

# Math Glossary

## A

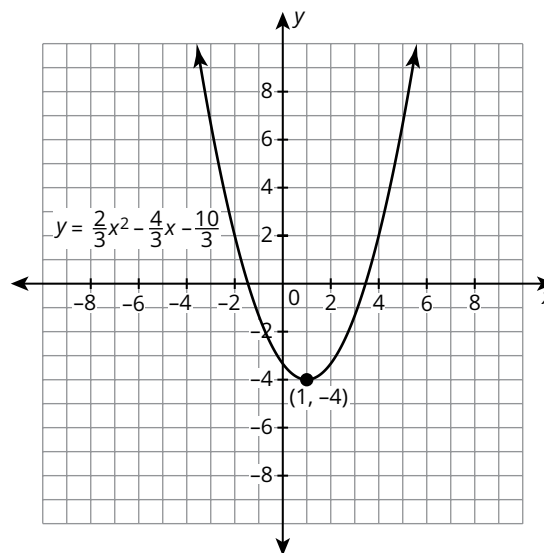
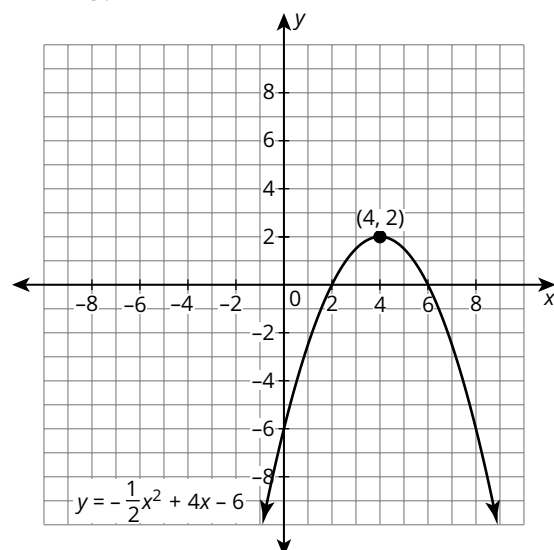
### absolute maximum

[máximo absoluto]

An absolute maximum is the highest point in the entire graph.

#### Example

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



### absolute value equation

[ecuación de valor absoluto]

An absolute value equation is an equation that contains an absolute value expression.

#### Example

$|a| = 6$ ,  $|x| - 1 = 4$ ,  $3|c - 2| = 12$  and  $20 = |y + 3| - 5$  are all examples of absolute value equations.

### absolute minimum

[mínimo absoluto]

An absolute minimum is the lowest point in the entire graph.

#### Example

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

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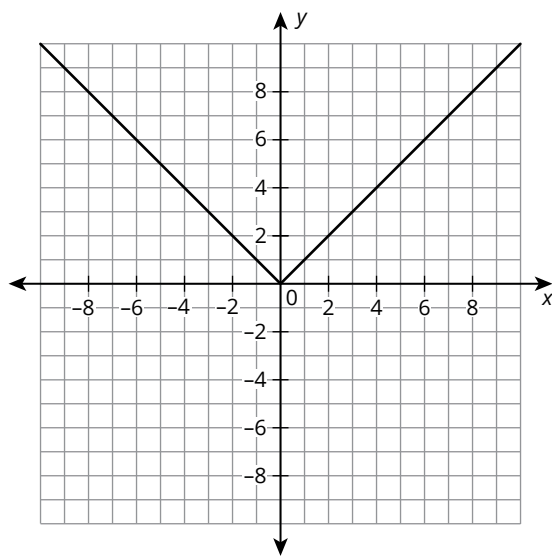
## absolute value function

[función de valor absoluto]

The absolute value function is a function in the form of  $g(x) = |x|$ .

### Example

The graph of the absolute value function  $g(x) = |x|$  is



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## absolute value inequality

[desigualdad de valor absoluto]

An absolute value inequality is an inequality that contains an absolute value expression.

### Example

$|x| \leq 2$ ,  $|x + 3| > 4$ ,  $|x - 1| < 5$ , and  $|x| + 6 \geq -1$  are all examples of absolute value inequality.

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## argument of a function

[argumento de una función]

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.

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## C

## coefficient of determination

[coeficiente de determinación]

The coefficient of determination ( $r^2$ ) measures the “strength” of the relationship between the original data and its regression function. The value of the coefficient of determination ranges from 0 to 1 with a value of 1 indicating a perfect fit between the regression function and the original data.

### Example

The coefficient of determination ( $r^2$ ) for the table is 1 which is modeled by a quadratic regression function.

| Time (seconds) | Height (meters) |
|----------------|-----------------|
| 0.0            | 5.0             |
| 0.5            | 13.75           |
| 1.0            | 20.0            |
| 1.5            | 23.75           |
| 2.0            | 25.0            |
| 2.5            | 23.75           |
| 3.0            | 20.0            |
| 3.5            | 13.75           |

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## coefficient matrix

[matriz de coeficientes]

A coefficient 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      The coefficient matrix is

$$\begin{cases} 2x - y - 2z = 3 \\ 3x + y - 2z = 11 \\ -2x - y + z = -8 \end{cases} \quad \begin{bmatrix} 2 & -1 & -2 \\ 3 & 1 & -2 \\ -2 & -1 & 1 \end{bmatrix}$$

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## common logarithm

[logaritmo común/decimal]

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.

