaller problems.

The image shows how an area model can be used to multiply $46 \cdot 67$. You can rewrite 46 as $40 + 6$, and 67 as $60 + 7$. Use these numbers as the dimensions of a large rectangle, as shown. Determine the area of each of the smaller rectangles and then calculate the sum of the four smaller areas. This sum is the answer to the original problem.



$46 \cdot 67 = (40 + 6)(60 + 7) = 2{,}400 + 280 + 360 + 42$
$= 3{,}082$

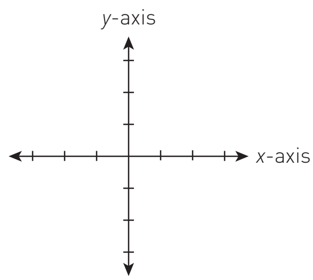
association A relationship between two (or more) variables. An association between numerical variables can be displayed on a scatter plot, and described by its form, direction, strength, and outliers. Possible association between two categorical variables can be studied in a conditional relative frequency table. See *scatter plot*.

Associative Property of Addition The Associative Property of Addition states that if a sum contains terms that are grouped, then the sum may be grouped differently with no effect on the total, that is, $a + (b + c) = (a + b) + c$. For example, $3 + (4 + 5) = (3 + 4) + 5$.

Associative Property of Multiplication The Associative Property of Multiplication states that if a product contains terms that are grouped, then the product may be grouped differently with no effect on the result, that is, $a(bc) = (ab)c$. For example, $2 \cdot (3 \cdot 4) = (2 \cdot 3) \cdot 4$.

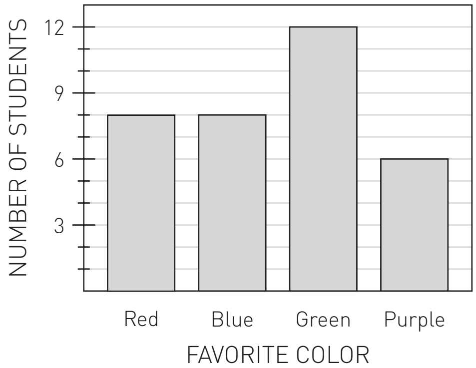
average The sum of given values divided by the number of values used in computing the sum. For example, the average of 1, 4, and 10 is $\frac{1 + 4 + 10}{3}$. See *mean*.

axis (plural: axes) On a coordinate plane, two number lines that meet at right angles at the origin (0, 0). The x-axis runs horizontally and the y-axis runs vertically.



b When the equation of a line is expressed in $y = mx + b$ form, the constant b gives the y-intercept of the line. For example, the y-intercept of the line $y = -\frac{1}{3}x + 7$ is 7.

bar graph A bar graph is a set of rectangular bars that have height proportional to the number of data elements in each category. Each bar stands for all of the elements in a single distinguishable category (such as "red"). Bars are the same width and separated from each other. See *histogram*.



base of a geometric figure

(a) The base of a triangle: any side of a triangle to which a height is drawn. There are three possible bases in each triangle.

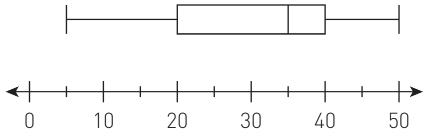
(b) The base of a trapezoid: either of the two parallel sides.

(c) The base of a parallelogram (including rectangle, rhombus, and square): any side to which a height is drawn. There are four possible bases.

(d) The base of a three-dimensional figure: see *prism* and *pyramid*.

base of an exponent When working with an exponential expression in the form b^a, b is called the base. For example, 2 is the base in 2^5. (5 is the exponent, and 32 is the value.) See *exponent*.

box plot A graphic way of showing a summary of data using the median, quartiles, and extremes of the data.



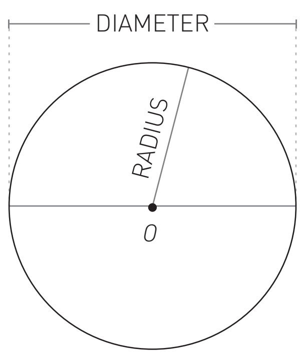
categorical data Data that can be put into categories (like color preference, gender identification, or the state you were born in), as opposed to numerical data that can be placed on a number line.

center of a circle On a flat surface, the fixed point from which all points on the circle are equidistant. See *circle*.

central angle An angle with its vertex at the center of a circle.

chord A line segment with its endpoints on a circle. A chord that passes through the center of a circle is called a "diameter." See *circle*.

circle The set of all points on a flat surface that are the same distance from a fixed point. If the fixed point (center) is O, the symbol $\odot O$ represents a circle with center O. If r is the length of a circle's radius and d is the length of its diameter, the circumference of the circle is $C = 2\pi r$ or $C = \pi d$. The area of the circle is $A = \pi r^2$.



circumference The perimeter (distance around) of a circle.

coefficient (numerical) A number multiplying a variable or product of variables. For example, −7 is the coefficient of $-7x$.

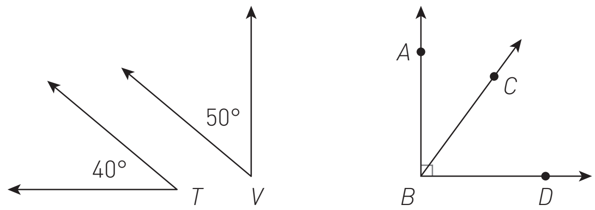
coincide Two graphs coincide if they have all their points in common. For example, the graphs of $y = 2x + 4$ and $3y = 6x + 12$ coincide; both graphs are lines with a slope of 2 and a y-intercept of 4. When the graphs of two equations coincide, those equations share all the same solutions and have an infinite number of intersection points.

combining like terms Combining two or more like terms simplifies an expression by summing constants and summing those variable terms in which the same variables are raised to the same power. For example, combining like terms in the expression $3x + 7 + 5x - 3 + 2x^2 + 3y^2$ gives $8x + 4 + 2x^2 + 3y^2$. When working with algebra tiles, combining like terms involves putting together tiles with the same dimensions.

Commutative Property of Addition The Commutative Property of Addition states that if two terms are added, then the order may be reversed with no effect on the total. That is, $a + b = b + a$. For example, $7 + 12 = 12 + 7$.

Commutative Property of Multiplication The Commutative Property of Multiplication states that if two expressions are multiplied, then the order may be reversed with no effect on the result. That is, $ab = ba$. For example, $5 \cdot 8 = 8 \cdot 5$.

complementary angles Two angles whose measures add up to 90°. Angles T and V are complementary because $m\angle T + m\angle V = 90°$. Complementary angles may also be adjacent, like $\angle ABC$ and $\angle CBD$ in the diagram.

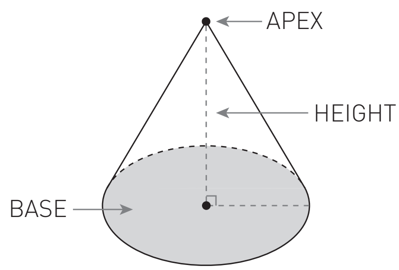


complete graph A complete graph is one that includes everything that is important about the graph (such as intercepts and other key points, asymptotes, or limitations on the domain or range), and that makes the rest of the graph predictable based on what is shown.

compound interest Interest that is paid on both the principal and the previously accrued interest.

conditional relative frequency table A two-way table which shows proportions or percentages with respect to a particular variable.

cone A three-dimensional figure with a circular base, a point called the apex, and a curved surface connecting the apex to the edge of the base. The height of the cone is the distance from the base to the apex.



congruent Two shapes are congruent if there is a sequence of rigid transformations that carries one onto the other. The corresponding angles and sides of congruent polygons have equal measures. Congruent shapes are similar and have a scale factor of 1.

conjecture An educated guess that often results from noticing a pattern.

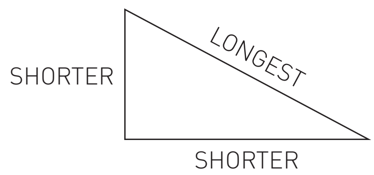
constant of proportionality (k) In a proportional relationship, equations are of the form $y = kx$, where k is the constant of proportionality.

constant term A number that is not multiplied by a variable. In the expression $2x + 3(5 - 2x) + 8$, the number 8 is a constant term. The number 3 is not a constant term because it is multiplied by a variable inside the parentheses.

continuous graph For this course, when the points on a graph are connected and it makes sense to connect them, then the graph is continuous. Such a graph will have no holes or breaks in it. This term will be more completely defined in a later course.

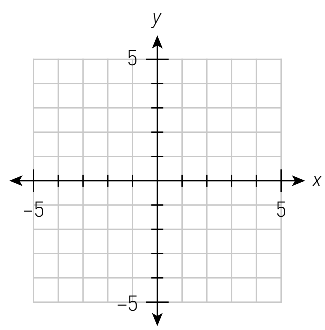
converse The converse of a conditional statement can be identified by switching the hypothesis (the "if" part) and the conclusion (the "then" part). For example, the converse of *"If P, then Q"* is *"If Q, then P."*

converse of the Right Triangle Theorem The converse of the Right Triangle Theorem states that if the square of the length of the longest side of a triangle is equal to the sum of the squares of the lengths of the two shorter sides, then the triangle is a right triangle. In equation form: if $(\text{shorter side})^2 + (\text{shorter side})^2 = (\text{longest side})^2$, then the triangle is a right triangle.



