

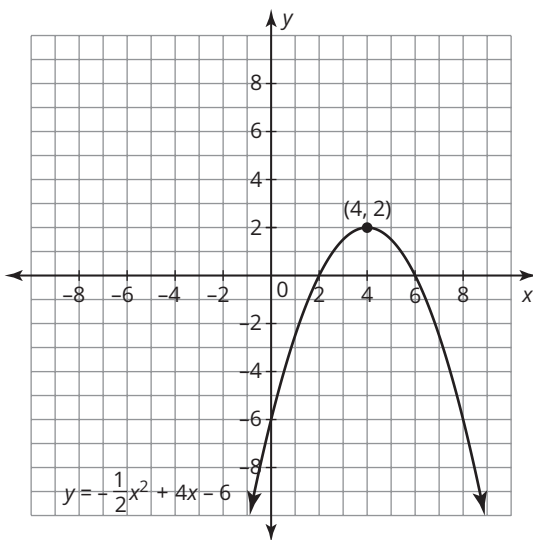
A

absolute maximum

A function has an absolute maximum if there is a point that has a y-coordinate that is greater than the y-coordinates of every other point on the graph.

Example

The ordered pair $(4, 2)$ is the absolute maximum of the graph of the function $f(x) = -\frac{1}{2}x^2 + 4x - 6$.

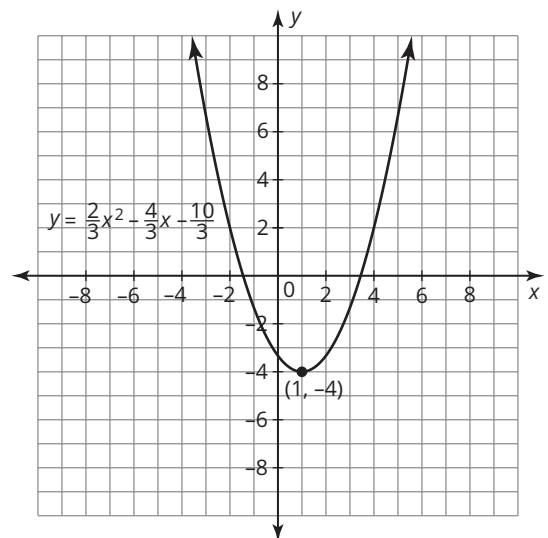


absolute minimum

A function has an absolute minimum if there is a point that has a y-coordinate that is less than the y-coordinates of every other point on the graph.

Example

The ordered pair $(1, -4)$ is the absolute minimum of the graph of the function $y = \frac{2}{3}x^2 - \frac{4}{3}x - \frac{10}{3}$.



argument of a function

The argument of a function is the expression inside the parentheses.

Example

In the function $f(x + 5) = 32$, the argument is $x + 5$.

arithmetic sequence

An arithmetic sequence is a sequence of numbers in which the difference between any two consecutive terms is a constant.

Example

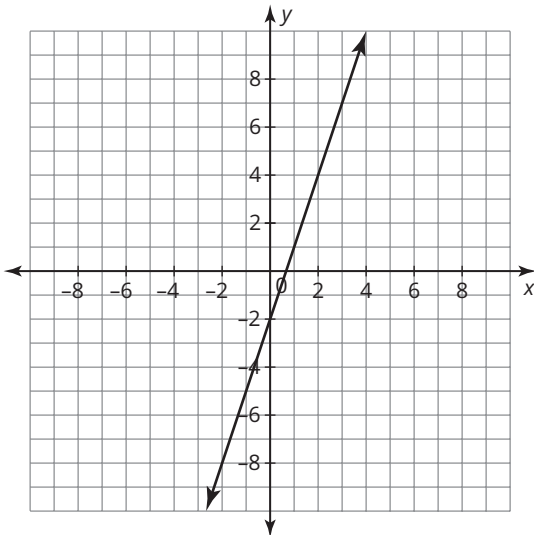
The sequence 1, 3, 5, 7 is an arithmetic sequence with a common difference of 2.

average rate of change

Another name for the slope of a linear function is average rate of change. The formula for the average rate of change is $\frac{f(t) - f(s)}{t - s}$.

Example

The average rate of change of the function shown is 3.

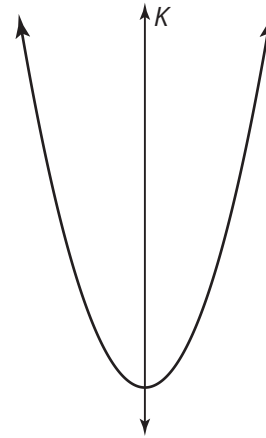


axis of symmetry

The axis of symmetry of a parabola is the vertical line that passes through the vertex and divides the parabola into two mirror images.

Example

Line K is the axis of symmetry of this parabola.



B

base

The base of a power is the expression that is used as a factor in the repeated multiplication.

binomial

Polynomials with exactly two terms are binomials.

Example

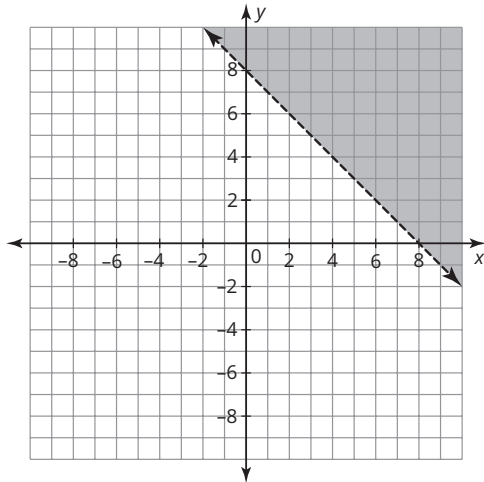
The polynomial $3x + 5$ is a binomial.

boundary line

A boundary line, determined by the inequality in a linear inequality, divides the plane into two half-planes and the inequality symbol indicates which half-plane contains all the solutions.

