Glossary

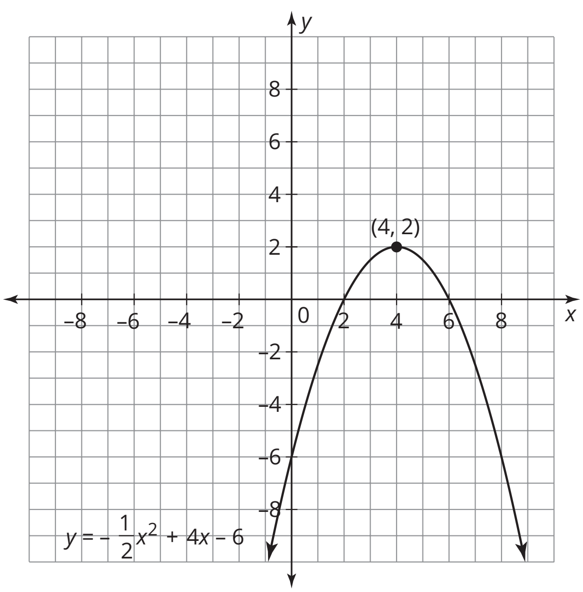
A

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 $f(x) = -\frac{1}{2}x^2 + 4x - 6$.

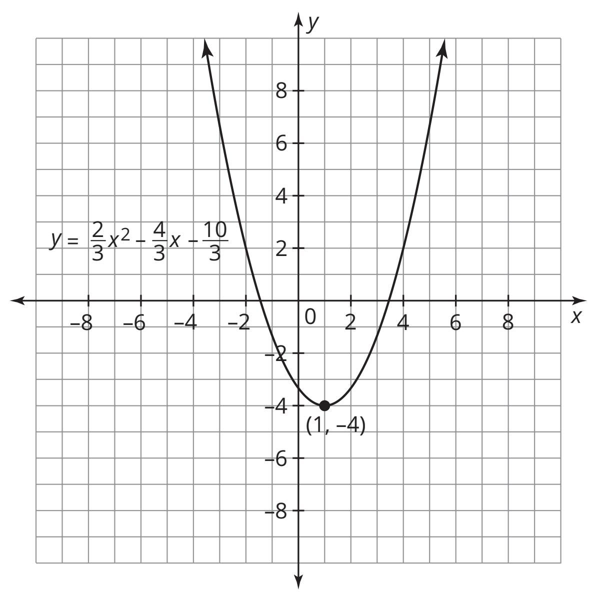


absolute minimum

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 $y = \frac{2}{3}x^2 - \frac{4}{3}x - \frac{10}{3}$.



absolute value

The absolute value of a number is its distance from zero on the number line.

argument of a function

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

Example

For $y = f(x - c)$ the expression $(x - c)$ is the argument of the function.

average rate of change

The average rate of change of a function is the ratio of the independent variable to the dependent variable over a specific interval. The formula for average rate of change is $\frac{f(b) - f(a)}{b - a}$. for an interval (a, b). The expression $a - b$ represents the change in the input of the function f. The expression $f(b) - f(a)$ represents the change in the function f as the input changes from a to b.

Example

Consider the function $f(x) = x^2$.

The average rate of change of the interval (1, 3) is $\frac{3^2 - 1^2}{3 - 1} = \frac{9 - 1}{3 - 1} = \frac{8}{2} = 4$.

B

biased sample

A biased sample is a sample that does not accurately represent all of a population.

Example

A survey is conducted asking students their favorite class. Only students in the math club are surveyed. The sample of students is a biased sample.

Binomial Theorem

The Binomial Theorem states that it is possible to extend any power of $(a + b)$ into a sum of the form shown.

$$(a + b)^n = \binom{n}{0} a^n b^0 + \binom{n}{1} a^{n-1} b^1 + \binom{n}{2} a^{n-2} b^2 + \ldots + \binom{n}{n-1} a^1 b^{n-1} + \binom{n}{n} a^0 b^n$$

Example

Use the Binomial Theorem to find the third term of $(x + y)^{20}$.

$$(x + y)^{20} = \binom{20}{2} x^{20-2} y^2 = \frac{20!}{18!2!} x^{18} y^2$$

$$= \frac{20 \cdot 19}{2 \cdot 1} x^{18} y^2 = 190\, x^{18} y^2$$

C

Change of Base Formula

The Change of Base Formula allows you to calculate an exact value for a logarithm by rewriting it in terms of a different base. It is especially helpful when using a calculator.

The Change of Base Formula states:

$\log_b (c) = \frac{\log_a (c)}{\log_a (b)}$, where $a, b, c > 0$ and $a, b \neq 1$.

Example

$$\log_4 (50) = \frac{\log 50}{\log 4}$$

$$\approx 2.821928095$$

closed under an operation

A set is closed under an operation if the operation is performed on any of the numbers in the set and the result is a number that is also in the same set.

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 (R^2) measures the "strength" of the relationship between the original data and its regression equation. The value of the coefficient of determination ranges from 0 to 1 with a value of 1 indicating a perfect fit between the regression equation and the original data.

coefficient matrix

A coefficent matrix is a square matrix that consists of each coefficient of each equation in the system of equations, in order, when they are written in standard form.

Example

For the system

$$\begin{cases} 2x - y - 2z = 3 \\ 3x + y - 2z = 11 \\ -2x - y + z = -8 \end{cases}$$

The coefficient matrix is

$$\begin{bmatrix} 2 & -1 & -2 \\ 3 & 1 & -2 \\ -2 & -1 & 1 \end{bmatrix}$$

constant matrix

A constant matrix is a matrix in one column that represents each of the constants in the system of equations.

Example

For the system

$$\begin{cases} 2x - y - 2z = 3 \\ 3x + y - 2z = 11 \\ -2x - y + z = -8 \end{cases}$$

The constant matrix is

$$\begin{bmatrix} 3 \\ 11 \\ -8 \end{bmatrix}$$

common logarithm

A common logarithm is a logarithm with a base of 10. Common logarithms are usually written without a base.