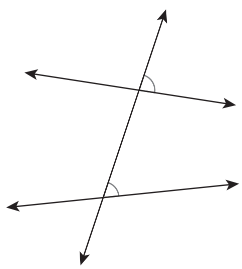
coordinate The number corresponding to a point on the number line or an ordered pair (x, y) that corresponds to a point in a two-dimensional coordinate system. In an ordered pair, the x-coordinate appears first and the y-coordinate appears second. For example, the point (3, 5) has an x-coordinate of 3 and a y-coordinate of 5. See *ordered pair*.

coordinate graph (system) A system of graphing ordered pairs of numbers on a coordinate plane. An ordered pair represents a point, with the first number giving the horizontal position relative to the x-axis and the second number giving the vertical position relative to the y-axis. See *ordered pair*.

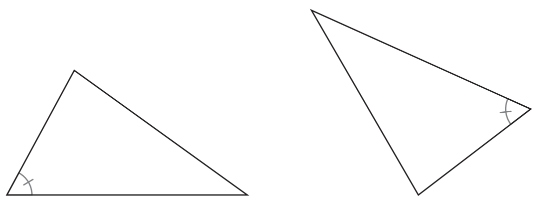


coordinate plane A flat surface defined by two number lines meeting at right angles at their zero points. A coordinate plane is also sometimes called a "Cartesian Plane."

corresponding angles When two lines are intersected by a third line (called a transversal), angles on the same side of the two lines and on the same side of the transversal are called corresponding angles. For example, the marked angles in the following diagram are corresponding angles. Note that if the two lines cut by the transversal are parallel, the corresponding angles are congruent. Conversely, if the corresponding angles are congruent, then the two lines intersected by the transversal are parallel.

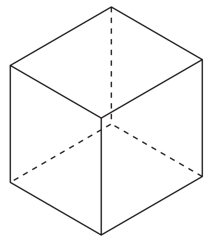


corresponding parts Points, sides, edges, or angles in two or more figures that are images of each other with respect to a transformation. If two figures are congruent, then the corresponding parts of the figures are congruent to each other. See *similar figures* and *congruent*.



counterexample An example showing that a statement has at least one exception; that is, a situation in which the statement is false. For example, the number 4 is a counterexample to the statement that all even numbers are greater than 7.

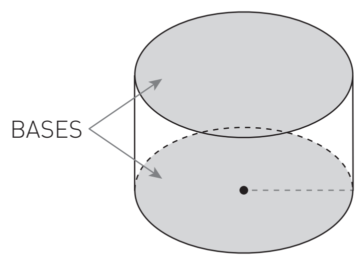
cube A polyhedron of six faces, each of which is a square.



cube root In the equation $a = b^3$, the value b that is multiplied by itself three times to give the value a. For example, the cube root of 8 is 2 because $8 = 2 \cdot 2 \cdot 2 = 2^3$. This is written $\sqrt[3]{8} = 2$.

cubic unit A cube, each of whose edges measure 1 unit in length. Volume is measured in cubic units.

cylinder (circular) A three-dimensional figure that consists of two parallel congruent circular regions (called *bases*) and a lateral surface containing segments connecting each point on the circular boundary of one base to the corresponding point on the circular boundary of the other.



degree A unit for measuring angles. Usually denoted by ° (the degree symbol). There are 360° in one full rotation.

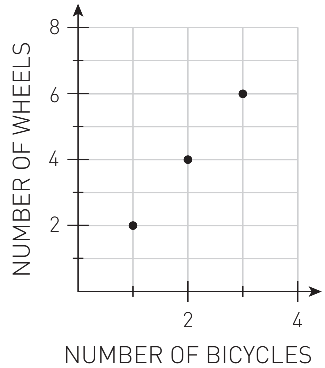
dependent variable When one quantity depends for its value on one or more others, it is called the dependent variable. For example, the speed of a car might be related to the amount of force you apply to the gas pedal. Here, the speed of the car is the dependent variable; it depends on how hard you push the pedal. The dependent variable appears as the output value in an (x, y) table, and is usually placed relative to the vertical axis of a graph. You often use the letter y and the vertical y-axis for the dependent variable. When working with functions or relations, the dependent variable represents the output value. In Statistics, the dependent variable is often called the response variable. See *independent variable*.

diameter A line segment drawn through the center of a circle with both endpoints on the circle. The length of a diameter is usually denoted d. Note that the length of a circle's diameter is twice the length of its radius. See *circle*.

dilation A transformation which produces a figure similar to the original by proportionally shrinking or stretching the figure. In a dilation, a shape is stretched (or compressed) proportionally from a point, called the point of dilation.

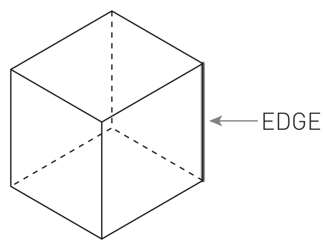
direction (of an association) If one variable in a relationship increases as the other variable increases, the direction is said to be a positive association. If one variable decreases as the other variable increases, there is said to be a negative association. If there is no apparent pattern in the scatter plot, then the variables have no association. When describing a linear association, you can use the slope, and its numerical interpretation in context, to describe the direction of the association.

discrete graph A graph that consists entirely of separated points is called a discrete graph. For example, the graph shown is discrete. See *continuous*.



Distributive Property For any a, b, and c, $a(b + c) = ab + ac$. For example, $10(7 + 2) = 10 \cdot 7 + 10 \cdot 2$.

edge In three dimensions, a line segment formed by the intersection of two faces of a polyhedron.



endpoint A point that marks the ends of a line segment or ray.

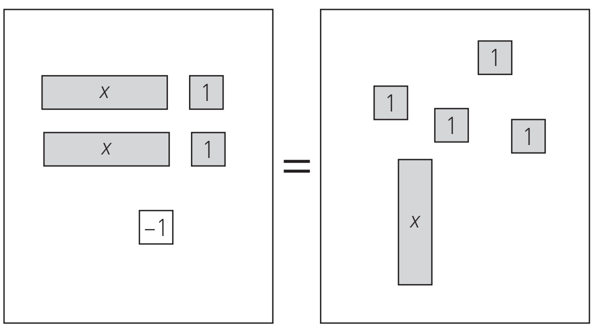
enlarge To make larger.

Equal Values Method A method for solving a system of equations. To use the equal values method, take two expressions that are each equal to the same variable and set those expressions equal to each other. For example, in the system of equations shown, $-2x + 5$ and $x - 1$ each equal y. So you write $-2x + 5 = x - 1$, then solve that equation to calculate the value of x. Once you have x, you substitute that value back into either of the original equations to calculate the value of y.

$$y = -2x + 5$$
$$y = x - 1$$

equation A mathematical sentence that uses an equals sign (=) to show two expressions are the same. For example, the equation $7x + 4.2 = -8$ means that the value of $7x + 4.2$ equals -8. Equations can also represent rules that link two quantities, like $y = 4x - 3$, which calculates the area y of a tile pattern based on its figure number x.

Equation Mat An Equation Mat places two Expression Mats side-by-side to form an equation. By applying mathematically valid moves, you can determine the value(s) that makes the expressions equal. For example, the Equation Mat shown represents the equation $2(x + 1) - 1 = x + 4$ and can be solved to determine that when $x = 3$ both sides are equal. See *valid moves*.



equivalent

(a) Two expressions are equivalent if they have the same value. For example, $2 + 3$ is equivalent to $1 + 4$.

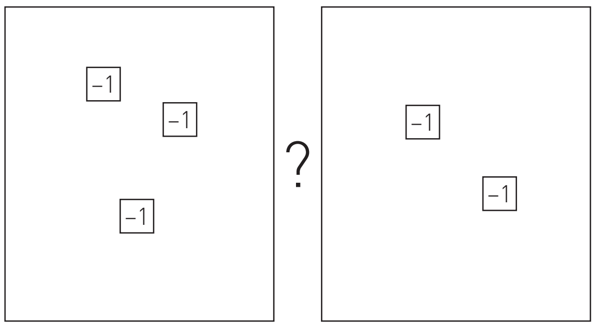
(b) Two equations are equivalent if they have all the same solutions. For example, $y = 3x$ is equivalent to $2y = 6x$. Equivalent equations have the same graph.

evaluate (an expression) To determine the numerical value of. To evaluate an expression, substitute the value(s) given for the variable(s) and perform the operations according to the Order of Operations. For example, evaluating $2x + y - 10$ when $x = 4$ and $y = 3$ gives the value 1. See *expression*.

exponent In an expression of the form b^a, a is called the exponent. For example, in the expression 2^5, 5 is called the exponent (2 is the base, and 32 is the value). The exponent indicates how many times to use the base as a multiplier. For example, in 2^5, 2 is used 5 times: $2^5 = 2 \cdot 2 \cdot 2 \cdot 2 \cdot 2 = 32$. For exponents of zero, the rule is: for any number $x \neq 0$, $x^0 = 1$.