Example

For the linear inequality $y > -x + 8$, the boundary line is a dashed line because no point on that line is a solution.



C

causation

Causation is when one event affects the outcome of a second event.

centroid

The centroid is a point in which x-value is the mean of all the x-values of the points on the scatterplot and its y-value is the mean of all the y-values of the points on the scatterplot.

Example

For the data points (1, 3), (1, 7), (2, 6), (3, 5), and (3, 4), the centroid is (2, 5).

closed (closure)

When an operation is performed on any of the numbers in a set and the result is a number that is also in the same set, the set is said to be closed (or to have closure) under that operation.

Example

The set of whole numbers is closed under addition. The sum of any two whole numbers is always another whole number.

coefficient of determination

The coefficient of determination measures how well the graph of a regression fits the data. It is calculated by squaring the correlation coefficient and represents the percentage of variation of the observed values of the data points from their predicted values.

Example

The correlation coefficient for a data set is -0.9935 . The coefficient of determination for the same data set is approximately 0.987, which means 98.7% of the data values should fall on the graph.

common difference

The difference between any two consecutive terms in an arithmetic sequence is called the common difference. It is typically represented by the variable d .

Example

The sequence 1, 3, 5, 7 is an arithmetic sequence with a common difference of 2.

common ratio

The ratio between any two consecutive terms in a geometric sequence is called the common ratio. It is typically represented by the variable r .

Example

The sequence 2, 4, 8, 16 is a geometric sequence with a common ratio of 2.

common response

A common response is when a variable other than the ones measured cause the same result as the one observed in the experiment.

completing the square

Completing the square is a process for writing a quadratic expression in vertex form which then allows you to solve for the zeros.

compound interest

In a compound interest account, the balance is multiplied by the same amount at each interval.

Example

Sonya opens a savings account with \$100. She earns \$4 in compound interest the first year. The compound interest y is found by using the equation $y = 100(1 + 0.04)^t$, where t is the time in years.

concave down

A graph that opens downward is identified as being concave down.

concave up

A graph that opens upward is identified as being concave up.

confounding variable

A confounding variable is when there are other variables in an experiment that are unknown or unobserved.

conjecture

A conjecture is a mathematical statement that appears to be true but has not been formally proven.

consistent systems

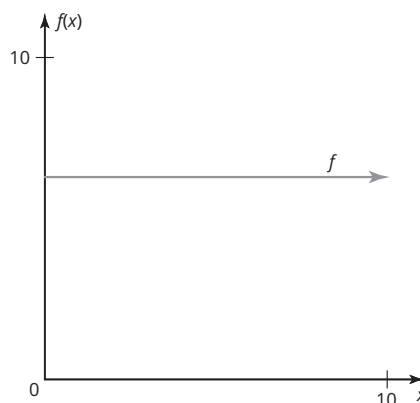
Systems that have one or many solutions are called consistent systems.

constant function

If the dependent variable of a function does not change or remains constant over the entire domain, then the function is called a constant function.

Example

The function shown is a constant function.



constraints

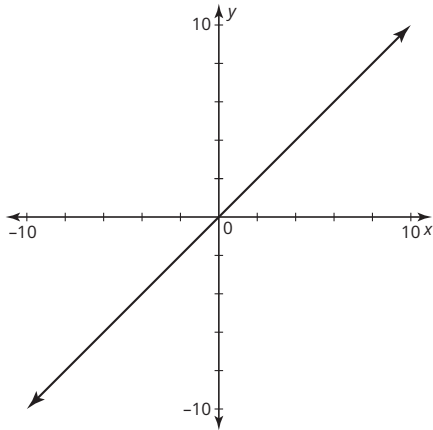
In a system of linear inequalities, the inequalities are known as constraints because the values of the expressions are “constrained” to lie within a certain region on the graph.

continuous graph

A continuous graph is a graph of points that are connected by a line or smooth curve on the graph. Continuous graphs have no breaks.

Example

The graph shown is a continuous graph.



correlation

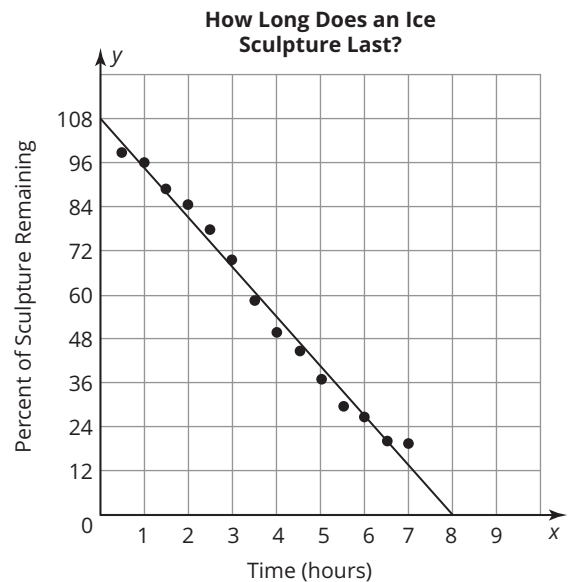
A measure of how well a regression fits a set of data is called a correlation.

correlation coefficient

The correlation coefficient is a value between -1 and 1 , which indicates how close the data are to the graph of the regression function. The closer the correlation coefficient is to -1 or 1 , the stronger the relationship is between the two variables. The variable r is used to represent the correlation coefficient.