Example

$\log(10x)$ or $\log x$ are examples of a common logarithm.

complex numbers

The set of complex numbers is the set of all numbers written in the form $a + bi$, where a and b are real numbers. The set of complex numbers consists of the set of imaginary numbers and the set of real numbers.

Example

The numbers $1 + 2i$, 7, and $-3i$ are complex numbers.

composition of functions

Composition of functions is the process of substituting one function for the variable in another function.

Example

If $f(x) = 3x - 5$ and $g(x) = x^2$, then the composition of the functions $f(g(x))$ can be written as $f(g(x)) = 3(x^2) - 5 = 3x^2 - 5$.

The composition of functions $g(f(x))$ can be written as $g(f(x)) = (3x + 5)^2$.

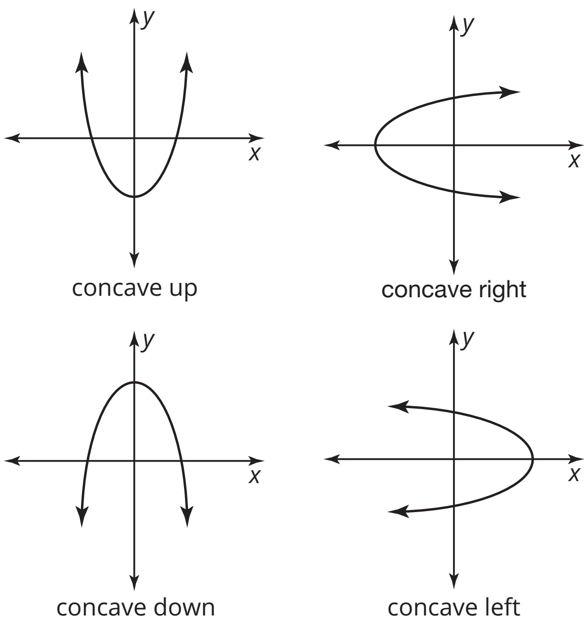
concavity

The concavity of a parabola describes the orientation of the curvature of the parabola.

concavity of a parabola

The concavity of a parabola describes the orientation of the curvature of the parabola.

Example



constant matrix

a constant matrix is a matrix in one column that represents each of the constants in the system of equations.

cube root function

The cube root function is the inverse of the power function $f(x) = x^3$.

Example

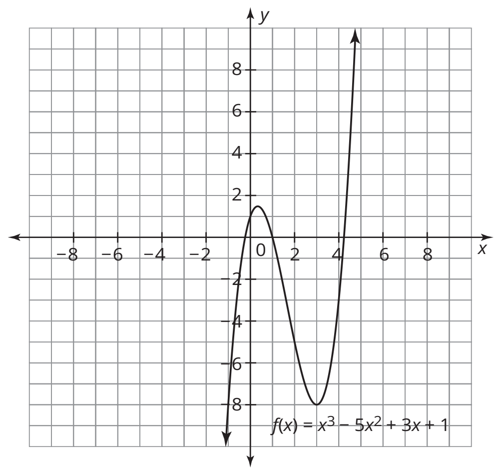
The cube root function is $g(x) = \sqrt[3]{x}$.

cubic function

A cubic function is a function that can be written in the standard form $f(x) = ax^3 + bx^2 + cx + d$ where $a \neq 0$.

Example

The function $f(x) = x^3 - 5x^2 + 3x + 1$ is a cubic function.



D

dimensions

The dimensions of a matrix are its number of rows and its number of columns.

Example

$$A = \begin{bmatrix} 1 & 0 & -5 & 3 \\ -2 & 1 & 4 & 7 \end{bmatrix}$$

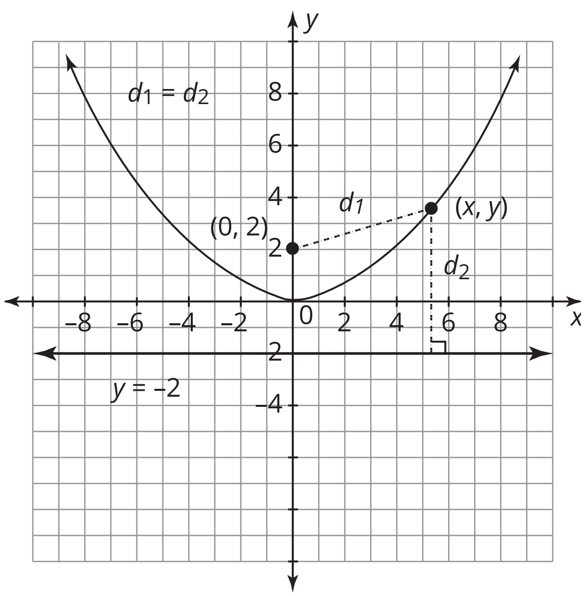
Matrix A is a 2 x 4 matrix because it has 2 rows and 4 columns.

directrix

The directrix of a parabola is a line such that all points on the parabola are equidistant from the focus and the directix.

Example

The focus of the parabola shown is the point (0, 2). The directix of the parabola shown is the line y= –2. All points on the parabola are equidistant from the focus and the directix.



E

equivalent compound inequality

Absolute value inequalities can take four different forms. To solve a linear absolute value inequality, you can first write it as an equivalent compound inequality.

Example

Absolute Value Inequality	Equivalent Compound Inequality
$\lvert ax + b\rvert < c$	$-c < ax + b < c$
$\lvert ax + b\rvert \leq c$	$-c \leq ax + b \leq c$
$\lvert ax + b\rvert > c$	$ax + b < -c$ or $ax + b > c$
$\lvert ax + b\rvert \geq c$	$ax + b \leq -c$ or $ax + b \geq c$

Euclid's Formula

Euclid's Formula is a formula used to generate Pythagorean triples given any two positive integers. Given positive integers r and s, where $r > s$, Euclid's Formula is $(r^2 + s^2)^2 = (r^2 - s^2)^2 + (2rs)^2$.