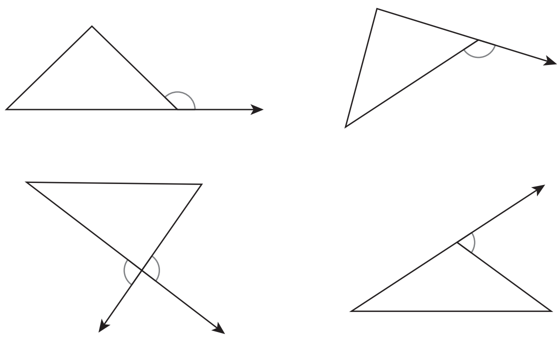
expression An expression is a combination of individual terms and operations (such as addition subtraction, multiplication or division). Numerical expressions combine numbers and operation symbols; algebraic (variable) expressions include variables. For example, $4 + (5 - 3)$ is a numerical expression. In an algebraic expression, if each of the following terms, $6xy^2$, 24, and $\frac{y-3}{4+x}$, are combined, the result may be $6xy^2 + 24 - \frac{y-3}{4+x}$. An expression does not have an equals sign.

Expression Comparison Mat Two expressions can be compared by splitting an Expression Mat in half to create an Expression Comparison Mat. The expressions are placed side by side and compared to see which one is greater. For example, in the Expression Comparison Mat shown, the left side represents −3, while the right side represents −2. Since $-2 > -3$, the right side is greater.

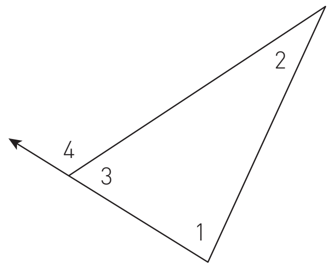


Expression Mat An organizing tool used to visually represent an expression with algebra tiles.

exterior angle (of a triangle) When a side of a triangle is extended to form an angle outside of the triangle, that angle is called an exterior angle. The exterior angle is adjacent to the angle inside the triangle. In the following diagrams, the marked angles are exterior angles of their respective triangles. See *remote interior angles*.



Exterior Angle Theorem The measure of an exterior angle of a triangle is equal to the sum of the measures of the two remote (non-adjacent) interior angles of the triangle. In the diagram shown, $m\angle 1 + m\angle 2 = m\angle 4$.



face One of the flat surfaces of a polyhedron, including the base(s).

factor

(a) In arithmetic: when two or more integers are multiplied, each of the integers is a factor of the product. For example, 4 is a factor of 24, because $4 \cdot 6 = 24$.

(b) In algebra: when two or more algebraic expressions are multiplied together, each of the expressions is a factor of the product. For example, x^2 is a factor of $-17x^2y^3$, because $(x^2)(-17y^3) = -17x^2y^3$.

(c) To factor an expression is to write it as a product. For example, the factored form of $3x - 18$ is $3(x - 6)$.

Fibonacci numbers The sequence of numbers 1, 1, 2, 3, 5, 8, 13, ... Each term of the Fibonacci sequence (after the first two terms) is the sum of the two preceding terms.

first quartile (Q1) The median of the lower half of an ordered set of data is the lower quartile.

flip See *reflection*.

form (of an association) The form of an association describes the pattern of data on a graph. This can be described as either linear, where points follow a straight line path, or nonlinear, where points follow a curved path. Sometimes, data points group together in clusters, showing areas where values are concentrated.

formula An equation that shows a mathematical relationship.

fraction The quotient of two quantities in the form $\frac{a}{b}$ where b is not equal to 0.

Fraction Busters "Fraction Busting" is a method of rewriting equations involving fractions that uses the Multiplicative Property of Equality to rearrange the equation so that no fractions remain. To use this method, multiply both sides of an equation by the common denominator of all the fractions in the equation. The result will be an equivalent equation with no fractions. For example, when given the equation $\frac{x}{7} + 2 = \frac{x}{3}$, we can multiply both sides by the "Fraction Buster" 21. The resulting equation, $3x + 42 = 7x$, is equivalent to the original but contains no fractions.

frequency The number of times that something occurs within an interval or data set.

frequency table A table that displays counts, or frequencies, of data.

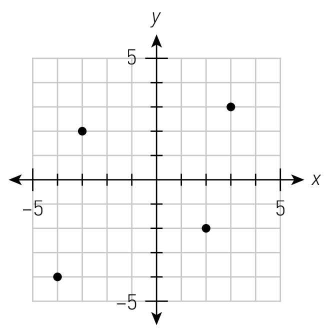
function A relationship in which for each input value there is one and only one output value. For example, the relationship $y = x + 4$ is a function; for each input value (x) there is exactly one output value (y). In terms of ordered pairs (x, y), no two ordered pairs of a function have the same first member (x).

Giant One A fraction that is equal to 1. Multiplying any fraction by a Giant One will create a new fraction equivalent to the original fraction. In the equation shown, $\frac{2}{2}$ is a Giant One.

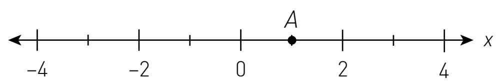
$$\frac{2}{3} \cdot \frac{2}{2} = \frac{4}{6}$$

graph A graph represents numerical information in a visual form. The numbers may come from a table, situation (pattern), or rule (equation or inequality). Most of the graphs in this course show points, lines, and/or curves on a two-dimensional coordinate system or on a single axis called a number line.

TWO-DIMENSIONAL COORDINATE SYSTEM

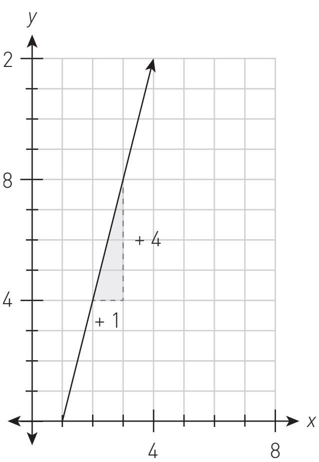


NUMBER LINE



growth One useful way to analyze a mathematical relationship is to examine how the output value grows as the input value increases. You can see this growth on a graph of a linear relationship by using a growth triangle.

growth triangle A growth triangle is a right triangle drawn on a graph with its hypotenuse following the line of data. The vertical leg shows the change in the *y*-value, and the horizontal leg shows the change in the *x*-value. These leg lengths describe how one quantity changes relative to another. For example, if the graph shown was describing a tile pattern, the growth might represent adding 4 tiles for every increase of 1 in the figure number.



height

(a) Triangle: the length of a segment that connects a vertex of the triangle to a line containing the opposite base (side) and is perpendicular to that line.

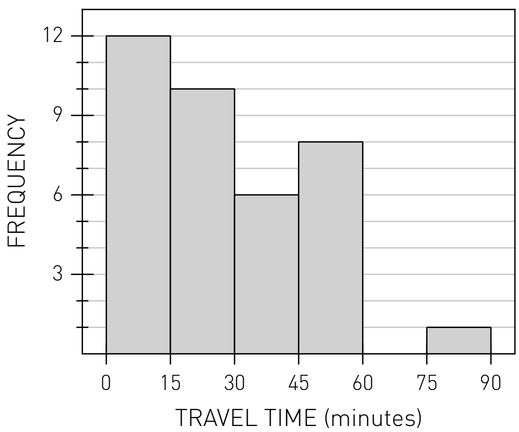
(b) Trapezoid: the length of any segment that connects a point on one base of the trapezoid to the line containing the opposite base and is perpendicular to that line.

(c) Parallelogram (includes rectangle, rhombus, and square): the length of any segment that connects a point on one base of the parallelogram to the line containing the opposite base and is perpendicular to that line.

d) Pyramid and cone: the length of the segment that connects the apex to a point in the plane containing the base of a figure and is perpendicular to that plane.

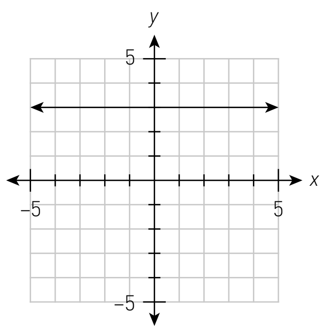
(e) Prism or cylinder: the length of a segment that connects one base of the figure to the plane containing the other base and is perpendicular to that plane.

histogram A way of displaying data that is much like a bar graph in that the height of the bars is proportional to the number of elements. The difference is that each bar of a histogram represents the number of data elements in a range of values, such as the time it takes to get to school from 0 minutes up to, but not including, 90 minutes. Each range of values should have the same width. See *bar graph*.

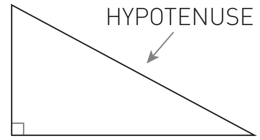


horizontal Parallel to the horizon. The x-axis of a coordinate graph is the horizontal axis.

horizontal lines Horizontal lines are flat and run left to right in the same direction as the x-axis. Horizontal lines have equations of the form $y = b$, where b can be any number. For example, the given graph shows the horizontal line $y = 3$. The slope of any horizontal line is 0. The x-axis has the equation $y = 0$ because $y = 0$ everywhere on the x-axis.



hypotenuse The longest side of a right triangle (the side opposite the right angle).



Identity Property of Addition The Identity Property of Addition states that adding zero to any expression leaves the expression unchanged. That is, $a + 0 = a$. For example, $7 + 0 = 7$, and $-2y + 0 = -2y$.