Example

The correlation coefficient for these data is -0.9935 . The value is negative because the equation has a negative slope. The value is close to -1 because the data are very close to the graph of the equation of the line.

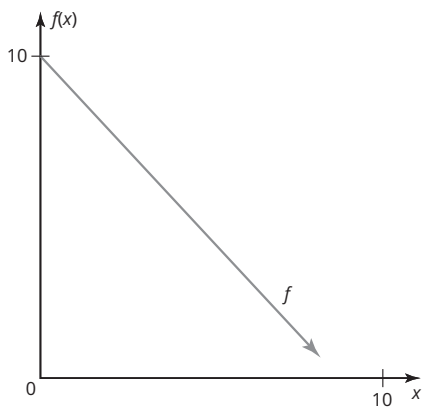


decreasing function

If a function decreases across the entire domain, then the function is called a decreasing function.

Example

The function shown is a decreasing function.



degree

The degree of a polynomial is the greatest variable exponent in the expression.

degree of a polynomial

The greatest exponent for any variable term in a polynomial determines the degree of the polynomial.

Example

The polynomial $2x^3 + 5x^2 - 6x + 1$ has a degree of 3.

dependent quantity

When one quantity is determined by another in a problem situation, it is said to be the dependent quantity.

Example

In the relationship between driving time and distance traveled, distance is the dependent quantity, because distance depends on the driving time.

difference of two squares

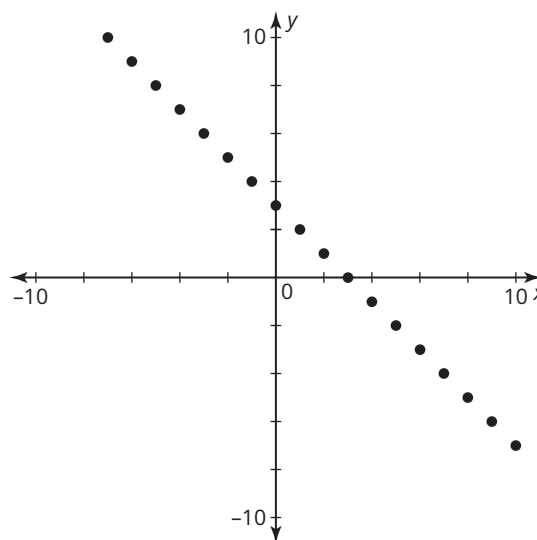
The difference of two squares is an expression in the form $a^2 - b^2$ that can be factored as $(a + b)(a - b)$.

discrete graph

A discrete graph is a graph of isolated points.

Example

The graph shown is a discrete graph.



discriminant

The discriminant is the radicand expression in the quadratic formula which “discriminates” the number of real roots of a quadratic equation.

Example

The discriminant in the quadratic formula is the expression $b^2 - 4ac$.

domain

The domain is the set of input values in a relation.

Example

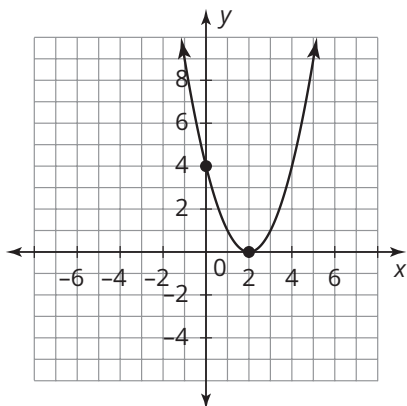
The domain of the function $y = 2x$ is the set of all real numbers.

double root

The root of an equation indicates where the graph of the equation crosses or touches the x-axis. A double root occurs when the graph just touches the x-axis but does not cross it.

Example

The quadratic equation $y = (x - 2)^2$ has a double root at $x = 2$.



E

explicit formula

An explicit formula of a sequence is a formula for calculating the value of each term of a sequence using the term's position in the sequence. The explicit formula for an arithmetic sequence is $a_n = a_1 + d(n - 1)$. The explicit formula for a geometric sequence is $g_n = g_1 \cdot r^{n-1}$.

Example

The sequence 1, 3, 5, 7, 9, ... can be described by the rule $a_n = 2n - 1$ where n is the position of the term. The fourth term of the sequence a_4 is $2(4) - 1$, or 7.

exponent

The exponent of a power is the number of times that the base is used as a factor in the repeated multiplication.

exponential decay function

An exponential decay function is an exponential function with a b -value greater than 0 and less than 1 and is of the form $y = a(1 - r)^x$, where r is the rate of decay.

Example

Greenville has a population of 7000. Its population is decreasing at a rate of 1.75%. The exponential decay function that models this situation is $f(x) = 7000 \cdot 0.9825^x$.

exponential functions

The family of exponential functions includes functions of the form $f(x) = ab^x$, where a and b are real numbers, and b is greater than 0 but is not equal to 1.

Example

The function $f(x) = 2^x$ is an exponential function.

exponential growth function

An exponential growth function is an exponential function with a b -value greater than 1 and is of the form $y = a(1 + r)^x$, where r is the rate of growth.