Example

Let $r = 3$ and $s = 1$.

$$(3^2 + 1^2)^2 = (3^2 - 1^2)^2 + (2 \cdot 3 \cdot 1)^2$$

$$10^2 = 8^2 + 6^2$$

So, one Pythagorean triple is 6, 8, 10.

even function

An even function f is a function for which $f(-x) = f(x)$ for all values of x in the domain.

Example

The function $f(x) = x^2$ is an even function because $(-x)^2 = x^2$.

extraneous solution

Extraneous solutions are solutions that result from the process of solving an equation; but are not valid solutions to the equation.

Example

$$\log_2(x) + \log_2(x + 7) = 3$$

$$\log_2(x^2 + 7x) = 3$$

$$x^2 + 7x = 2^3$$

$$x^2 + 7x = 8$$

$$x^2 + 7x - 8 = 0$$

$$(x + 8)(x - 1) = 0$$

$$x + 8 = 0 \quad \text{or} \quad x - 1 = 0$$

$$x = -8 \qquad\qquad x = 1$$

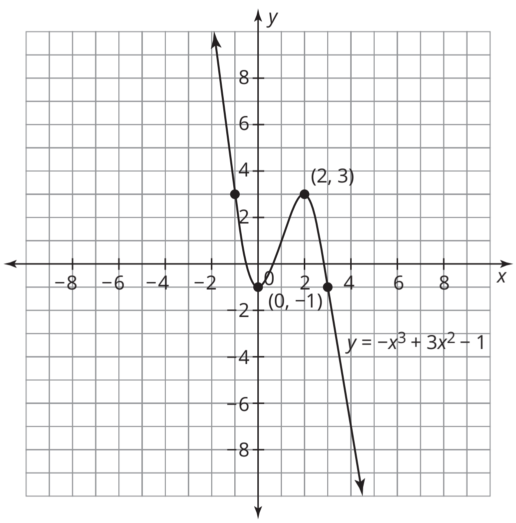
The solution $x = -8$ is an extraneous solution because the argument of a logarithm must be greater than zero.

extrema

Extrema are the set of all relative maximums, relative minimums, absolute maximums, and absolute minimums for a graph.

Example

The graph shown has 2 extrema, a relative maximum at (2, 3) and a relative minimum at (0, −1).



F

Factor Theorem

The Factor Theorem states that a polynomial is divisible by $(x - r)$ if the value of the polynomial at r is zero.

Example

The polynomial $x^3 - 2x^2 + 2x - 1$ is divisible by $x - 1$ because $(1)^3 - 2(1)^2 + 2(1) - 1 = 0$.

factored form of a quadratic function

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

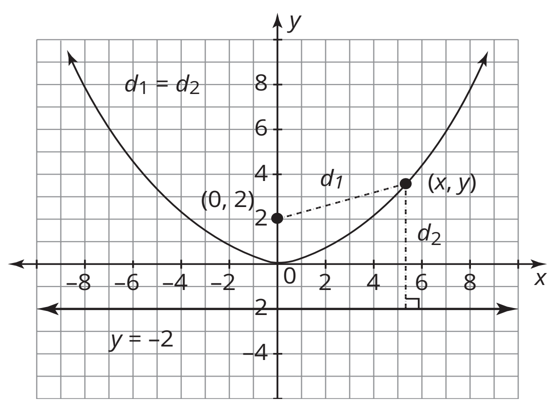
The function $h(x) = x^2 - 8x + 12$ written in factored form is $h(x) = (x - 6)(x - 2)$.

focus

The focus of a parabola is a point such that all points on the parabola are equidistant from the focus and the directrix.

Example

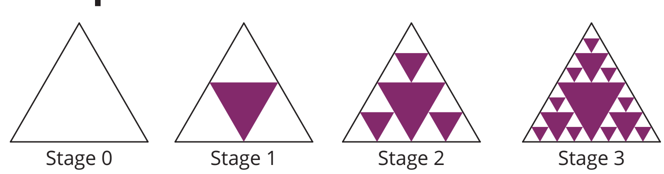
The focus of the parabola shown is the point (0, 2). The directix of the parabola shown is the line y = –2. All points on the parabola are equidistant from the focus and directix.



fractal

A fractal is a complex geometric shape that is constructed by a mathematical pattern. Fractals are infinite and self-similar.

Example



function

A function is a relation such that for each element of the domain there exists exactly one element in the range.

Example

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

function notation

Function notation is a way of representing functions algebraically. The function $f(x)$ is read as "f of x" and indicates that x is the input and $f(x)$ is the output.

Example

The function $f(x) = 0.75x$ is written using function notation.

Fundamental Theorem of Algebra

The Fundamental Theorem of Algebra states that any polynomial equation of degree n must have exactly n complex roots or solutions; also, every polynomial function of degree n must have exactly n complex zeros. However, any root or zero may be a multiple root or zero.

Example

The polynomial equation $x^5 + x^2 - 6 = 0$ has 5 complex roots because the polynomial $x^5 + x^2 - 6$ has a degree of 5.

G

Gaussian elimination

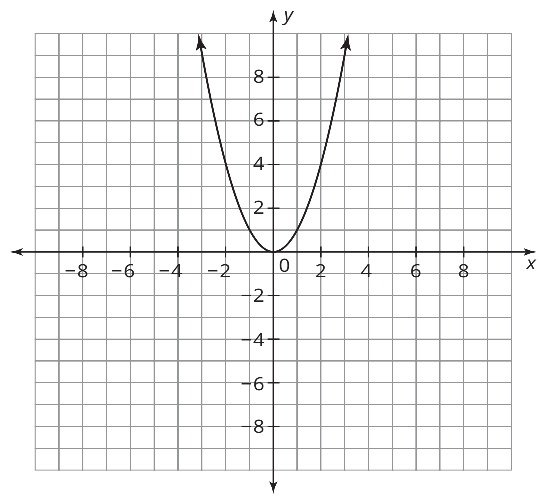
Gaussian elimination is a method for solving linear systems of equations, named after the mathematician Carl Friedrich Gauss. It involves using linear combinations of the equations in the system to isolate one variable per equation.

general form of a parabola

The general form of a parabola centered at the origin is an equation of the form
$Ax^2 + Dy = 0$ or $By^2 + Cx = 0$

Example

The equation for the parabola shown can be written in general form as $x^2 - 2y = 0$.



geometric series

A geometric series is the sum of the terms of a geometric sequence.