Identity Property of Multiplication The Identity Property of Multiplication states that multiplying any expression by 1 leaves the expression unchanged. That is, $a(1) = a$. For example, $437x \cdot 1 = 437x$.

independent variable When one quantity changes in a way that does not depend on the value of another quantity, the value that changes independently is represented with the independent variable. For example, you might relate the speed of a car to the amount of force you apply to the gas pedal. Here, the amount of force applied may be whatever the driver chooses, so it represents the independent variable. The independent variable appears as the input value in an (x, y) table, and is usually placed relative to the horizontal axis of a graph. You often use the letter x and the horizontal x-axis for the independent variable. When working with functions or relations, the independent variable represents the input value. In Statistics, the independent variable is often called the explanatory variable. See *dependent variable*.

indirect measurement A technique that uses proportionality to determine a measurement when directly measuring the object is not possible.

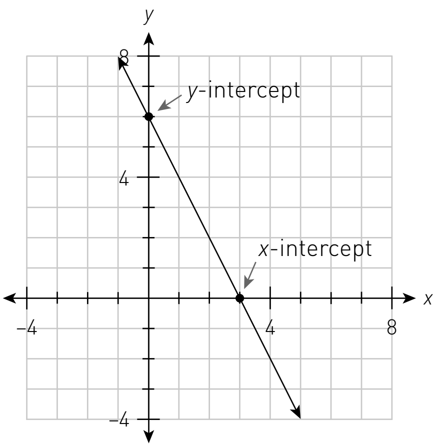
inequality An inequality consists of two expressions on either side of an inequality symbol. For example, the inequality $7x + 4.2 < -8$ states that the expression $7x + 4.2$ has a value less than -8.

inequality symbols The symbol $\leq$ read from left to right means "less than or equal to," the symbol $\geq$ read from left to right means "greater than or equal to," and the symbols $<$ and $>$ mean "less than" and "greater than," respectively. For example, "$7 < 13$" means that 7 is less than 13.

input value The input value is the value you put into a function or rule to determine the output. It is often represented by x and is independent of the output. For example, in a function that calculates the area of a rectangle based on its length, the length is the input value. In an (x, y) table, the input is typically listed first.

integers The set of numbers $\{\ldots, -3, -2, -1, 0, 1, 2, 3, \ldots\}$.

intercepts Points where a graph crosses the axes. x-intercepts are points at which the graph crosses the x-axis and y-intercepts are points at which the graph crosses the y-axis. On the graph, the x-intercept is $(3, 0)$ and the y-intercept is $(0, 6)$.



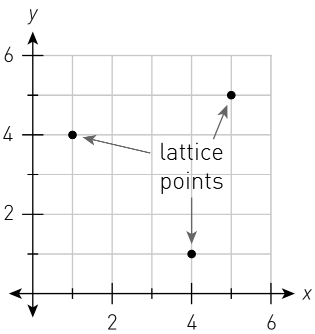
interest An amount paid which is a percentage of an initial value (principal). For example, a savings account may offer 4% annual interest rate, which means they will pay $4.00 in interest for a principal of $100 kept in the account for one year.

inverse operation An operation that undoes another operation. For example, multiplication is the inverse operation for division.

irrational numbers The set of numbers that cannot be expressed in the form $\frac{a}{b}$, where a and b are integers and $b \neq 0$. For example, π and $\sqrt{2}$ are irrational numbers.

lateral face A (flat) side of a polyhedron. It is always a polygon.

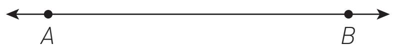
lattice points The points on a coordinate grid where the grid lines intersect. The coordinates of lattice points are integers.



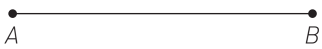
legs The two sides of a right triangle that form the right angle. Note that legs of a right triangle are always shorter than its hypotenuse.

like terms Two or more terms that contain the same variable(s), with corresponding variables raised to the same power. For example, $5x^2$ and $2x^2$ are like terms. See *combining like terms*.

line A line is an undefined term in geometry. A line is one-dimensional and continues without end in two directions. A line is made up of points and has no thickness. A line may be named with a letter (such as l), but also may be labeled using two points on the line, such as $\overleftrightarrow{AB}$.



line segment The portion of a line between two points. A line segment is named using its endpoints. For example, the line segment shown may be named either $\overline{AB}$ or $\overline{BA}$.



linear association See *association*.

linear equation An equation in two variables whose graph is a line. For example, $y = 2.1x - 8$ is a linear equation. The standard form for a linear equation is $ax + by = c$, where a, b, and c are constants and a and b are not both zero. Most linear equations can be written in $y = mx + b$ form, which is more useful for determining the line's slope and y-intercept.

lowest common denominator (LCD) The smallest common multiple of the denominators of two or more fractions. For example, the LCD of $\frac{5}{12}$ and $\frac{3}{8}$ is 24.

m When the equation of a line is expressed in $y = mx + b$ form, the parameter m gives the slope of the line. For example, the slope of the line $y = -\frac{1}{3}x + 7$ is $-\frac{1}{3}$.

mean The mean, or average, of several numbers is one way of defining the "middle" of the numbers. To calculate the average of a group of numbers, add the numbers together then divide by the number of numbers in the set. For example, the average of the numbers 1, 5, and 6 is $(1 + 5 + 6) \div 3 = 4$. The mean is generally the best measure of central tendency when there are no outliers in the data set. See *average*.

measure of central tendency Mean and median are measures of central tendency, reflecting special statistical information about a set of data.

measurement For the purposes of this course, a measurement is an indication of the size or magnitude of a geometric figure. For example, an appropriate measurement of a line segment would be its length. Appropriate measurements of a square would include not only the length of a side, but also its area and perimeter. The measure of an angle represents the number of degrees of rotation from one ray to the other about the vertex.

median The middle number of an ordered set of data. If there is no distinct middle, then the average of the two middle numbers is the median. The median is generally more accurate than the mean as a measure of central tendency when there are outliers in the data set.

model A mathematical summary (often an equation) of a trend in data, after making assumptions and approximations to simplify a complicated situation. Models help us to describe data to others, compare data more easily to other data, and help us to make predictions. For example, mathematical models of weather patterns help us to predict the weather. No model is perfect, but some models are better at describing trends than other models.

multiplicative identity The number 1 is called the multiplicative identity because multiplying any number by 1 does not change the number. For example, $7(1) = 7$.

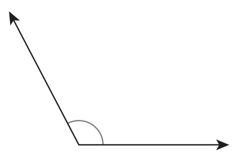
Multiplicative Identity Property The Multiplicative Identity Property states that multiplying any expression by 1 leaves the expression unchanged. That is, $a(1) = a$. For example, $437x \cdot 1 = 437x$.

multiplicative inverse The multiplicative inverse for a non-zero number is the number we can multiply by to get the multiplicative identity, 1. For example, for the number 5, the multiplicative inverse is $\frac{1}{5}$; for the number $\frac{2}{3}$ the multiplicative inverse is $\frac{3}{2}$.

non-commensurate Two measurements are called non-commensurate if no whole number multiple of one measurement can ever equal a whole number multiple of the other. For example, measures of 1 cm and $\sqrt{2}$ cm are non-commensurate, because no combination of items 1 cm long will ever have exactly the same length as a combination of items $\sqrt{2}$ cm long.

number line A diagram representing all real numbers as points on a line. All real numbers are assigned to points. The numbers are called the coordinates of the points and the point for which the number 0 is assigned is called the origin.

obtuse angle Any angle that measures between (but not including) 90° and 180°.



obtuse triangle A triangle with one obtuse angle.

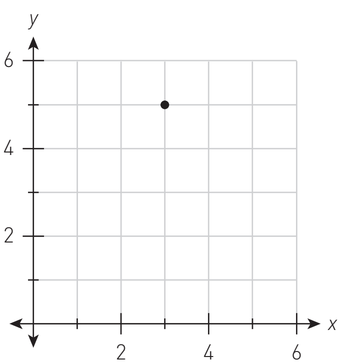
one-dimensional Something that does not have any width or depth. Lines and curves are one-dimensional.

operation A mathematical process such as addition, subtraction, multiplication, division, raising to a power, or taking a root.

opposite (of a number) The same number but with the opposite sign (+ or –). The additive inverse.

Order of Operations The specific order in which certain operations are to be carried out to evaluate or rewrite expressions: parentheses (or other grouping symbols), exponents (powers or roots), multiplication and division (from left to right), and addition and subtraction (from left to right).

ordered pair Two numbers written in order as follows: (x, y). The primary use of ordered pairs in this course is to represent points in an xy-coordinate system. The first coordinate (x) represents the distance from the x-axis. The second coordinate (y) represents the distance from the y-axis. For example, the ordered pair (3, 5) can be represented by the point shown on the following graph.