Example

Blueville has a population of 7000. Its population is increasing at a rate of 1.4%. The exponential growth function that models this situation is $f(x) = 7000 \cdot 1.014^x$.

extract the square root

To extract a square root, solve an equation of the form $a^2 = b$ for a .

extrapolation

To make predictions for values of x that are outside of the data set is called extrapolation.

factor theorem

The factor theorem states that a polynomial function $p(x)$ has $x - r$ as a factor if and only if the value of the function at r is 0, or $p(r) = 0$.

factored form

A quadratic function written in factored form is in the form $f(x) = a(x - r_1)(x - r_2)$, where $a \neq 0$.

Example

The function $h(x) = x^2 - 8x + 12$ written in factored form is $(x - 6)(x - 2)$.

finite sequence

If a sequence terminates, it is called a finite sequence.

Example

The sequence 22, 26, 30 is a finite sequence.

first differences

First differences are the values determined by subtracting consecutive output values in a table when the input values have an interval of 1.

Example

	Time (minutes)	Height (feet)	First Differences
$1 - 0 = 1 <$	0	0	$1800 - 0 = 1800$
$2 - 1 = 1 <$	1	1800	$3600 - 1800 = 1800$
$3 - 2 = 1 <$	2	3600	$5400 - 3600 = 1800$
	3	5400	

function

A function is a relation that assigns to each element of the domain exactly one element of the range.

Example

The equation $y = 2x$ is a function. Every value of x has exactly one corresponding y -value.

function notation

Function notation is a way of representing functions algebraically.

Example

In the function $f(x) = 0.75x$, f is the name of the function, x represents the domain, and $f(x)$ represents the range.

function family

A function family is a group of functions that share certain characteristics.

Example

Linear functions and exponential functions are examples of function families.

geometric sequence

A geometric sequence is a sequence of numbers in which the ratio between any two consecutive terms is a constant.

Example

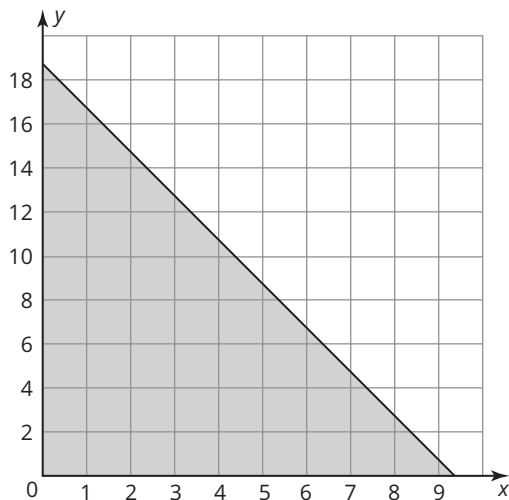
The sequence 2, 4, 8, 16 is a geometric sequence with a common ratio of 2.

half-plane

The graph of a linear inequality is a half-plane, or half of a coordinate plane.

Example

The shaded portion of the graph is a half-plane.

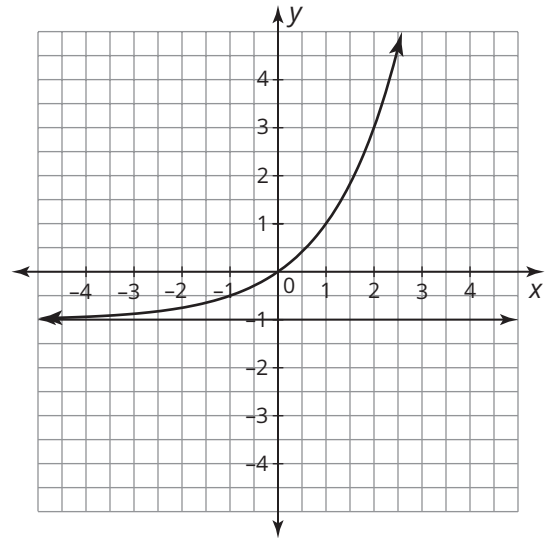


horizontal asymptote

A horizontal asymptote is a horizontal line that a function gets closer and closer to, but never intersects.

Example

The graph shows a horizontal asymptote at $y = -1$.



inconsistent systems

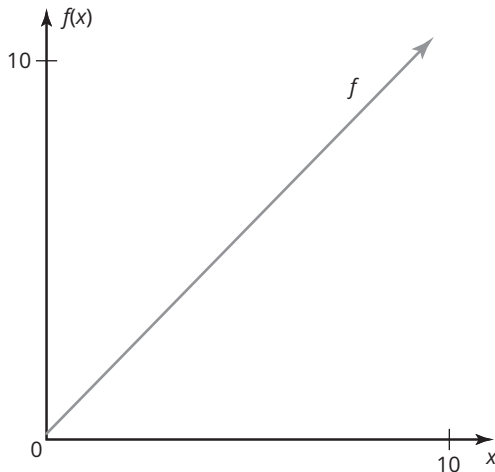
Systems with no solution are called inconsistent systems.

increasing function

If a function increases across the entire domain, then the function is called an increasing function.

Example

The function shown is an increasing function.



independent quantity

The quantity that the dependent quantity depends upon is called the independent quantity.

Example

In the relationship between driving time and distance traveled, driving time is the independent quantity, because it does not depend on any other quantity.

infinite sequence

If a sequence continues on forever, it is called an infinite sequence.

Example

The sequence 22, 26, 30, 34 . . . is an infinite sequence.

infinite solutions

An equation with infinite solutions means that any value for the variable makes the equation true.