Example

The geometric series corresponding to the geometric sequence 2, 4, 8, 16 is 2 + 4 + 8 + 16, or 30.

H

half-life

A half-life is the amount of time it takes a substance to decay to half of its original amount.

Example

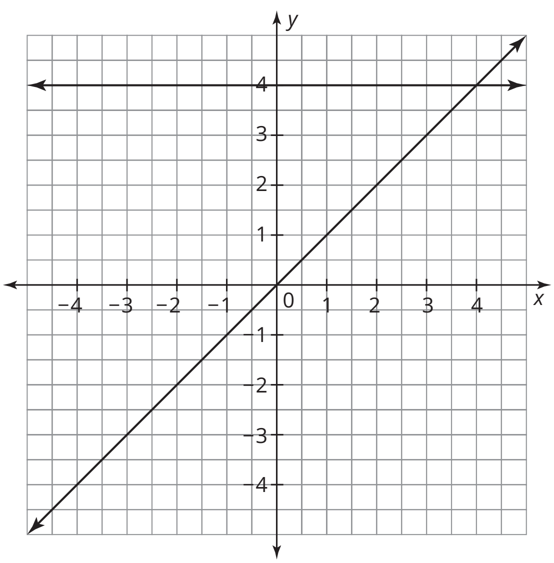
The radioactive isotope strontium-90 has a half-life of about 30 years. A 1000-gram sample of strontium-90 will decay to 500 grams in 30 years.

Horizontal Line Test

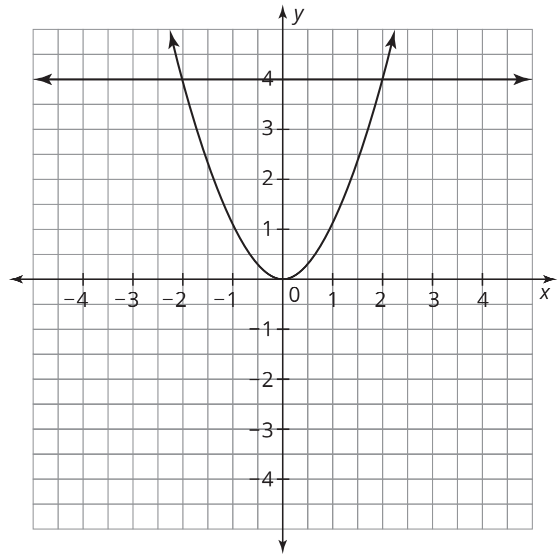
The Horizontal Line Test is a test to determine if a function is one to one. To use the test, imagine drawing every possible horizontal line on the coordinate plane. If no horizontal line intersects the graph of a function at more than one point, then the function is one to one.

Example

The function $y = x$ passes the Horizontal Line Test because no horizontal line can be drawn that intersects the graph at more than one point. So, the function is one to one.



The function $y = x^2$ does not pass the Horizontal Line Test because a horizontal line can be drawn that intersects the graph at more than one point. So, the function is not one to one.



I

identity matrix

The identity matrix, I, is a square matrix whose elements are 0s and 1s. The 1s are arranged diagonally from upper left to lower right as shown.

Example

$I_1 = [1]$

$$I_2 = \begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}$$

$$I_3 = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

imaginary numbers

The set of imaginary numbers is the set of all numbers written in the form $a + bi$, where a and b are real numbers and b is not equal to 0.

Example

The numbers $2 - 3i$ and $5i$ are imaginary numbers. The number 6 is not an imaginary number.

imaginary part of a complex number

In a complex number of the form $a + bi$, the term bi is called the imaginary part of a complex number.

Example

The imaginary part of the complex number $3 + 2i$ is $2i$.

imaginary roots (imaginary zeros)

Equations and functions that have imaginary solutions requiring i have imaginary roots or imaginary zeros.

Example

The quadratic equation $x^2 - 2x + 2 = 0$ has two imaginary roots: $1 + i$ and $1 - i$.

inverse of a function

The inverse of a one-to-one function is a function that results from exchanging the independent and dependent variables. A function $f(x)$ with coordinates $(x, f(x))$ will have an inverse with coordinates $(f(x), x)$.

Example

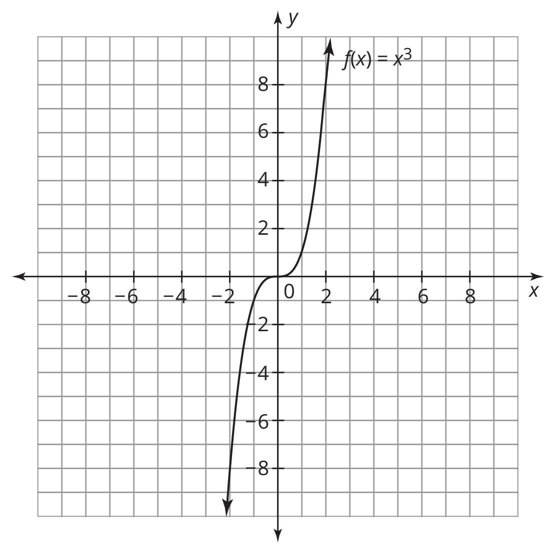
The inverse of the function $y = 2x$ can be found by exchanging the variables x and y.