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## complex numbers

[números complejos]

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.

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## composition of functions

[composición de funciones]

Composition of functions is the process of evaluating one function inside of 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  $g(f(x)) = (3x - 5)^2$ .

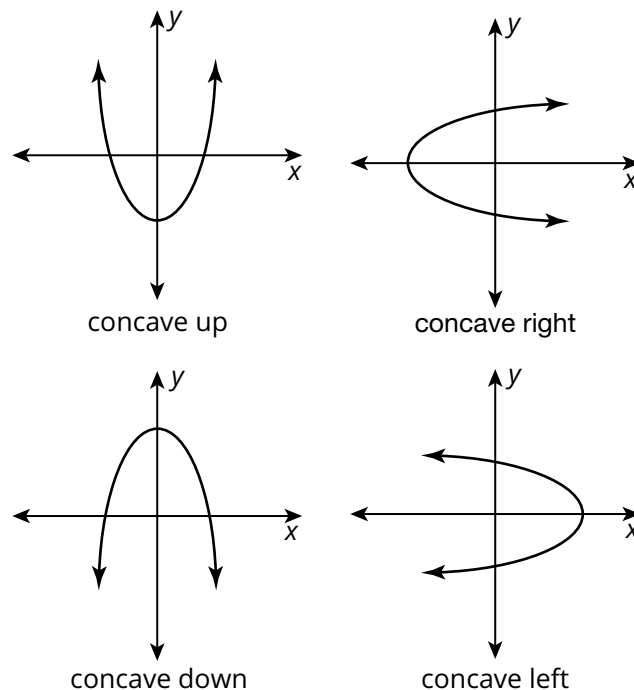
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## concavity of a parabola

[concauidad de una parábola]

The concavity of a parabola describes the direction the parabola opens.

### Example



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## constant matrix

[matriz constante]

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

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

## cube root function

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

### Example

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

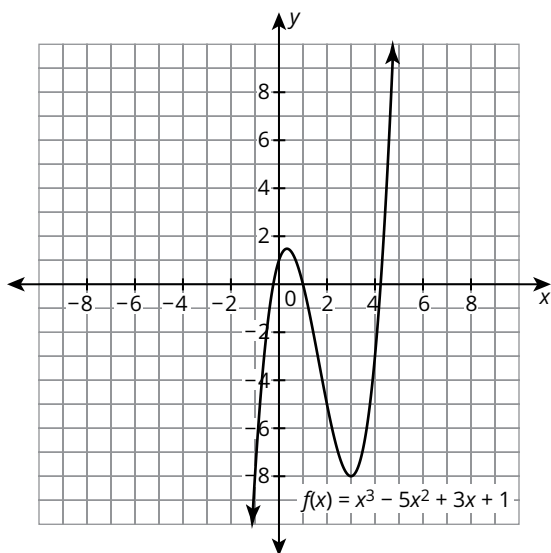
## cubic function

[función cúbica]

A cubic function is a function that can be written in the general 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

[dimensiones]

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.

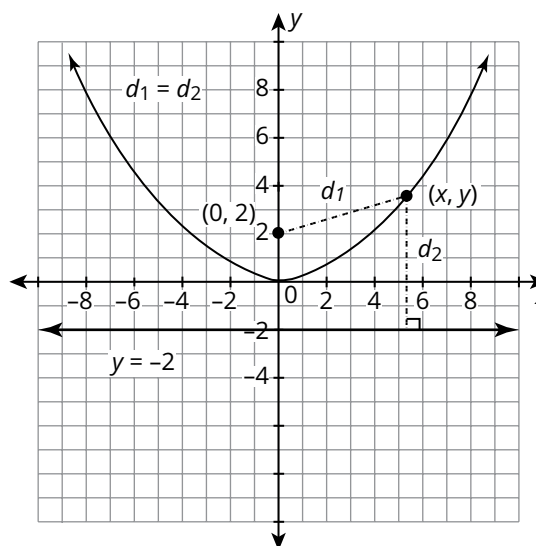
## directrix

[directriz]

The directrix of a parabola is a line 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 directrix of the parabola shown is the line  $y = -2$ . All points on the parabola are equidistant from the focus and the directrix.



E

## equivalent compound inequality

[desigualdad compuesta equivalente]

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      |
|---------------------------|-------------------------------------|
| $ ax + b  < c$            | $-c < ax + b < c$                   |
| $ ax + b  \leq c$         | $-c \leq ax + b \leq c$             |
| $ ax + b  > c$            | $ax + b < -c$ or $ax + b > c$       |
| $ ax + b  \geq c$         | $ax + b \leq -c$ or $ax + b \geq c$ |

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### extraneous solution

[solución extraña]

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

#### Example

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

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

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

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

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

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

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

$$x = -8 \quad \quad \quad x = 1$$

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

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### extrema

[extremos]

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  $(0, -1)$ .

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## F

### factor theorem

[teorema del factor]

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  $p(r) = 0$ .