Example

The equation $2x + 1 = 2x + 1$ has infinite solutions.

interpolation

Using a linear regression to make predictions within the data set is called interpolation.

leading coefficient

The leading coefficient of a polynomial is the numeric coefficient of the term with the greatest power.

Example

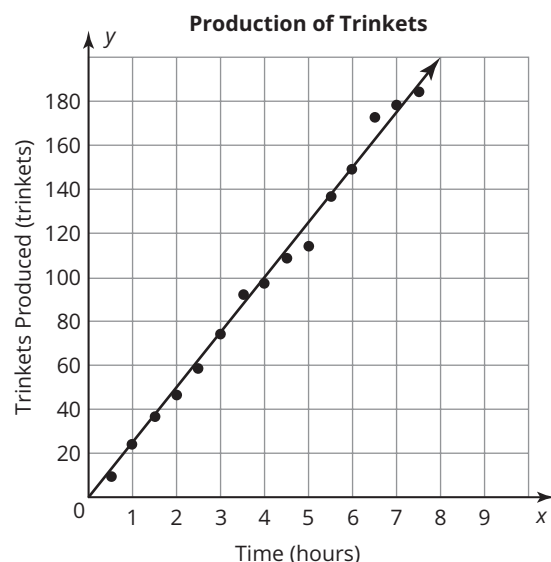
In the polynomial $-7x^2 + x + 25$, the value -7 is the leading coefficient.

Least Squares Method

The Least Squares Method is a method that creates a regression line for a scatterplot that has two basic requirements: 1) the line must contain the centroid of the data set, and 2) the sum of the squares of the vertical distances from each given data point is at a minimum with the line.

Example

The regression line shown was created using the Least Squares Method.



linear combinations method

The linear combinations method is a process used to solve a system of equations by adding two equations together, resulting in an equation with one variable.

Example

Solve the following system of equations by using the linear combinations method:

$$\begin{aligned}6x - 5y &= 3 \\ 2x + 2y &= 12\end{aligned}$$

First, multiply the second equation by -3 . Then, add the equations and solve for the remaining variable. Finally, substitute $y = 3$ into the first equation and solve for x . The solution of the system is $(3, 3)$.

linear functions

The family of linear functions includes functions of the form $f(x) = ax + b$, where a and b are real numbers.

Example

The function $f(x) = 3x + 2$ is a linear function.

linear inequality

A linear inequality is a non-equal comparison of two linear expressions

Example

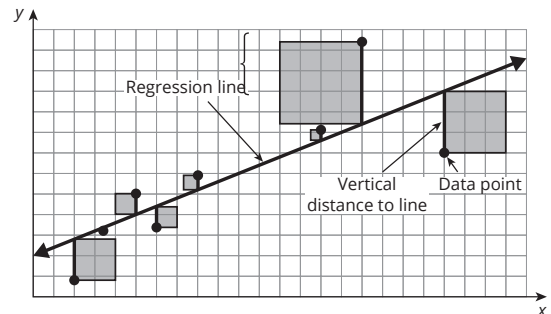
Diego has \$25 in his gift fund that he is going to use to buy graduation gifts. Graduation is 9 weeks away. He would like to have at least \$70 to buy gifts, how much should he save each week?

linear regression function

A linear regression function has the smallest possible vertical distances from each given data point to the regression line.

Example

The sum of the squares of those distances are at the minimum with the line.

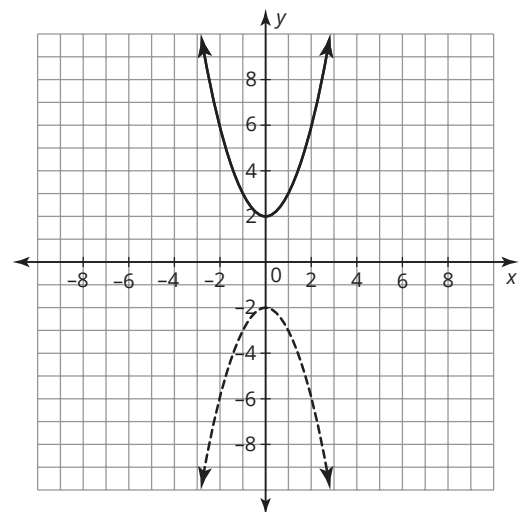


line of reflection

A line of reflection is the line that the graph is reflected across.

Example

The graph of $y = x^2 + 2$ was reflected across the line of reflection, $y = 0$.



literal equation

Literal equations are equations in which the variables represent specific measures.

Example

The equations $I = Prt$ and $A = lw$ are literal equations.

M

mathematical modeling

Mathematical modeling is explaining patterns in the real world based on mathematical ideas.

monomial

Polynomials with only one term are monomials.

Example

The expressions $5x$, 7 , $-2xy$, and $13x^3$ are monomials.

N

necessary condition

A correlation is a necessary condition for causation, meaning that for one variable to cause another, they must be correlated.

no solution

An equation with no solution means that there is no value for the variable that makes the equation true.

Example

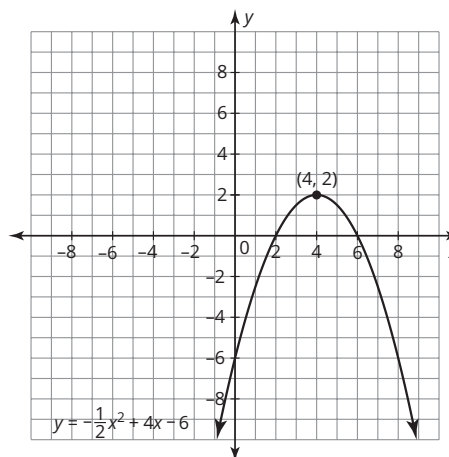
The equation $2x + 1 = 2x + 3$ has no solution.