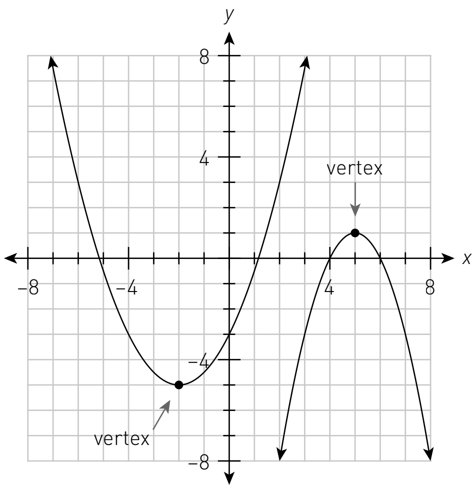


origin The point on a coordinate plane where the x-axis and y-axis intersect is called the origin. This point has coordinates (0, 0). The point assigned to zero on a number line is also called the origin. See *axis*.

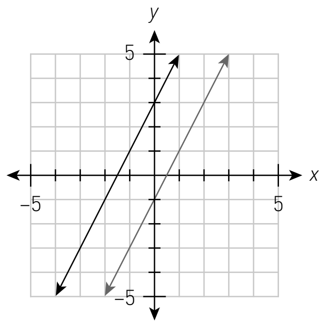
outlier A number in a set of data that is much larger or much smaller than the other numbers in the set.

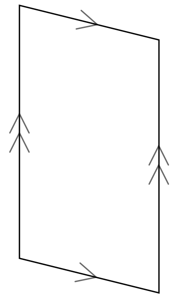
output value The output value is the result of applying a function or rule to an input. It depends on the input value and is usually represented by y. For example, in a function that calculates the area of a rectangle based on its length, the area is the output value. In an (x, y) table, the output is typically listed second.

parabola A parabola is a particular kind of mathematical curve. In this course, a parabola is always the graph of a quadratic function $y = ax^2 + bx + c$ where a does not equal 0. The following diagram shows examples of two parabolas graphed on the same axes. The highest or lowest point on the graph is called the vertex.



parallel Two or more straight lines on a flat surface that do not intersect (no matter how far they are extended) are parallel. Matching arrows on lines or line segments are used to indicate that those segments are parallel, like the ones on the parallelogram shown.





parameter In a general equation where x and y represent the inputs and outputs of the function, variables such as b and m, are often referred to as parameters, and they are often replaced with specific values. For example: in the equation $y = mx + b$ representing all lines, the b and m are (variable) parameters that give the slope and y-intercept, while x and y are the independent and dependent variables.

pattern A pattern is a set of things in order that change in a regular way. For example, the numbers 1, 4, 7, 10, ... form a pattern, because each number increases by 3. The numbers 1, 4, 9, 16, ... form a pattern, because they are squares of consecutive integers. In this course, you often look at tile patterns, whose figure numbers and areas are represented with a table, a rule (equation), or a graph.

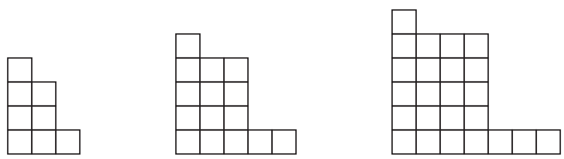
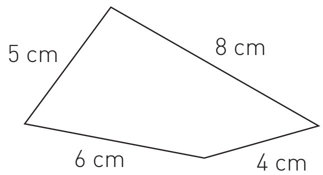


FIGURE 2 FIGURE 3 FIGURE 4

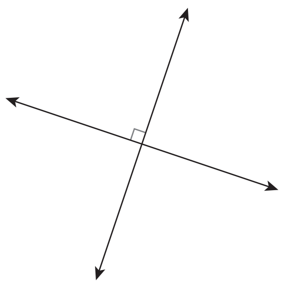
percent (%) A ratio that compares a number to 100. Percents are often written using the "%" symbol. For example, 0.75 is equal to $\frac{75}{100}$ or 75%.

perfect square A number that is the product of an integer and itself. For example, 25 is a perfect square because it is the product of 5 and 5.

perimeter The distance around a figure on a flat surface. In the example shown, the perimeter is 5 + 8 + 4 + 6 = 23 cm.

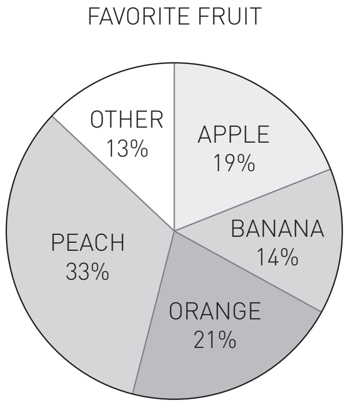


perpendicular Two rays, line segments, or lines that meet (intersect) to form a right angle (90°) are called perpendicular. A line and a flat surface may also be perpendicular if the line does not lie on the flat surface but intersects the surface and forms a right angle with every line on the flat surface passing through the point of intersection. A small square at the point of intersection of two lines or segments indicates that the lines form a right angle and are therefore perpendicular.



pi (π) The ratio of the circumference (C) of the circle to its diameter (d). For every circle, $\pi = \frac{C}{d}$. Numbers such as 3.14, 3.14159, or $\frac{22}{7}$ are approximations of π.

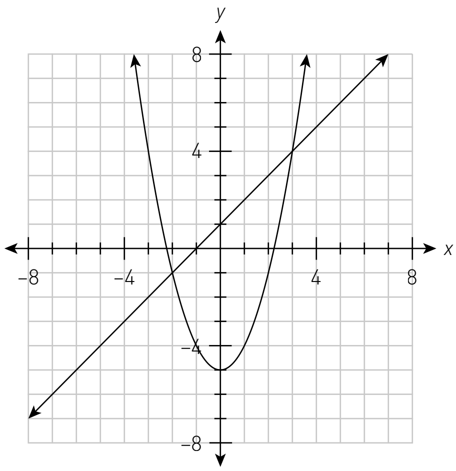
pie chart A way of displaying categorical data. A pie chart shows the proportion each category is of the whole. See *categorical data*.



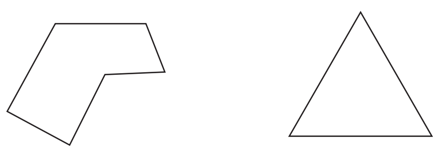
plane A plane is a two-dimensional flat surface that extends without end. It is made up of points and has no thickness.

point An exact location in space. In two dimensions, an ordered pair specifies a point on a coordinate plane. See *ordered pair*.

point of intersection A point of intersection is a point that the graphs of two equations have in common. For example, (3, 4) is a point of intersection of the two graphs shown. Two graphs may have one point of intersection, several points of intersection, or no points of intersection. The ordered pair representing a point of intersection gives a solution to the equations of each of the graphs.

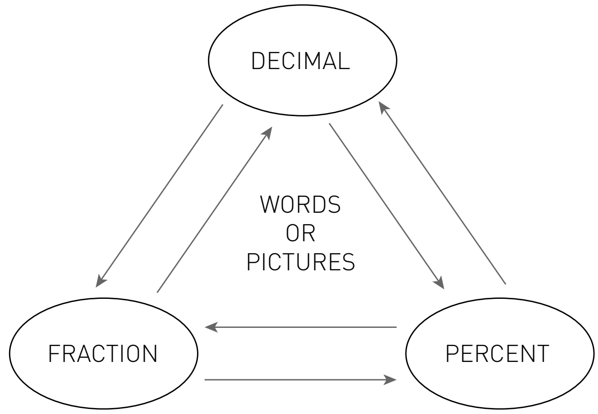


polygon A two-dimensional closed figure of three or more line segments (sides) connected end to end. Each segment is a side and only intersects the endpoints of its two adjacent sides. Each point of intersection is a vertex. Shown are two examples of polygons.



portion A part of something; a part of a whole.

Portions Web The web diagram shown illustrates that fractions, decimals, and percents are different ways to represent a portion of a number. Portions may also be represented in words, such as "four-fifths" or "seven-fourths," or as diagrams.



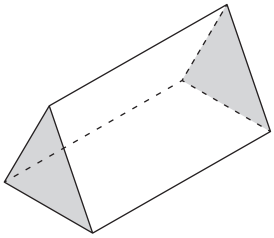
power A number or variable raised to an exponent in the form x^n. See *exponent*.

predicted value (of an association) The dependent (y-value) that is predicted for an independent (x-value) by the best-fit model for an association.

prime number A positive integer with exactly two factors. The only factors of a prime number are 1 and itself. For example, the numbers 2, 3, 17, and 31 are all prime.

principal The initial amount of money invested, borrowed, or owed in a financial transaction.

prism A three-dimensional figure with two parallel, congruent polygonal bases. The lateral faces are parallelograms that connect the corresponding vertices of the bases.



product The result of multiplying. For example, 20 is the product of 4 and 5.

properties of exponents The properties of exponents studied in this course are:

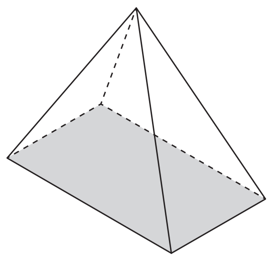
Property	Examples
$x^m x^n = x^{m+n}$ for all x	$x^3x^4 = x^7$ and $2^5 \cdot 2^{-1} = 2^4$
$\frac{x^m}{x^n} = x^{m-n}$ for $x \neq 0$	$x^{10} \div x^4 = x^6$ and $\frac{5^4}{5^7} = 5^{-3}$
$(x^m)^n = x^{mn}$ for all x	$(x^4)^3 = x^{12}$ and $(10^5)^6 = 10^{30}$
$x^0 = 1$ for $x \neq 0$	$y^0 = 1$ and $9^0 = 1$
$x^{-1} = \frac{1}{x}$ for $x \neq 0$	$x^{-2} = \frac{1}{x^2}$ and $3^{-1} = \frac{1}{3}$

proportion An equation stating that two ratios (fractions) are equal. For example, the equation $\frac{\text{68 votes for Mr. Mears}}{\text{100 people surveyed}} = \frac{\text{34 votes for Mr. Mears}}{\text{50 people surveyed}}$ is a proportion. A proportion is a useful type of equation to set up when solving problems involving proportional relationships.

proportional equation An equation stating that two ratios (fractions) are equal.