### Example

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

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### factored form of a quadratic equation

[forma factorizada de una ecuación cuadrática]

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

#### Example

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

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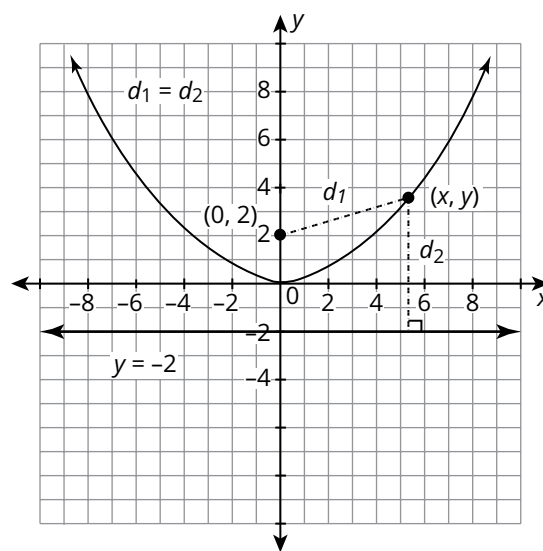
### focus

[foco]

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 directrix of the parabola shown is the line  $y = -2$ . All points on the parabola are equidistant from the focus and directrix.



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## Fundamental Theorem of Algebra

[Teorema fundamental del álgebra]

The Fundamental Theorem of Algebra states that any polynomial equation of degree  $n$  must have exactly  $n$  complex roots or solutions.

### 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.

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## G

## Gaussian elimination

[eliminación gaussiana]

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.

### Example

The system 
$$\begin{cases} 2x + 2y + 3z = 3 \\ x + 3y + 2z = 5 \\ 3x + y + z = 5 \end{cases}$$

can be solved using Gaussian elimination. Operations are performed to eliminate a variable such as:

- Multiplying the second equation by  $-2$  and adding the result to the first equation.
- Then, replacing the first equation in the system with the new equation.
- After that, multiplying the second equation by  $-3$  and adding the result to the third equation.
- Then, replacing the third equation in the system with the new equation.

By performing these steps, the  $x$ -variable have been eliminated in all equations except the second equation. We continue in this same manner to isolate  $y$  and  $z$ .

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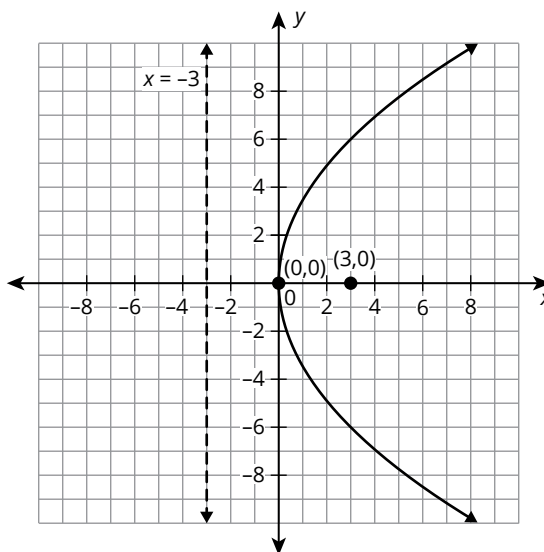
## geometric form of a parabola

[forma geométrica de una parábola]

The geometric form of a parabola centered at the origin is an equation of the form  $x^2 = 4py$  or  $y^2 = 4px$ . The geometric form of a parabola with vertex  $(h, k)$  is an equation of the form  $(x - h)^2 = 4p(y - k)$  or  $(y - k)^2 = 4p(x - h)$ .

### Example

The equation of the geometric form of the parabola shown is  $y^2 = 12x$ .



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## 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.

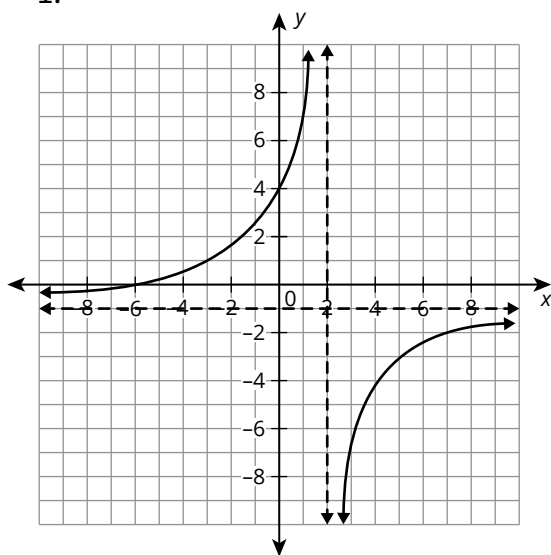
## horizontal asymptote

[asíntota horizontal]

A horizontal asymptote is a horizontal line that a function gets closer and closer to. In most cases, a graph never intersects a horizontal asymptote, but in some cases it does.