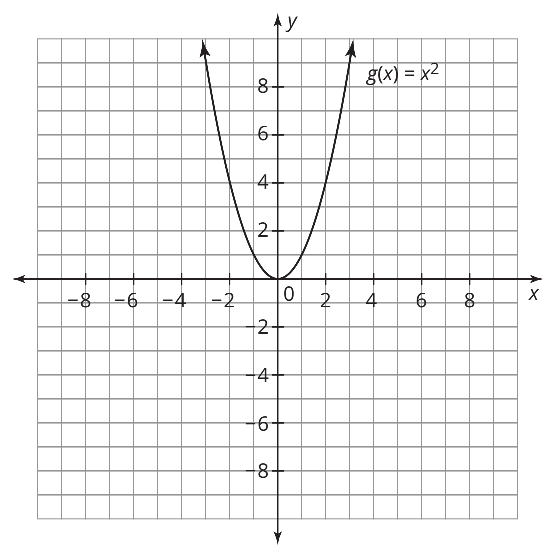
The inverse of $y = 2x$ is $x = 2y$.

invertible function

An invertible function is a function whose inverse exists. It is one-to-one and passes the Horizontal Line Test, so its inverse will also be a function.

Example





The graph of $f(x) = x^3$ is an invertible function because it is one-to-one and passes the Horizontal Line Test. Therefore its inverse will also be a function.

The graph of $g(x) = x^2$ is not an invertible function because it does not pass the Horizontal Line Test. Its inverse does not exist.

iterative process

An iterative process is one in which the output from one iteration is used as the input for the next iteration.

Example

A recursive sequence uses an iterative process to generate its terms.

$a_n = 3a_{n-1} + 1$

$a_1 = 2$

Begin with the first term, which is 2, and substitute it into the sequence to get the next term.

$a_2 = 3a_1 + 1$

$= 3(2) + 1$

$= 7$

Then substitute a_2 into the sequence to produce a_3, and so on.

L

logarithm

The logarithm of a positive number is the exponent to which the base must be raised to result in that number.

Example

Because $10^2 = 100$, the logarithm of 100 to the base 10 is 2.

$\log 100 = 2$

Because $2^3 = 8$, the logarithm of 8 to the base 2 is 3.

$\log_2 (8) = 3$

line of reflection

A line of reflection is the line that the graph is reflected across. A horizontal line of reflection affects the *y*-coordinates. A vertical line of reflection affects the *x*-coordinates.

linear absolute value equation

An equation in the form of $|x - a| = c$ is a linear absolute value equation.

Example

The equation $|x - 1| = 6$ is a linear absolute value equation.

linear absolute value inequality

An inequality in the form $|x + a| < c$ is a linear absolute value inequality.

Example

The inequality $|w - 145.045| \leq 3.295$ is a linear absolute value inequality.

linear programming

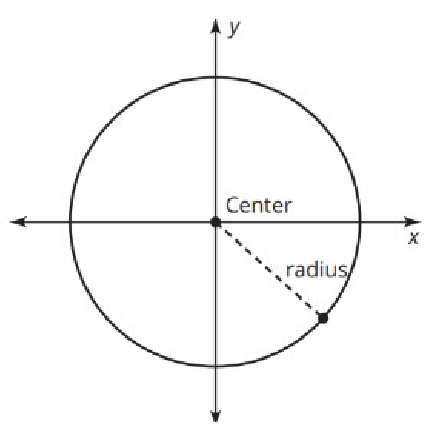
Linear programming is a branch of mathematics that determines the maximum and minimum value of linear expressions on a region produced by a system of linear inequalities.

locus of points

A locus of points is a set of points that satisfy one or more conditions.

Example

A circle is defined as a locus of points that are a fixed distance, called the radius, from a given point, called the center.



logarithm with same base and argument

The logarithm of a number, with the base equal to the same number, is always equal to 1.

$$\log_b (b) = 1$$

Example

$\log_4 (4) = 1$

logarithmic equation

A logarithmic equation is an equation that contains a logarithm.

Example

The equation $\log_2 (x) = 4$ is a logarithmic equation.

logarithmic function

A logarithmic function is a function involving a logarithm.

Example

The function $f(x) = 3 \log x$ is a logarithmic function.

M

matrix

A matrix (plural matrices) is an array of numbers composed of rows and columns. A matrix is usually designated by a capital letter.

matrix element

Each number in the matrix is knows as a matrix element.

matrix equation

Matrices can be used to solve a system of equations. A system can be written as a matrix equation, or an equation with matrices.

multiplicative inverse of a matrix

The multiplicative inverse of a matrix (or just inverse) of A is designated as A^{-1}, and is a matrix such that $A \cdot A^{-1} = |$ or the identity matrix.

multiplicity

Multiplicity is how many times a particular number is a zero for a given function.

Example

The equation $x^2 + 2x + 1 = 0$ has a double root at $x = -1$. The root -1 has a multiplicity of 2.

$$x^2 + 2x + 1 = 0$$
$$(x + 1)(x + 1) = 0$$
$$x + 1 = 0 \quad \text{or } x + 1 = 0$$
$$x = -1 \quad \text{or} \quad x = -1$$

matrix multiplication

In matrix multiplication, an element a_{pq} of the product matrix is determined by multiplying each element in row p of the first matrix by an element from column q in the second matrix and calculating the sum of the products.

Example

$$\begin{array}{r} \\ \text{Lauren} \\ \text{Kerri} \\ \text{Meaghan} \\ \text{Erin} \end{array}
\overset{\textbf{Sprinter's Matrix}}{\begin{array}{c} \begin{array}{ccccc} \text{1st} & \text{2nd} & \text{3rd} & \text{4th} & \text{5th} \end{array} \\ \begin{bmatrix} 3 & 1 & 0 & 0 & 0 \\ 0 & 2 & 0 & 1 & 2 \\ 0 & 1 & 3 & 1 & 2 \\ 2 & 1 & 0 & 1 & 1 \end{bmatrix} \end{array}}
\times
\overset{\textbf{Scoring Matrix}}{\begin{array}{r} \\ \text{1st} \\ \text{2nd} \\ \text{3rd} \\ \text{4th} \\ \text{5th} \end{array} \begin{array}{c} \text{Points} \\ \begin{bmatrix} 10 \\ 8 \\ 6 \\ 4 \\ 2 \end{bmatrix} \end{array}}
=
\overset{\textbf{Results Matrix}}{\begin{array}{r} \\ \text{Lauren} \\ \text{Kerri} \\ \text{Meaghan} \\ \text{Erin} \end{array} \begin{array}{c} \text{Points} \\ \begin{bmatrix} 38 \\ 24 \\ 34 \\ 34 \end{bmatrix} \end{array}}$$

N

natural base *e*

The natural base e is an irrational number equal to approximately 2.71828.