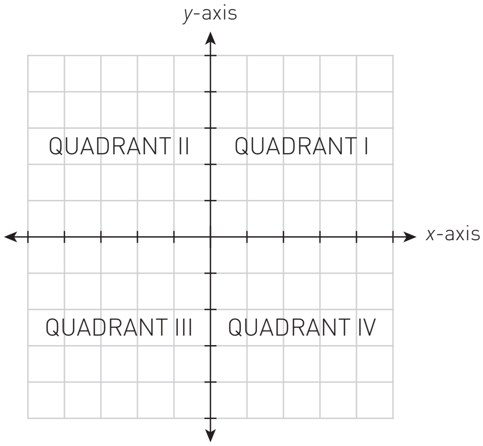
proportional relationship Two values are in a proportional relationship if a proportion may be set up that relates the values.

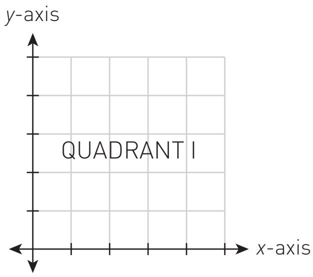
pyramid A three-dimensional figure with a base that is a polygon. The lateral faces are formed by connecting each vertex of the base to a single point (the apex of the pyramid) that is above or below the surface that contains the base.



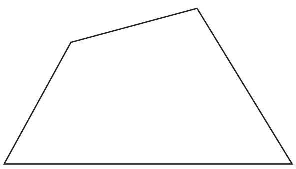
Pythagorean Theorem See *Right Triangle Theorem.*

quadrants The coordinate plane is divided by its axes into four quadrants. The quadrants are numbered as shown in the first diagram. When graphing data that has no negative values, sometimes a graph that shows only the first quadrant is used.





quadrilateral A polygon with four sides. The following shape is a quadrilateral.



quartile Along with the median, the quartiles divide a set of data into four groups of the same size. See *box plot*.

quotient The result of a division problem.

radical An expression in the form $\sqrt{a}$, where $\sqrt{a}$ is the positive square root of a. For example, $\sqrt{49} = 7$. See *square root*.

radicand The expression under a radical sign. For example, in the expression $3 + 2\sqrt{x - 7}$, the radicand is $x - 7$.

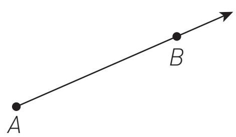
radius (plural: radii) A line segment drawn from the center of a circle to a point on the circle.

rate A ratio comparing two quantities, often a comparison of time. For example, miles per hour.

ratio A ratio compares two quantities by division. A ratio may be written using a colon, but is more often written as a fraction. For example, the comparison may be made of the ratio of female students in a particular school to the total number of students in the school. This ratio could be written as 1,521:2,906 or as $\frac{\text{1,521 female students}}{\text{2,906 total students}}$.

rational numbers Numbers that may be expressed in the form $\frac{a}{b}$, where a and b are integers and $b \neq 0$. For example, 0.75 is a rational number because 0.75 may be expressed in the form $\frac{3}{4}$.

ray A ray is part of a line that starts at one point and extends without end in one direction. In the example shown, ray $\overrightarrow{AB}$ is part of $\overleftrightarrow{AB}$ that starts at A and contains all of the points of $\overleftrightarrow{AB}$ that are on the same side of A as point B, including A. Point A is the endpoint of $\overrightarrow{AB}$.

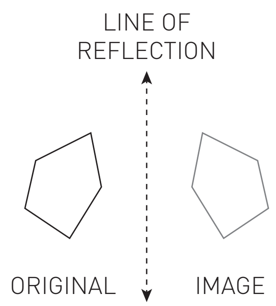


real numbers Irrational numbers together with rational numbers form the set of the real numbers. For example, the following are all real numbers: 2.78, -137, 0, $\frac{3}{7}$, π, $\sqrt{2}$. All real numbers are represented on the number line.

reciprocal The reciprocal of a nonzero number is its multiplicative inverse, that is, the reciprocal of x is $\frac{1}{x}$. For a number in the form $\frac{a}{b}$, where a and b are non-zero, the reciprocal is $\frac{b}{a}$. The product of a number and its reciprocal is 1. For example, the reciprocal of 12 is $\frac{1}{12}$, because $12 \cdot \frac{1}{12} = 1$.

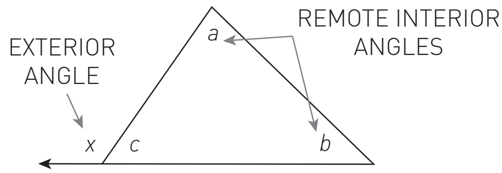
reduce To make smaller.

reflection A transformation across a line that produces a mirror image of the original (pre-image) shape. The reflection is called the "image" of the original figure. The line is called a "line of reflection."



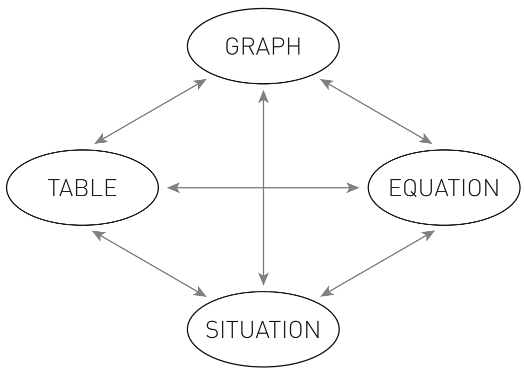
relative frequency A ratio or percent. If 60 people are asked, and 15 people prefer "red," the relative frequency of people preferring red is $\frac{15}{60} = 25\%$.

remote interior angles If a triangle has an exterior angle, the remote interior angles are the two angles not adjacent to the exterior angle. Also called "non-adjacent interior angles." See *exterior angle (of a triangle).*

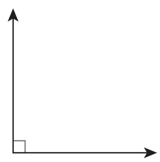


repeating decimal A repeating decimal is a decimal that repeats the same sequence of digits forever from some point onward. For example, 4.56073073073... is a decimal for which the three digits 073 continue to repeat forever. Repeating decimals are always the decimal expansions of rational numbers.

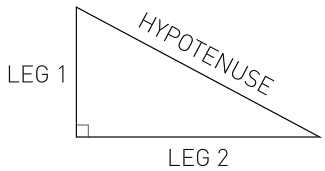
Representations of Patterns Web An organizational tool used to keep track of connections between the four representations of relationships between quantities emphasized in this course. In this course, four different ways of representing a numerical relationship are emphasized: with a graph, table, situation (pattern), or rule (equation or inequality).



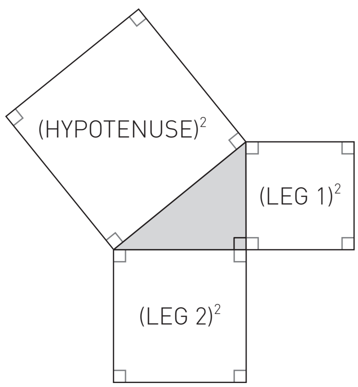
right angle An angle that measures 90°. A small square is used to note a right angle, as shown in the example.



right triangle A triangle that has one right angle. The side of a right triangle opposite the right angle is called the "hypotenuse," and the two sides adjacent to the right angle are called "legs."

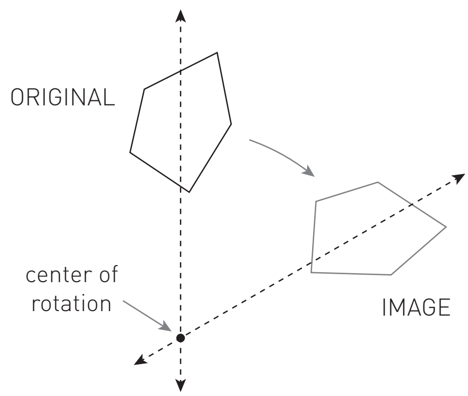


Right Triangle Theorem The Right Triangle Theorem, also known as the Pythagorean Theorem, states that in a right triangle, the sum of the squares of the lengths of the two shorter sides (legs) is equal to the square of the length of the longest side (hypotenuse). In equation form: $(\text{leg } 1)^2 + (\text{leg } 2)^2 = \text{hypotenuse}^2$. This relationship makes it possible for you to calculate the length of any side of a right triangle if you know the lengths of the other two sides.