### Example

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

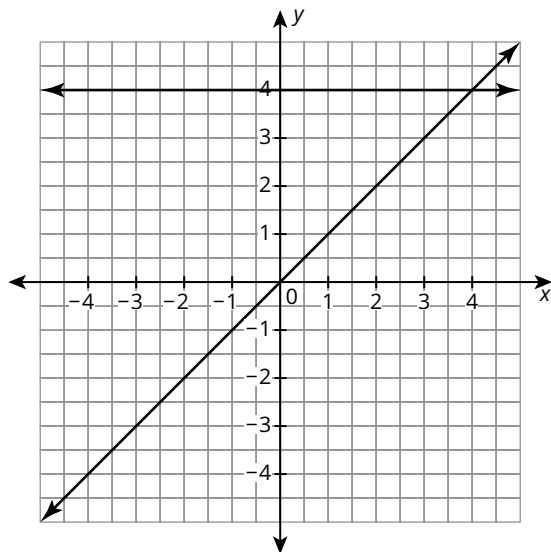


## Horizontal Line Test

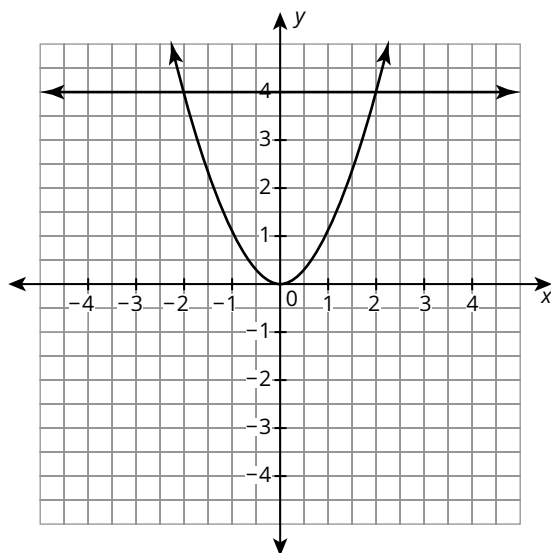
The Horizontal Line Test is a test to determine if a function is one-to-one. To use the test, imagine drawing every possible horizontal line on the coordinate plane. If no horizontal line intersects the graph of a function at more than one point, then the function is one-to-one.

### 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.



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## identity function

[función identidad]

The identity function is the function that maps every real number  $x$  to the same real number  $x$ . The composition identity, also known as the identity function, is defined as  $f(x) = x$ .

### Example

The composition function  $f(g(x))$  is an identity function where  $f(x) = x^3$  and  $g(x) = \sqrt[3]{x}$  since  $f(g(x)) = x$ .

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## identity matrix

[matriz de identidad]

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

[números imaginarios]

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.

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## imaginary part of a complex number

[parte imaginaria de un número complejo]

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  $2i$ .

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## 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  $1 - i$ .

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## interval notation

[notación de intervalo]

An interval notation is a notation that represents a range of values on the number line.

### Example

The solution sets in inequalities shown can be written in interval notation as:

| Solution Set in Inequalities | Solution Set in Interval Notation |
|------------------------------|-----------------------------------|
| $-2 < x < 4$                 | $(-2, 4)$                         |
| $x \geq 0$                   | $[0, \infty)$                     |
| $x < 3$                      | $(-\infty, 3)$                    |

---

## inverse of a function

[inversa de una función]

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  $x = 2y$ .

---

## inverse variation function

[función de variación inversa]

The inverse variation is a function of the form  $y = \frac{k}{x}$ , where  $k$  is the constant of variation.

### Example

The real-world situation involves a group of friends sharing a \$600 gas budget for a road trip. As more people contribute, each person pays less. If  $x$  is the number of people and  $y$  is the amount each pays, the inverse variation equation is  $y = \frac{600}{x}$ . This shows that the number of people sharing varies inversely with the amount each pays.

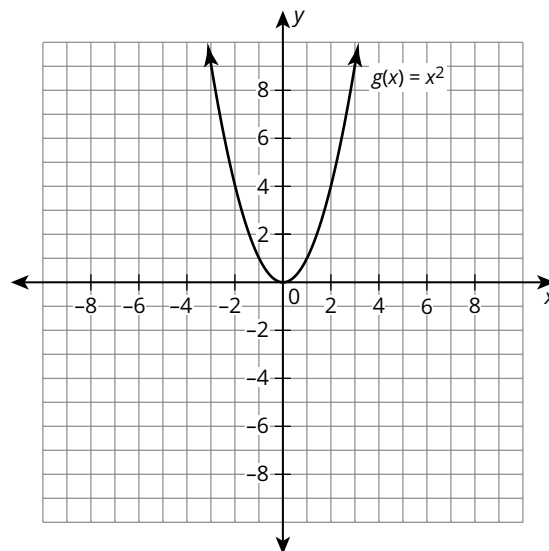
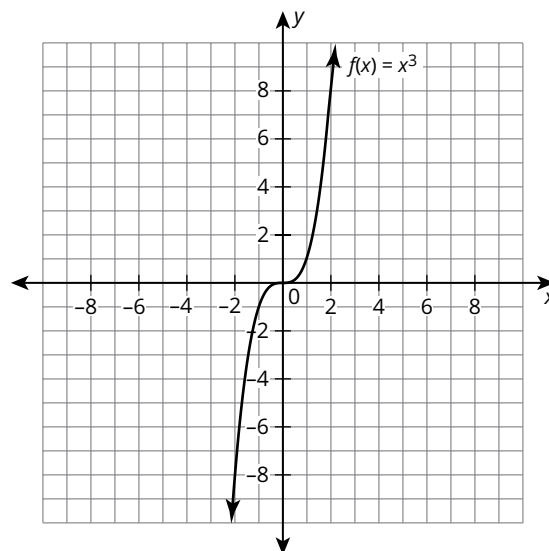
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## invertible function

[función invertible]

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.