P

parabola

The shape that a quadratic function forms when graphed is called a parabola. A parabola is a smooth curve with reflectional symmetry.

Example



parent function

A parent function is the simplest function of its type.

Examples

The parent linear function is $f(x) = x$.

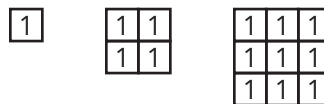
The parent exponential function is $g(x) = 2^x$.

The parent quadratic function is $h(x) = x^2$.

perfect square

A perfect square is the product of a whole number multiplied by itself.

Example



perfect square trinomial

A perfect square trinomial is an expression in the form $a^2 + 2ab + b^2$ or in the form $a^2 - 2ab + b^2$.

point-slope form

The point-slope form of a linear equation is $y - y_1 = m(x - x_1)$, where m is the slope of the line and (x_1, y_1) is a point on the line.

polynomial

A polynomial is a mathematical expression involving the sum of powers in one or more variables multiplied by coefficients.

Example

The expression $3x^3 + 5x - 6x + 1$ is a polynomial.

polynomial long division

Polynomial long division is an algorithm for dividing one polynomial by another of equal or lesser degree. The process is similar to integer long division.

Example

Polynomial Long Division	
$(2x^2 + 5x - 12) \div (x + 4)$	
or $\begin{array}{r} 2x^2 + 5x - 12 \\ x + 4 \end{array}$	
$\begin{array}{r} \textcircled{A} 2x \quad \textcircled{D} 3 \\ x + 4 \overline{) 2x^2 + 5x - 12} \\ \textcircled{B} (2x^2 + 8x) \downarrow \textcircled{C} \\ \underline{-3x - 12} \\ -(-3x - 12) \\ \hline \text{Remainder } 0 \end{array}$	A. Divide $\frac{2x^2}{x} = 2x$. B. Multiply $2x(x + 4)$, and then subtract. C. Bring down -12. D. Divide $\frac{-3x}{x} = -3$. E. Multiply $-3(x + 4)$, and then subtract.

power

A power has a *base* and an *exponent*.

principal square root

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

product property of radicals

The product property of radicals states that $\sqrt[n]{a} \cdot \sqrt[n]{b} = \sqrt[n]{ab}$, when a and b are greater than 0.

Q

quadratic formula

The quadratic formula is $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

and can be used to calculate the solutions to any quadratic equation of the form $ax^2 + bx + c$, where a , b , and c represent real numbers and $a \neq 0$.

quadratic functions

The family of quadratic functions includes functions of the form $f(x) = ax^2 + bx + c$, where a , b , and c are real numbers, and a is not equal to 0.

Examples

The equations $y = x^2 + 2x + 5$ and $y = -4x^2 - 7x + 1$ are quadratic functions.

quotient property of radicals

The quotient property of radicals states that $\sqrt[n]{\frac{a}{b}} = \frac{\sqrt[n]{a}}{\sqrt[n]{b}}$, where $a \geq 0$ and $b > 0$.

R

radical

The symbol $\sqrt{}$ is a radical.

radicand

The quantity under the radical symbol is the radicand.

range

The range is the set of output values in a relation.

Example

The range of the function $y = x^2$ is the set of all numbers greater than or equal to zero.

recursive formula

A recursive formula expresses each new term of a sequence based on the preceding term in the sequence. The recursive formula for an arithmetic sequence is $a_n = a_{n-1} + d$. The recursive formula for a geometric sequence is $g_n = g_{n-1} \cdot r$.

Example

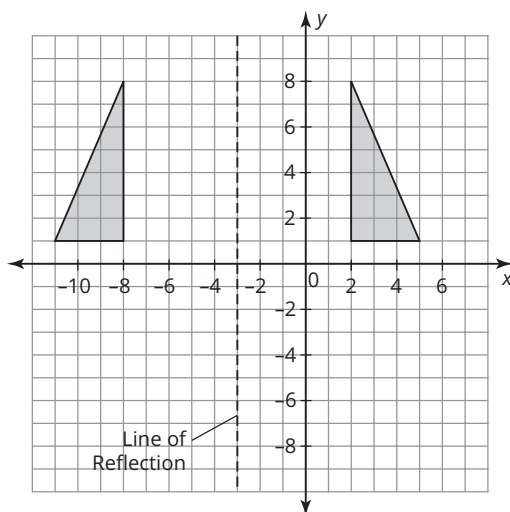
The formula $a_n = a_{n-1} + 2$ is a recursive formula. Each successive term is calculated by adding 2 to the previous term. If $a_1 = 1$, then $a_2 = 1 + 2 = 3$.

reflection

A reflection of a graph is a mirror image of the graph about a line of reflection.

Example

The triangle on the right is a reflection of the triangle on the left.



regression function

On a scatterplot, a regression function is a mathematical model that can be used to predict the values of a dependent variable based upon the values of an independent variable.

relation

A relation is the mapping between a set of input values called the domain and a set of output values called the range.