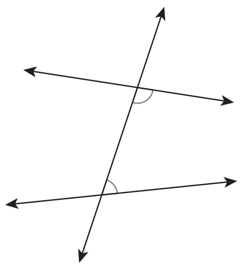
rigid motions Movements of figures that preserve their shape and size. Examples of rigid motions are reflections, rotations, and translations.

rotation A transformation that turns all of the points in the original (pre-image) figure the same number of degrees around a fixed center point (such as the origin on a graph). The result is called the "image" of the original figure. The point that the shape is rotated about is called the "center of rotation." To define a rotation, you need to state the measure of turn (in degrees), the direction the shape is turned (such as clockwise or counterclockwise), and the center of rotation.



rule A rule is an equation or inequality that represents the relationship between two numerical quantities. A rule is often used to represent the relationship between quantities in a table, a pattern, a real-world situation, or a graph.

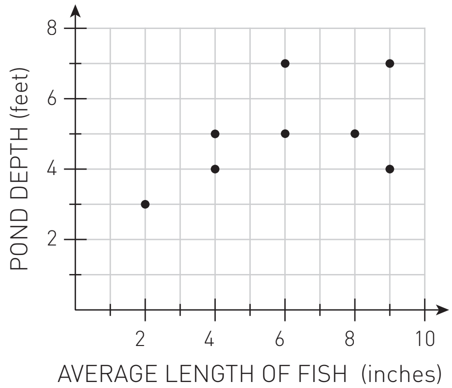
same-side interior angles Two angles between two lines and on the same side of a third line that intersects them (called a transversal). The marked angles in the following diagram are an example of a pair of same-side interior angles. Note that if the two lines that are cut by the transversal are parallel, then the two angles will add up to 180°.



scale factor A ratio that compares the sizes of the parts of one figure or object to the sizes of the corresponding parts of a similar figure or object. In this course it is also referred to as the multiplier.

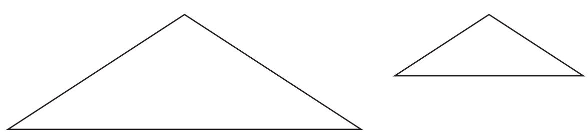
scale on axes The scale on an axis tells you what number each successive tick mark on the axis represents. A complete graph has the scale marked with numbers on each axis. Each axis should be scaled so that each interval represents the same amount.

scatter plot A way of displaying two-variable numerical data where two measurements are taken for each subject (like height and forearm length, or surface area of cardboard and volume of cereal held in a cereal box). To create a scatter plot, the two values for each subject are written as coordinate pairs and graphed on a pair of coordinate axes (each axis representing a variable). See *association*.



scientific notation A number is expressed in scientific notation when it is in the form $a \times 10^n$, where $1 \leq a < 10$ and n is an integer. For example, the number 31,000 can be expressed in scientific notation as 3.1×10^4.

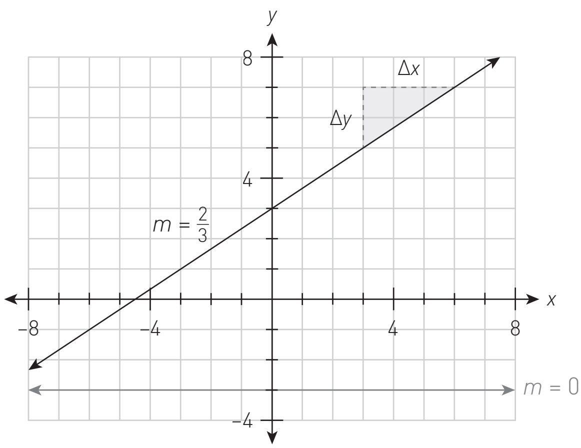
similar figures Two shapes are similar if there is a sequence of rigid motions, followed by a dilation, that carries one onto the other. For example the two triangles can be shown to be similar by either enlarging the triangle on the left or reducing the triangle on the right and translating them so they coincide. In similar figures, the measures of corresponding angles are equal and the ratio of the corresponding sides lengths are equal.



simple interest Interest paid on the principal alone.

slide See *translation*.

slope A ratio that describes how steep (or flat) a line is. Slope can be positive, negative, or even zero, but a straight line has only one slope. Slope is the ratio $\frac{\text{vertical change}}{\text{horizontal change}}$ or $\frac{\text{change in } y\text{-value}}{\text{change in } x\text{-value}}$, sometimes written $\frac{\Delta y}{\Delta x}$. When the equation of a line is written in $y = mx + b$ form, m is the slope of the line. Some texts refer to slope as the ratio of the "rise over the run." A line has positive slope if it slopes upward from left to right on a graph, negative slope if it slopes downward from left to right, zero slope if it is horizontal, and undefined slope if it is vertical. Slope is interpreted in context as the amount of change in the y-variable for an increase of one unit in the x-variable.



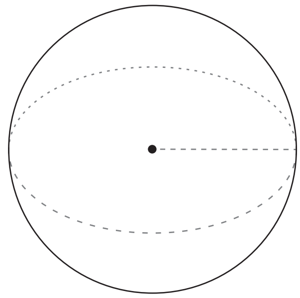
slope–intercept form A form of a linear equation: $y = mx + b$. In this form, m is the slope and the point $(0, b)$ is the y-intercept. See $y = mx + b$.

solid A closed three-dimensional shape and all of its interior points. Examples include regions bounded by pyramids, cylinders, and spheres.

solution The number or numbers that when substituted into an equation or inequality make the equation or inequality true. For example, $x = 4$ is a solution to the equation $3x = 12$ because $3x$ equals 12 when $x = 4$.

solve To determine all the solutions to an equation or an inequality. The solution(s) may be number(s), variable(s), or an expression.

sphere The set of all points in space that are the same distance from a fixed point. The fixed point is the center of the sphere and the distance is its radius.



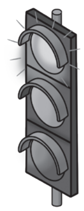
square (a number) To square a number means to multiply it by itself, or raise it to the second power. For example, 7 squared is 7^2 or $7 \cdot 7$ which is 49.

square root A number a is a square root of b if $a^2 = b$. For example, the number 9 has two square roots, 3 and −3. A negative number has no real square roots; a positive number has two; and zero has just one square root, namely, itself. See *radical*.

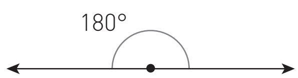
square units The units used to describe the measure of an area in the form of 1 × 1 unit squares.

standard form of a linear equation The standard form for a linear equation is $ax + by = c$, where a, b, and c are real numbers and a and b are not both zero. For example, the equation $2.5x - 3y = 12$ is in standard form. When you are given the equation of a line in standard form, it is often useful to write an equivalent equation in $y = mx + b$ form to identify the line's slope and y-intercept.

stoplight icon The icon shown will appear periodically throughout the text. Problems that display this icon contain errors of some type.



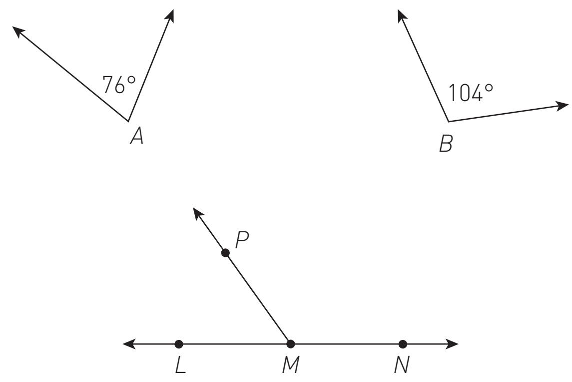
straight angle An angle that measures 180°. This occurs when the rays of the angle point in opposite directions, forming a line.



strength (of an association) A description of how much scatter there is in the data away from the trend line or curve.

substitution Replacing one symbol with a number, a variable, or another algebraic expression of the same value. Substitution does not change the value of the overall expression. For example, suppose that the expression $13x - 6$ must be evaluated for $x = 4$. Since x has the value 4, 4 may be substituted into the expression wherever x appears, giving the equivalent expression $13(4) - 6$.

supplementary angles Two angles whose measures add up to 180°. Angles A and B are supplementary because $m\angle A + \angle B = 180°$. Supplementary angles may also be adjacent like $\angle LMP$ and $\angle PMN$ in the diagram.



surface area The sum of all the area(s) of the surface(s) of a three-dimensional solid. For example, the surface area of a prism is the sum of the areas of its top and bottom bases, and its vertical surfaces (lateral faces).

system of equations A system of equations is a set of equations with the same variables. Solving a system of equations means determining one or more solutions that make each of the equations in the system true. A solution to a system of equations gives a point of intersection of the graphs of the equations in the system. There may be zero, one, multiple, or infinite solutions to a system of equations. For example, $(1.5, -3)$ is a solution to the system of equations shown; setting $x = 1.5$, $y = -3$ makes both of the equations true. Also, $(1.5, -3)$ is a point of intersection of the graphs of these two equations.

$$y = 2x - 6$$
$$y = -2x$$

table The tables used in this course represent numerical information by organizing it into columns and rows. The numbers may come from a graph, situation (pattern), or rule (equation). Many of the tables in this course are (x, y) tables like the one shown.

x	y
–8	11
4	3
11	–8
6	3
–8	11

term A term is a single number, variable, or the product of numbers and variables, such as –45, $1.2x$, and $3xy^2$.

terminating decimal A terminating decimal is a decimal that has only a finite number of non-zero digits, such as 4.067. Terminating decimals are a particular kind of repeating decimal for which the repeating portion is zeros, so the example could be written 4.0670000000... but it is not necessary to write the zeros at the end.