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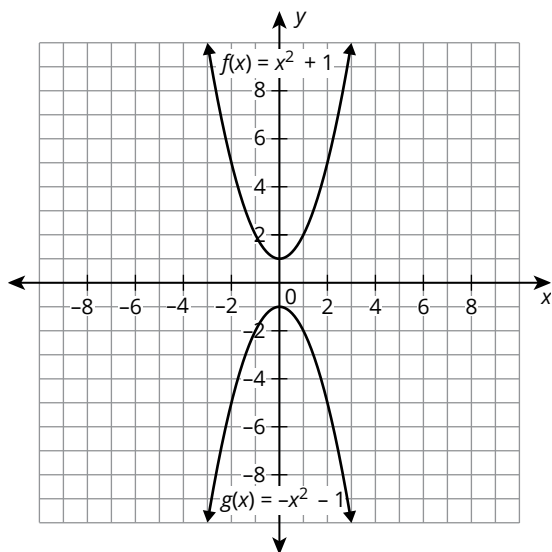
## line of reflection

[línea de reflexión]

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.

### Example

The line  $y = 0$  ( $x$ -axis) is the line of reflection of the graph of  $f(x) = x^2 + 1$  of which it was reflected to have the graph of  $g(x) = -x^2 - 1$ .



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## linear programming

[programación lineal]

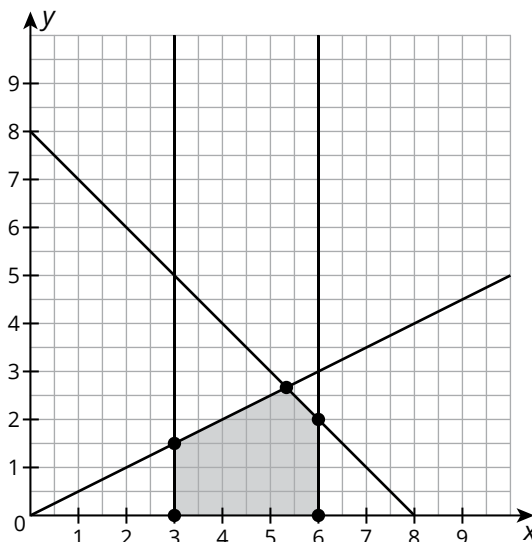
Linear programming is a process that uses the intersection points to determine the optimal solution to a system of inequalities. In linear programming, the vertices of the solution region of the system of linear inequalities are substituted into a given equation to determine the maximum or minimum value.

### Example

The vertices of the shaded region of the

$$\text{system } f(x) = \begin{cases} 3 \leq x \leq 6 \\ y \leq \frac{1}{2}x \\ x + y \leq 8 \\ x \geq 0 \\ y \geq 0 \end{cases}$$

are  $(3, 0)$ ,  $(6, 0)$ ,  $(3, 1.5)$ ,  $(5\frac{1}{3}, 2\frac{2}{3})$  and  $(6, 2)$  as shown on the graph



We substitute these vertices into a given equation to determine the maximum or minimum value.

---

## logarithm

[logaritmo]

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.

$$\log_2 (8) = 3$$

---

## 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

[función logarítmica]

A logarithmic function is a function involving a logarithm.

### Example

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

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## M

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## matrix

[matriz]

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

### Example

The matrix  $A = \begin{bmatrix} 1 & -1 \\ 4 & 3 \end{bmatrix}$  is a square matrix with 2 rows and 2 columns. The matrix

$B = \begin{bmatrix} 0 & -3 \\ -1 & 1 \\ 5 & 7 \end{bmatrix}$  is a matrix with 3 rows and 2 columns.

---

## matrix element

[elemento de una matriz]

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

### Example

The matrix elements of  $A = \begin{bmatrix} -1 & 2 & 1 \\ 3 & 0 & 5 \end{bmatrix}$  are

$a_{11} = -1$ ,  $a_{12} = 2$ ,  $a_{13} = 1$ ,  $a_{21} = 3$ ,  $a_{22} = 0$ , and  $a_{23} = 5$ . Each matrix element is labeled using the notation  $a_{ij}$ , where  $a_{ij}$  means the number in the  $i$ th row and the  $j$ th column.

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## matrix equation

[ecuación matricial]

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

### Example

The system of equation

$$f(x) = \begin{cases} -x + y = 0 \\ 2x + 3y - z = 1 \\ 4y + 3z = -2 \end{cases} \text{ can be written as a}$$

$$\text{matrix equation } \begin{bmatrix} -1 & 1 & 0 \\ 2 & 3 & -1 \\ 0 & 4 & 3 \end{bmatrix} \cdot \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 0 \\ 1 \\ -2 \end{bmatrix}.$$

---

## multiplicative inverse of a matrix

[inversa multiplicativa de una matriz]

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

### Example

The inverse of matrix  $A = \begin{bmatrix} 4 & 3 \\ 2 & 5 \end{bmatrix}$  is

$$A^{-1} = \begin{bmatrix} \frac{5}{14} & -\frac{3}{14} \\ -\frac{1}{7} & \frac{2}{7} \end{bmatrix} \text{ since } A \cdot A^{-1} = I.$$

---

## multiplicity

[multiplicidad]

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.