Example

The set of points $\{(0, 1), (1, 8), (2, 5), (3, 7)\}$ is a relation.

remainder theorem

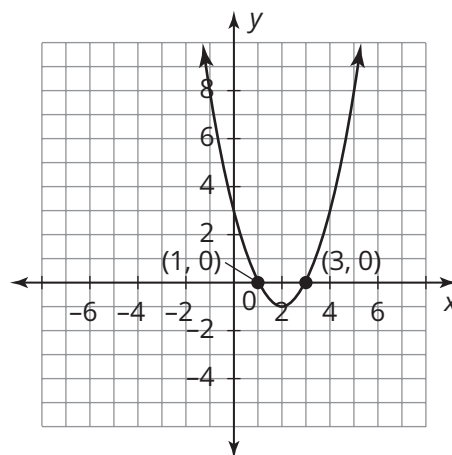
The remainder theorem states that when any polynomial function, $f(x)$, is divided by a linear expression of the form $(x - r)$, the remainder $R = f(r)$, or the value of the function when $x = r$.

root (roots)

The root or roots of an equation indicate where the graph of the equation touches the x-axis.

Example

The roots of the quadratic equation $x^2 - 4x + 3 = 0$ are $x = 3$ and $x = 1$.



S

second differences

Second differences are the differences between consecutive values of the first differences.

Example

x	y	First Differences	Second Differences
-3	-5		
-2	0	5	
-1	3	3	-2
0	4	1	-2
1	3	-1	-2
2	0	-3	-2
3	-5	-5	-2

sequence

A sequence is a pattern involving an ordered arrangement of numbers, geometric figures, letters, or other objects.

Example

The numbers 1, 1, 2, 3, 5, 8, 13 form a sequence.

simple interest

In a simple interest account, the interest earned at the end of each interval is a percent of the starting balance (also known as the principal).

Example

Tonya deposits \$200 in a 3-year certificate of deposit that earns 4% simple interest. The amount of interest that Tonya earns can be found using the simple interest formula.

$$I = (200)(0.04)(3)$$
$$I = 24$$

Tonya earns \$24 in interest.

solution

The solution to an equation is any value for the variable that makes the equation a true statement.

Example

The solution of the equation $3x + 4 = 25$ is 7 because 7 makes the equation true: $3(7) + 4 = 25$, or $25 = 25$.

solution set of a system of linear inequalities

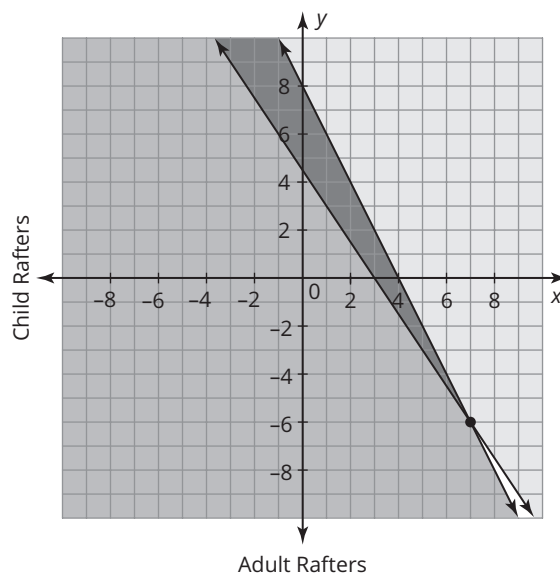
The solution set of a system of linear inequalities is the intersection of the solutions to each inequality. Every point in the intersection region satisfies all inequalities in the system.

Example

The solution set of this system of linear inequalities ...

$$\begin{cases} 200a + 100c \leq 800 \\ 75(a - 1) + 50c \geq 150 \end{cases}$$

... is shown by the shaded region, which represents the intersection of the solutions to each inequality.



solve an inequality

To solve an inequality means to determine the values of the variable that make the inequality true.

Example

The inequality $x + 5 > 6$ can be solved by subtracting 5 from each side of the inequality. The solution is $x > 1$. Any number greater than 1 will make the inequality $x + 5 > 6$ true.

square root

A square root is one of two equal factors of a given number.

standard form of a linear equation

The standard form of a linear equation is $Ax + By = C$, where A , B , and C are integers and A and B are not both zero.

standard form of a quadratic function

A quadratic function written in the form $f(x) = ax^2 + bx + c$, where $a \neq 0$, is in standard form.

Example

The function $f(x) = -5x^2 - 10x + 1$ is written in standard form.

sufficient condition

A correlation is not a sufficient condition for causation, meaning that a correlation between two variables is not enough to establish that one variable causes another.

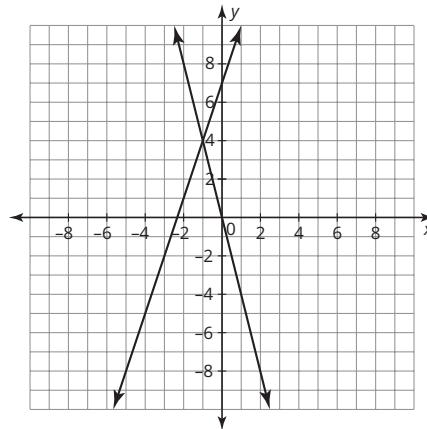
system of linear equations

When two or more linear equations define a relationship between quantities, they form a system of linear equations.

Example

The equations $y = 3x + 7$ and $y = -4x$ are a system of linear equations.

$$\begin{cases} y = 3x + 7 \\ y = -4x \end{cases}$$



T

term of a sequence

A term of a sequence is an individual number, figure, or letter in the sequence.