Example

$e^2 \approx 2.7183^2 \approx 7.3892$

natural logarithm

A natural logarithm is a logarithm with a base of e. Natural logarithms are usually written as ln.

Example

$\log_e(x)$ or $\ln x$ is a natural logarithm.

O

odd function

An odd function f is a function for which $f(-x) = -f(x)$ for all values of x in the domain.

Example

The function $f(x) = x^3$ is an odd function because $(-x)^3 = -x^3$.

one-to-one function

A function is a one-to-one function if both the function and its inverse are functions.

Example

The equation $y = x^3$ is a one-to-one function because its inverse, $\sqrt[3]{x} = y$, is a function. The equation $y = x^2$ is not a one-to-one function because its inverse, $\pm\sqrt{x} = y$, is not a function.

P

polynomial function

A polynomial function is a function that can be written in the form

$p(x) = \square x^n + \square x^{n-1} + \cdots + \square x^2 + \square x + \square$,

where the coefficients, represented by each $\square$, are complex numbers and the exponents are nonnegative integers.

Example

The function $f(x) = 5x^3 + 3x^2 + x + 1$ is a polynomial function.

polynomial long division

Polynomial long division is an algorithm for dividing one polynomial by another of equal or lesser degree.

Example

$$\begin{array}{r} 4x^2 - 6x + 3 \\ 2x + 3\overline{\big)\,8x^3 + 0x^2 - 12x - 7} \\ -(8x^3 + 12x^2) \qquad\qquad \\ \hline -12x^2 - 12x \quad\;\; \\ -(-12x^2 - 18x) \quad \\ \hline 6x - 7 \\ -(6x + 9) \\ \hline \text{Remainder } -16 \end{array}$$

power function

In this material, a power function is a function of the form $P(x) = ax^n$ where n is a non-negative integer.

Example

The functions $f(x) = x$, $f(x) = x^2$, and $f(x) = x^3$ are power functions.

Power Rule of Logarithms

The Power Rule of Logarithms states that the logarithm of a power is equal to the product of the exponent and the logarithm of the base of the power.

$$\log_b (x)^n = n \cdot \log_b (x)$$

Example

$\ln (x)^2 = 2 \ln x$

Product Rule of Logarithms

The Product Rule of Logarithms states that the logarithm of a product is equal to the sum of the logarithms of the factors.

$$\log_b (xy) = \log_b (x) + \log_b (y)$$

Example

$\log (5x) = \log 5 + \log x$

pure imaginary number

A pure imaginary number is a number of the form bi, where b is not equal to 0.

Example

The imaginary numbers $-4i$ and $15i$ are pure imaginary numbers.

Q

Quadratic Formula

The Quadratic Formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, 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 $a \neq 0$.

Quotient Rule of Logarithms

The Quotient Rule of Logarithms states that the logarithm of a quotient is equal to the difference of the logarithms of the dividend and the divisor.

$\log_b \left(\frac{x}{y}\right) = \log_b (x) - \log_b (y)$

Examples

$\log \left(\frac{x}{2}\right) = \log x - \log 2$

R

radical function

A radical function is a function that contains one or more radical expressions.

Example

The function $f(x) = \sqrt{3x + 5}$ is a radical function.

rational equation

A rational equation is an equation that contains one or more rational expressions.

Example

The equation $\frac{1}{x - 1} + \frac{1}{x + 1} = 4$ is a rational equation.

rational function

A rational function is any function that can be written as the ratio of two polynomial functions. A rational function can be written in the form $f(x) = \frac{P(x)}{Q(x)}$ where $P(x)$ and $Q(x)$ are polynomial functions, and $Q(x) \neq 0$.

Example

The function $f(x) = \frac{1}{x - 1} + \frac{1}{x + 1}$ is a rational function.

real part of a complex number

In a complex number of the form $a + bi$, the term a is called the real part of a complex number.

Example

The real part of the complex number $3 + 2i$ is 3.

reflection

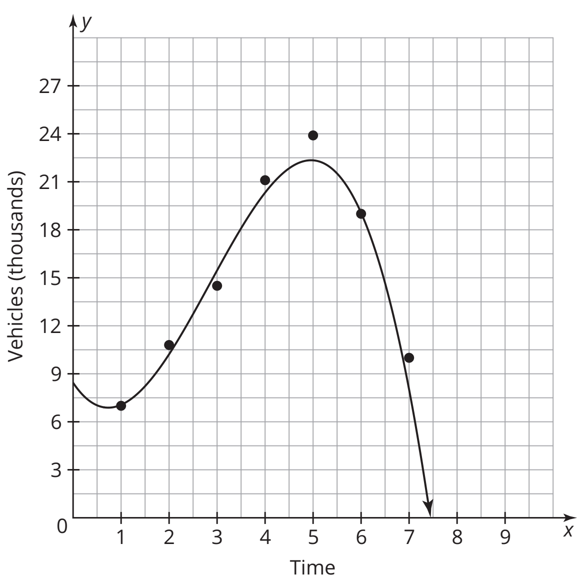
A reflection of a graph is the mirror image of the graph about a line of reflection.

regression equation

A regression equation is a function that models the relationship between two variables in a scatter plot.