$$x^2 + 2x + 1 = 0$$

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

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

$$x = -1 \quad \text{or} \quad x = -1$$

## matrix multiplication

[multiplicación de matrices]

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

| Sprinter's Matrix |     |     |     |     |     | Scoring Matrix |        | Results Matrix |        |
|-------------------|-----|-----|-----|-----|-----|----------------|--------|----------------|--------|
|                   | 1st | 2nd | 3rd | 4th | 5th |                | Points |                | Points |
| Lauren            | 3   | 1   | 0   | 0   | 0   | ×              | 1st    | Lauren         | 38     |
| Kerri             | 0   | 2   | 0   | 1   | 2   |                | 2nd    | Kerri          | 24     |
| Meaghan           | 0   | 1   | 3   | 1   | 2   |                | 3rd    | Meaghan        | 34     |
| Erin              | 2   | 1   | 0   | 1   | 1   |                | 4th    | Erin           | 34     |
|                   |     |     |     |     |     |                | 5th    |                |        |
|                   |     |     |     |     |     |                |        |                |        |

## N

### natural base e

[base natural 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

[logaritmo natural]

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

### one-to-one function

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

### Example

The linear function  $y = 2x + 3$  is a one-to-one function because its inverse,  $y = \frac{x-3}{2}$  is a function.

## P

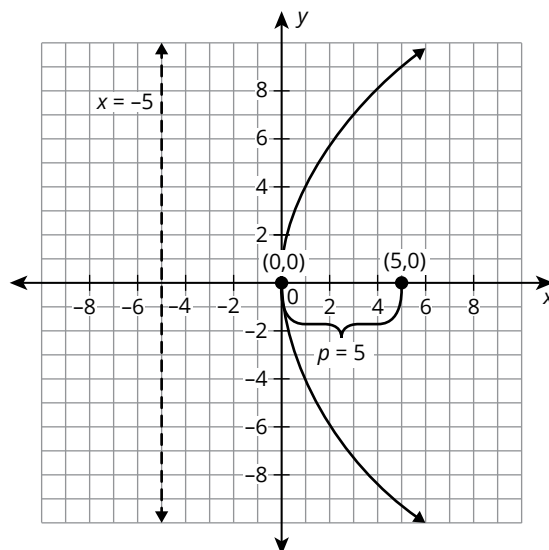
### parabola

[parábola]

A parabola is the set of all points in a plane that are equidistant from a fixed point, the focus, and a fixed line, the directrix.

### Example

The graph of the parabola is equidistant from the focus  $(5, 0)$  and directrix  $x = -5$ .



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## polynomial function

[función polinomial]

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

[división (larga) de polinomios]

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

### Example

$$\begin{array}{r} 4x^2 - 6x + 3 \\ 2x + 3 \overline{) 8x^3 + 0x^2 - 12x - 7} \\ \underline{-(8x^3 + 12x^2)} \phantom{-7} \\ -12x^2 - 12x \phantom{-7} \\ \underline{-(-12x^2 - 18x)} \phantom{-7} \\ 6x - 7 \\ \underline{-(6x + 9)} \\ \text{Remainder } \textcircled{-16} \end{array}$$

---

## power function

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.

---

## pure imaginary number

[número imaginario puro]

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

### Example

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

---

## Q

## quadratic formula

[fórmula cuadrática]

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

### Example

Using the quadratic formula

$$\begin{aligned} x &= \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}, \text{ the solutions of the quadratic equation } y = 3x^2 - 11x + 6 \text{ are} \\ x &= \frac{-(-11) \pm \sqrt{(-11)^2 - 4(3)(6)}}{2(3)} = \frac{11 \pm 7}{6} \text{ or} \\ x &= 3 \text{ and } x = \frac{2}{3}. \end{aligned}$$

---

## R

## radical function

[función radical]

A radical function is the inverse of a power function with exponents greater than or equal to 2, such as a square root function and a cube root function.

### Example

The functions  $f(x) = \sqrt{x}$  and  $g(x) = \sqrt[3]{x}$  are radical functions.

---

## rational equation

[ecuación racional]

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

[función racional]

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.

---

## rational root theorem

The rational root theorem states that a rational root of a polynomial equation  $a_n x^n + a_{n-1} x^{n-1} + \dots + a_2 x^2 + a_1 x + a_0 x^0 = 0$  with integer coefficients is of the form  $\frac{p}{q}$ , where  $p$  is a factor of the constant term,  $a_0$ , and  $q$  is a factor of the leading coefficient,  $a_n$ .

### Example

Using the rational root theorem, the list of all possible rational roots for the polynomial equation  $4x^4 - 2x^3 + 5x^2 + x - 10 = 0$  are  $\frac{p}{q} = \pm 1, \pm 2, \pm 5, \pm 10, \pm \frac{1}{2}, \pm \frac{5}{2}, \pm \frac{1}{4}, \pm \frac{5}{4}$ , where  $p$  are factors of  $-10$  and  $q$  are factors of  $4$ .

---

## real part of a complex number

[parte real de un número complejo]

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.