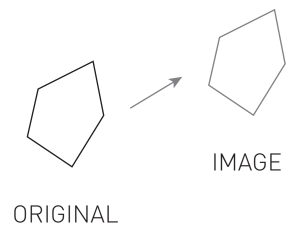
third quartile (Q3) The median of the upper half of an ordered set of data.

three-dimensional An object that has height, width, and depth.

tick mark A symbol that shows that a number line has been divided into intervals of equal length. See *number line*.

transformation This course studies four transformations: reflection, rotation, translation, and dilation. All of them preserve shape, and the first three preserve size.

translation A transformation that preserves the size, shape, and orientation of a figure while sliding (moving) it to a new location. The result is called the "image" of the original figure.

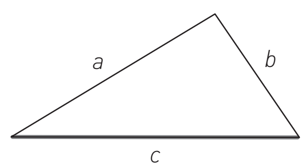


transversal A line that intersects two or more other lines on a flat surface (plane). In this course, you often work with a transversal that intersects two parallel lines.

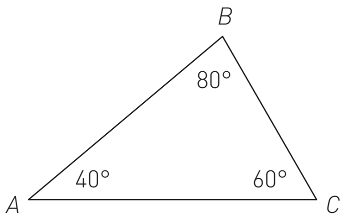
trend line A line that represents, in general, data on a scatter plot. The trend line is a model of numerical two-variable data that helps describe the data. It is also used to make predictions for other data.

triangle A polygon with three sides.

Triangle Inequality In a triangle with side lengths a, b, and c, c must be less than the sum of a and b and greater than the difference of a and b. In the example shown, a is greater than b (that is, $a > b$), so the possible values for c are all numbers such that $c > a - b$ and $c < a + b$.



Triangle Angle Sum Theorem The sum of the measures of the interior angles in any triangle is 180°. For example, in ΔABC, $m\angle A + m\angle B + m\angle C = 180°$.



two-dimensional An object having length and width.

turn See *rotation*.

undefined slope The slope of a vertical line is undefined.

undoing In this course, "undoing" refers to a method of solving one-variable equations. In "undoing," you undo the last operation that was applied to an expression by applying its inverse operation. You then solve the resulting equation using various solution methods, including perhaps undoing again. For example, in the equation $4(x + 2) = 36$, the last operation that was applied to the left-hand side was a *multiplication* by 4. So to use "undoing," you *divide* both sides of the equation by 4, giving us $x + 2 = 9$. You then solve the equation $x + 2 = 9$ (perhaps by "undoing" again and subtracting 2 from both sides) to determine that $x = 7$.

unit rate A rate with a denominator of one when simplified.

valid moves When working with an Equation Mat or Expression Comparison Mat, there are certain mathematically valid moves you can make with the algebra tiles that keep the relationship between the two sides of the mat intact. For example, removing an x-tile from the positive region of each side of an equation mat is a valid move; it keeps the expressions on each side of the mat equal. The valid moves are those justified by the properties of the real numbers.

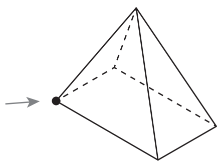
variable A symbol used to represent one or more numbers. In this course, letters of the English alphabet are used as variables. For example, in the expression $3x - (8.6xy + z)$, the variables are x, y, and z.

variable expression See *expression*.

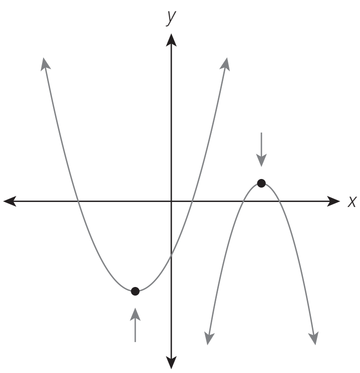
vertex (plural: vertices)

(a) For a two-dimensional geometric shape, a vertex is a point where two or more line segments or rays meet to form a corner, such as in a polygon or angle.

(b) For a three-dimensional polyhedron, a vertex is a point where the edges of the solid meet.

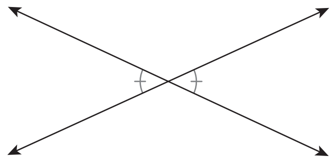


(c) For a parabola it is the highest or lowest point on the parabola (depending on the parabola's orientation).

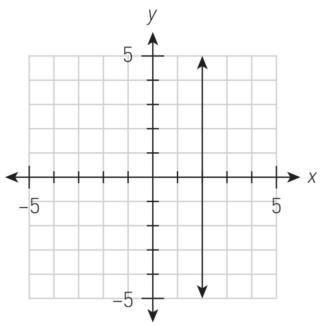


vertical At right angles to the horizon. On a coordinate graph, the *y*-axis runs vertically.

vertical angles The two opposite (that is, non-adjacent) angles formed by two intersecting lines. "Vertical" is a relationship between pairs of angles, so one angle cannot be called vertical. Angles that form a vertical pair are always congruent.



vertical lines Vertical lines run up and down in the same direction as the *y*-axis and are parallel to it. All vertical lines have equations of the form $x = a$, where a can be any number. For example, the given graph shows the vertical line $x = 2$. The *y*-axis has the equation $x = 0$ because $x = 0$ everywhere on the *y*-axis. Vertical lines have undefined slope. See *undefined slope*.

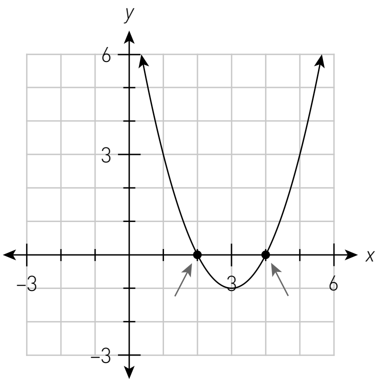


volume A measurement of the size of the three-dimensional region enclosed within an object. Volume is expressed as the number of 1 × 1 × 1 unit cubes (or parts of cubes) that fit inside a solid.

***x*-axis** The horizontal number line on a coordinate graph. See *axis*.

x-coordinate In an ordered pair, (x, y), that represents a point in the coordinate plane, x is the value of the x-coordinate. That is, the distance from the y-axis that is needed to plot the point.

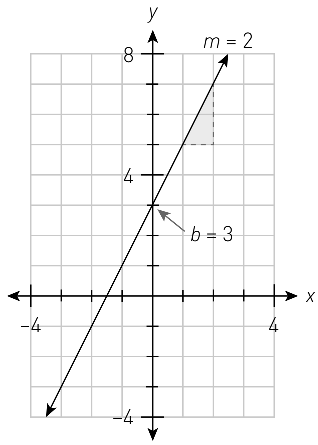
x-intercept The x-intercept of a graph is the point where a graph intersects the x-axis. At these points, the y-coordinate is always zero. A graph may have multiple x-intercepts, a single x-intercept, or none. Each x-intercept is expressed as a coordinate pair, with the y-coordinate equal to zero. For the graph shown, the x-intercepts are (2, 0) and (4, 0).



(x, y) table An (x, y) table represents pairs of values of two related quantities. Typically, the input value (x) appears first, and the output value (y) appears second. For example, the (x, y) table shown tells us that the input value 10 is paired with the output value 18 for some rule.

x	y
0	−2
−4	−10
10	18

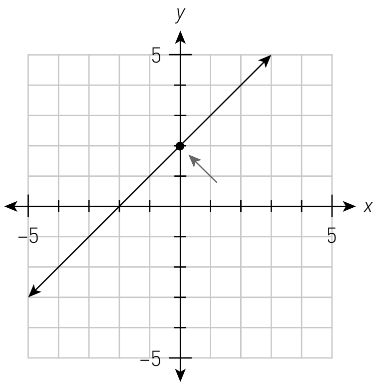
$y = mx + b$ When two quantities x and y have a linear relationship, that relationship can be represented with an equation in $y = mx + b$ form. The constant m is the slope, and b is the y-intercept of the graph. For example, the line graphed represents the equation $y = 2x + 3$, which has a slope of 2 and a y-intercept of 3. This form of a linear equation is also called the slope–intercept form.



y-axis The vertical number line on a coordinate graph. See *axis*.

y-coordinate In an ordered pair, (x, y), that represents a point in the coordinate plane, y is the value of the y-coordinate. That is, the distance from the x-axis that is needed to plot the point.

y-intercept The y-intercept of a graph is the point where a graph intersects the y-axis. A function has at most one y-intercept, while a relation may have multiple y-intercepts. Each y-intercept is expressed as a coordinate pair where the x-coordinate is always zero. In the equation of a line in the form $y = mx + b$, the y-value of the y-intercept is represented by b. The y-intercept often represents the initial value of a quantity in real-world contexts. For example, for the graph shown, $b = 2$ and its y-intercept is (0, 2). If the graph represents a tile pattern, the y-intercept details that the initial number of tiles was two.



zero A number often used to represent "having none of a quantity." Zero is neither negative nor positive. Zero is the additive identity.