Example

In the sequence 2, 4, 6, 8, 10, the first term is 2, the second term is 4, and the third term is 6.

trinomial

Polynomials with exactly three terms are trinomials.

Example

The polynomial $5x^2 - 6x + 9$ is a trinomial.

V

vertex form

A quadratic function written in vertex form is in the form $f(x) = a(x - h)^2 + k$, where $a \neq 0$.

Example

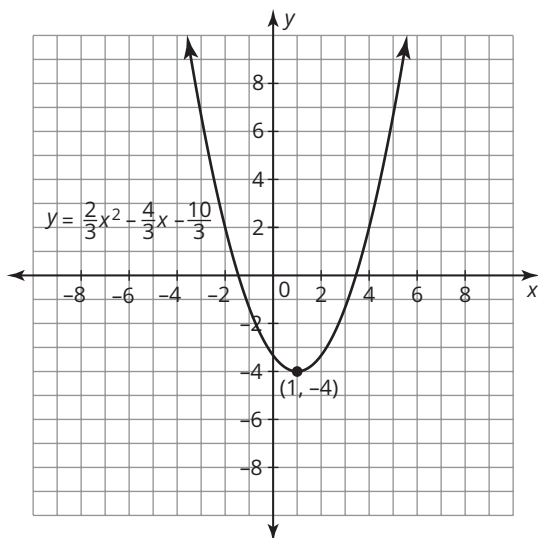
The quadratic equation $y = 2(x - 5)^2 + 10$ is written in vertex form. The vertex of the graph is the point (5, 10).

vertex of a parabola

The vertex of a parabola is the lowest or highest point on the graph of the quadratic function.

Example

The vertex of the graph of $y = \frac{2}{3}x^2 - \frac{4}{3}x - \frac{10}{3}$ is the point $(1, -4)$, the absolute minimum of the parabola.

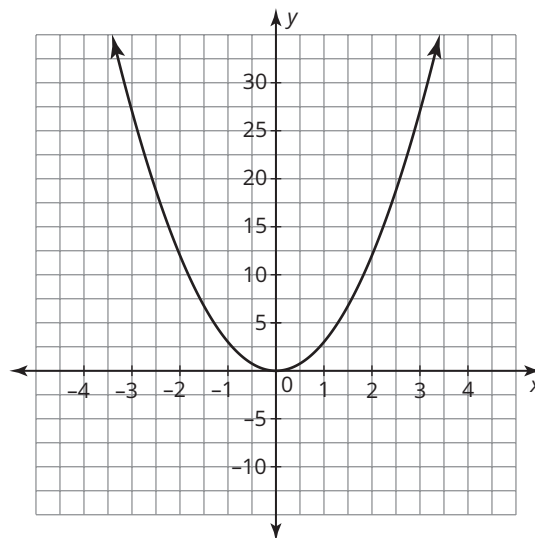


Vertical Line Test

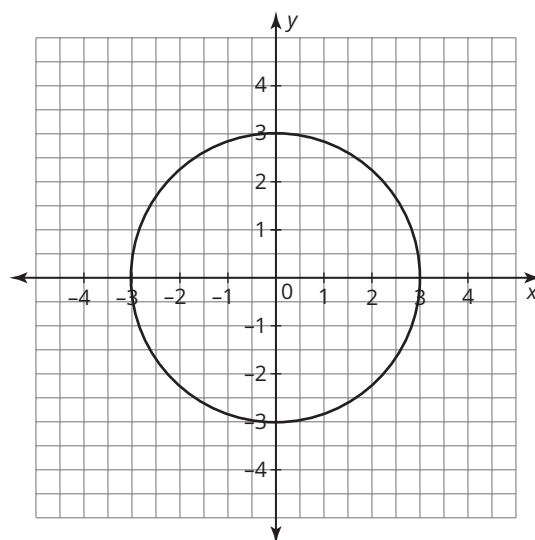
The Vertical Line Test is a visual method used to determine whether a relation represented as a graph is a function.

Example

The equation $y = 3x^2$ is a function. The graph passes the Vertical Line Test because there are no vertical lines that can be drawn that would intersect the graph at more than one point.



The equation $x^2 + y^2 = 9$ is not a function. The graph fails the Vertical Line Test because a vertical line can be drawn that intersects the graph at more than one point.



vertical motion model

A vertical motion model is a quadratic equation that models the height of an object at a given time. The equation is of the form $g(t) = -16t^2 + v_0t + h_0$, where $g(t)$ represents the height of the object in feet, t represents the time in seconds that the object has been moving, v_0 represents the initial velocity (speed) of the object in feet per second, and h_0 represents the initial height of the object in feet.

Example

A rock is thrown in the air at a velocity of 10 feet per second from a cliff that is 100 feet high. The height of the rock is modeled by the equation $y = -16t^2 + 10t + 100$.

X

x-intercept

The point where a graph crosses the x-axis is the x-intercept.

Y

y-intercept

The point where a graph crosses the y-axis is the y-intercept.

Z

zero of a function

A zero of a function is a real number that makes the value of the function equal to zero, or $f(x) = 0$.

Example

The zero of the linear function $f(x) = 2(x - 4)$ is $(4, 0)$.

The zeros of the quadratic function $f(x) = -2x^2 + 4x$ are $(0, 0)$ and $(2, 0)$.

zero product property

The zero product property states that if the product of two or more factors is equal to zero, then at least one factor must be equal to zero.

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