Example

The regression equation $y = -0.41x^3 + 3.50x^2 - 4.47x + 8.44$ models the relationship between time and the number of vehicles.



relation

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

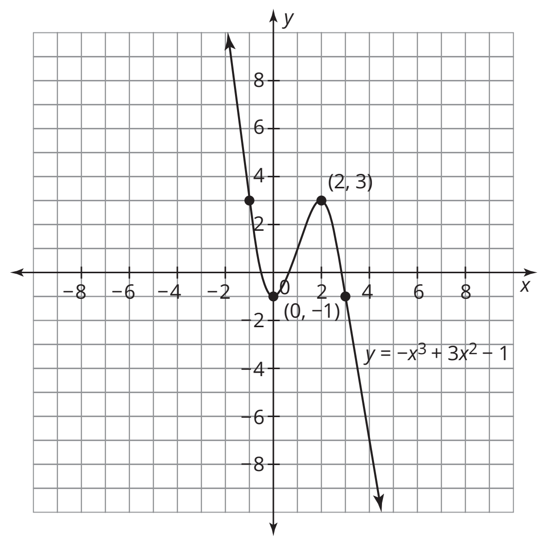
Example

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

relative maximum

A relative maximum is the highest point in a particular section of a graph.

Example

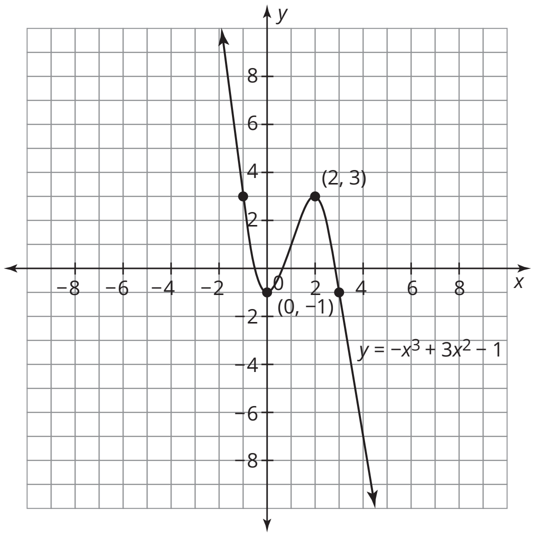


The graph shown has a relative maximum at (2, 3).

relative minimum

A relative minimum is the lowest point in a particular section of a graph.

Example



The graph shown has a relative minimum at (0, −1)

Remainder Theorem

The Remainder Theorem states that the remainder when dividing a polynomial by $(x - r)$ is the value of the polynomial at r.

Example

The value of the polynomial $x^2 + 5x + 2$ at 1 is $(1)^2 + 5(1) + 2 = 8$. So, the remainder when $x^2 + 5x + 2$ is divided by $x - 1$ is 8.

$$
\begin{array}{r}
x + 6 \\
x - 1 \overline{)\, x^2 + 5x + 2} \\
\underline{x^2 - x} \quad\quad \\
6x + 2 \\
\underline{6x - 6} \\
8
\end{array}
$$

restrict the domain

To restrict the domain of a function means to define a new domain for the function that is a subset of the original domain.

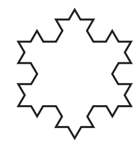
S

self-similar

A self-similar object is exactly or approximately similar to a part of itself.

Example

A Koch snowflake is considered to be self-similar.



sine function

The sine function is a periodic function. It takes angle measures (θ values) as inputs and then outputs real number values which correspond to the coordinates of points on the unit circle.

Example

The function $h(\theta) = -\sin(2\theta) + 1$ is a sine function.

solution of a system of inequalities

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

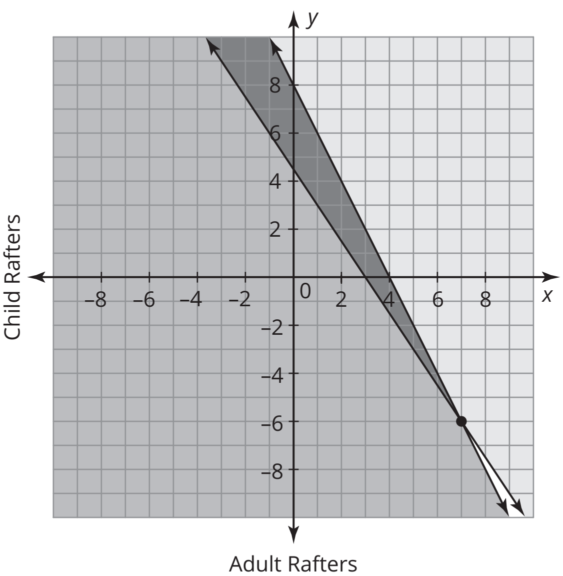
Example

The solution of this system of linear inequalities ...

$$200a + 100c \leq 800$$

$$75(a - 1) + 50c \geq 150$$

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



square matrix

A square matrix is a matrix that has an equal number of rows and columns.

Example

Matrix C is a 2 x 2 square matrix.

$$C = \begin{bmatrix} 9 & -2 \\ -4 & 1 \end{bmatrix}$$

square root function

The square root function is the inverse of the power function $f(x) = x^2$ when the domain is restricted to $x \geq 0$.

Example

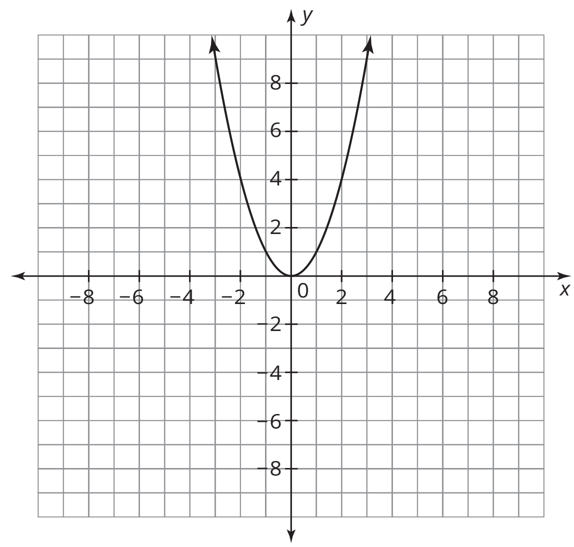
The square root function is $g(x) = \sqrt{x}$.

standard form of a parabola

The standard form of a parabola centered at the origin is an equation of the form $x^2 = 4py$ or $y^2 = 4px$, where p represents the distance from the vertex to the focus.