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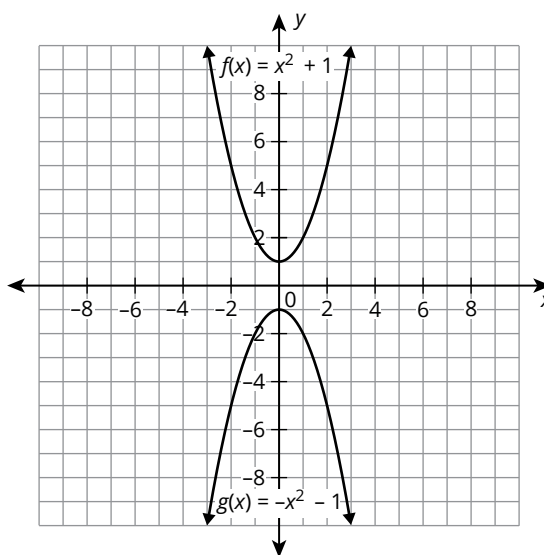
## reflection

[reflexión]

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

### Example

The graph of  $g(x) = -x^2 - 1$  is a reflection of the graph of  $f(x) = x^2 + 1$  along the  $x$ -axis.



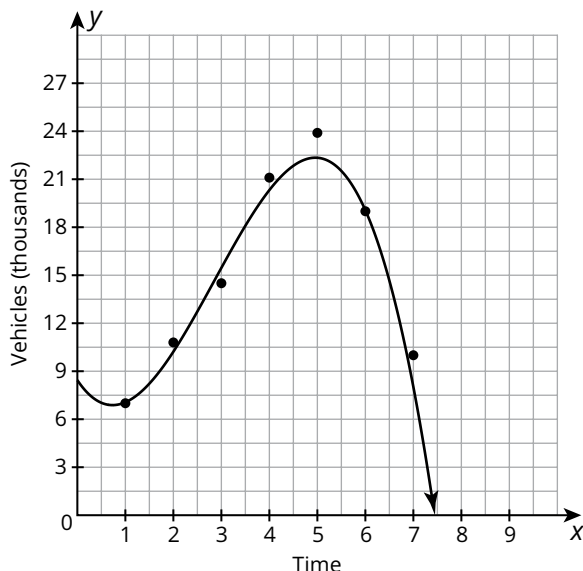
## regression function

[función de regresión]

A regression function models the relationship between two variables in a scatterplot.

### Example

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

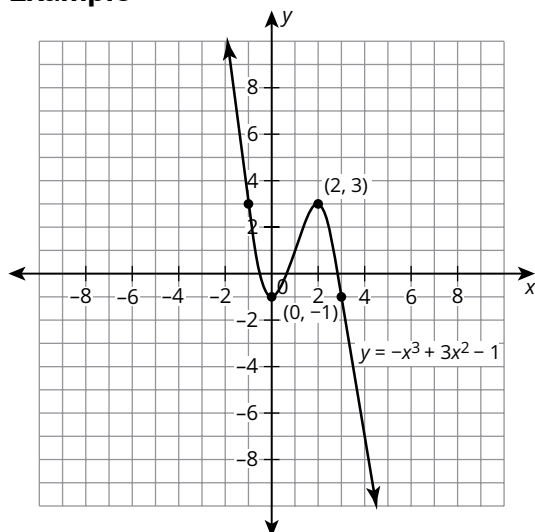


## relative maximum

[máximo relativo]

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

### Example



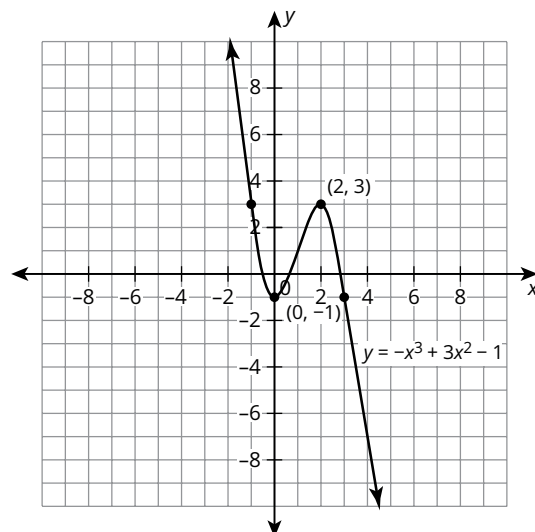
The graph shown has a relative maximum at (2, 3).

## relative minimum

[mínimo relativo]

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 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  $x = r$ .

### 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.

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

---

## restrict the domain

[restringir el dominio]

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

### Example

The function  $f(x) = x^2$  with domain  $-\infty < x < \infty$  will need to restrict the domain to  $x \geq 0$  for its inverse to exist.

---

## S

---

## set notation

In set notation, the domain of a function is represented by the set of all possible input values,  $x$ , using curly brackets “{” and a description of the allowed values with a vertical bar “|” and the range is the set of all possible output values,  $y$ , using the same notation, representing the set of values the function can produce based on the domain inputs.

### Example

A function with a domain “all real numbers except 4” can be represented in set notation as  $\{x|x \neq 4\}$ .

---

## 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.

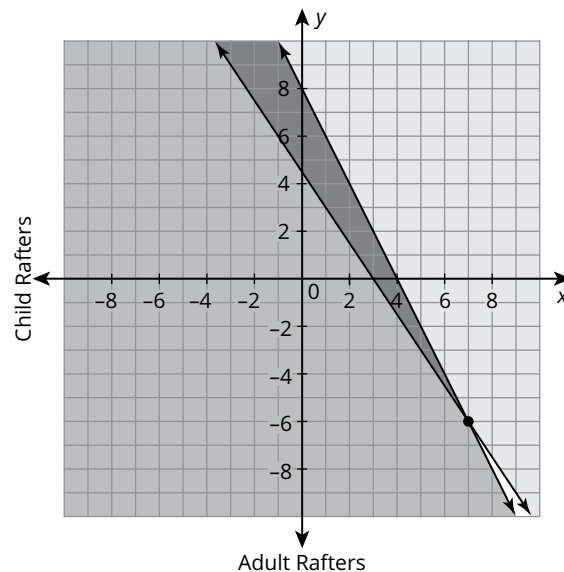
### Example

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 quadratic equation

[forma estandarizada de una ecuación cuadrática]

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

### Example

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

---

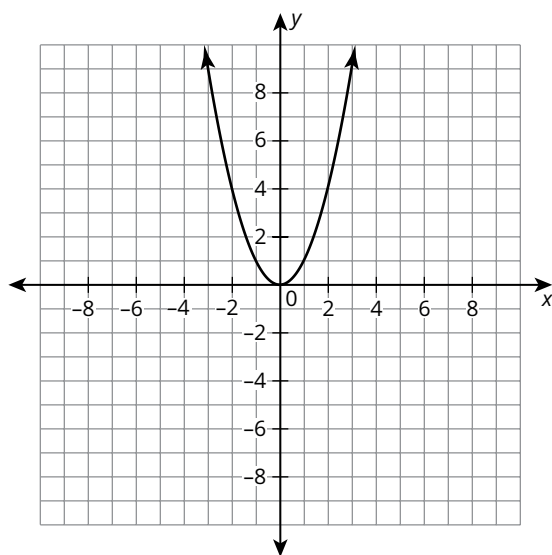
## symmetric about a line

[simétrico respecto a una línea]

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  $x = 0$ .



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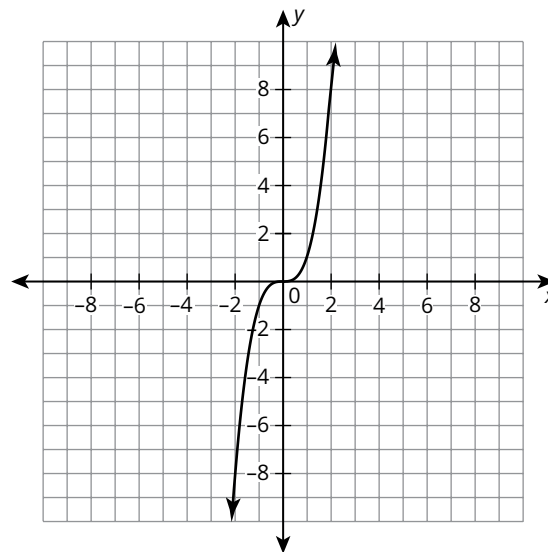
## symmetric about a point

[simétrico respecto a un punto]

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

[división sintética]

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.

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

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

### the number $i$ [el número $i$ ]

The number  $i$  is a number such that  $i^2 = -1$ . The number  $i$  is also called the imaginary identity.

#### Example

The solutions to the equation  $x^2 = -1$  is the number  $i$  and  $-i$ .

### variable matrix [matriz de variables]

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

#### Example

For the system                      The variable matrix is

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

### vertex form of a quadratic equation [forma de vértice de una ecuación cuadrática]

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

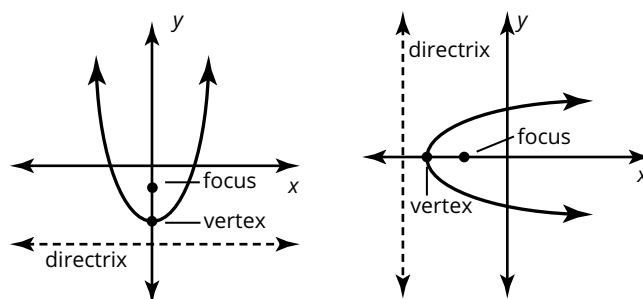
#### Example

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 [vértice de una parábola]

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



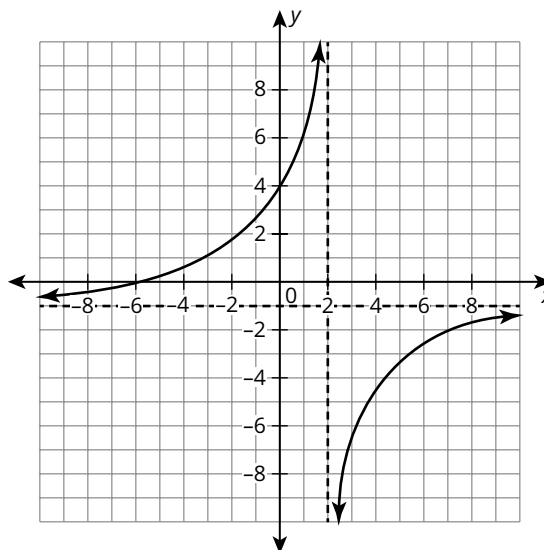
### vertical asymptote [asíntota vertical]

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  $y = -1$ .



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