Example

The equation for the parabola shown can be written in standard form as $x^2 = 2y$.



standard form (general 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, or general form.

Example

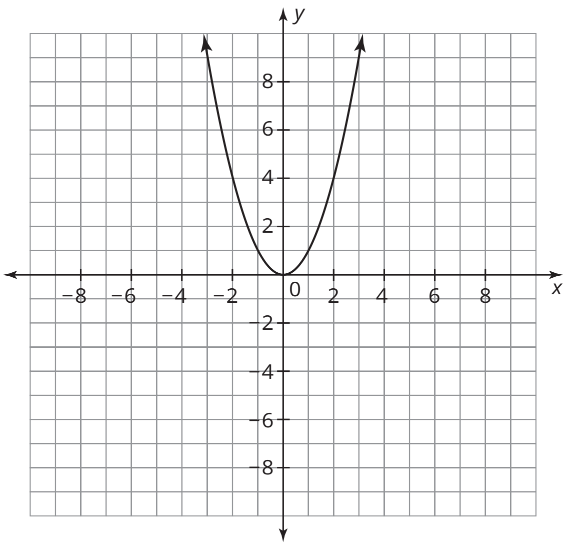
The function $f(x) = -5x^2 - 10x + 1$ is written in standard form

symmetric about a line

If a graph is symmetric about a line, the line divides the graph into two identical parts.

Example

The graph of $f(x) = x^2$ is symmetric about the line $x = 0$.

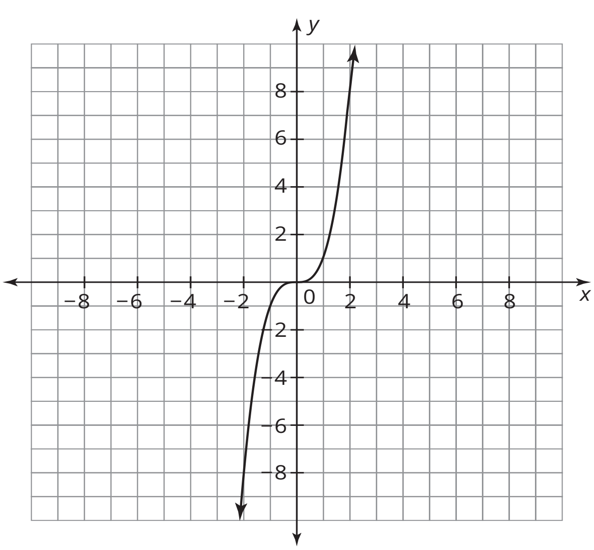


symmetric about a point

A function is symmetric about a point if each point on the graph has a point the same distance from the central point, but in the opposite direction.

Example

The graph of $f(x) = x^3$ is symmetric about the point (0, 0).



synthetic division

Synthetic division is a method for dividing a polynomial by a linear factor of the form $(x - r)$.

Example

The quotient of $2x^2 - 3x - 9$ and $x - 3$ can be calculated using synthetic division.

$$\begin{array}{r|rrr} 3 & 2 & -3 & -9 \\ & & 6 & 9 \\ \hline & 2 & 3 & \boxed{0} \end{array}$$

The quotient of $2x^2 - 3x - 9$ and $x - 3$ is $2x + 3$.

T

the number *i*

The number i is a number such that $i^2 = -1$.

V

variable matrix

A variable matrix is a matrix in one column that represents all of the variables in the system of equations.

Example

For the system

$$\begin{cases} 2x - y - 2z = 3 \\ 3x + y - 2z = 11 \\ -2x - y + z = -8 \end{cases}$$

The variable matrix is

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}$$

vertex form of a quadratic function

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

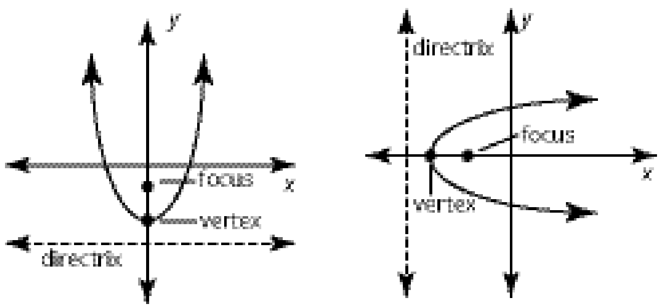
Example

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 point on the axis of symmetry which is exactly midway between the focus and the directrix. It is also the point where the parabola changes direction.

Example

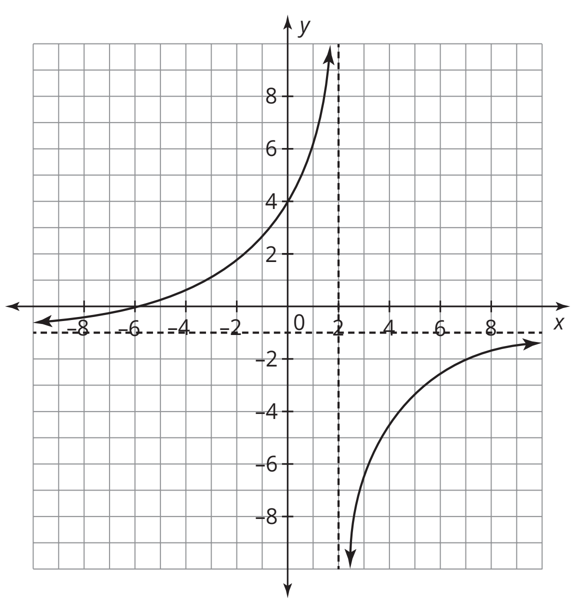


vertical asymptote

A vertical asymptote is a vertical line that a function gets closer and closer to, but never intersects. The asymptote does not represent points on the graph of the function. It represents the output value that the graph approaches.

Example

The graph has two asymptotes: a vertical asymptote $x = 2$ and a horizontal asymptote $y = -1$.



Z

Zero Property of Logarithms

The Zero Property of Logarithms states that the logarithm of 1, with any base, is always equal to 0.

$$\log_b (1) = 0$$

Example

$\log_3 (1) = 0$