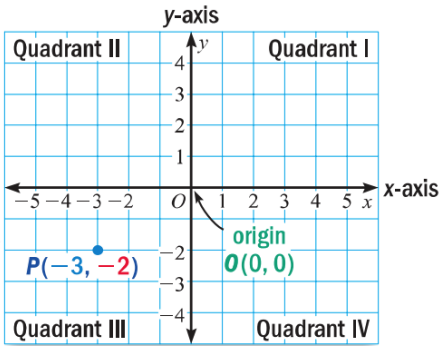
Graphing on a Coordinate Plane

Coordinate Plane: a coordinate plane is formed by the intersection of a horizontal number line called the x-axis and a vertical number line called the y-axis. The axes meet at a point called the origin and divide the coordinate plane into four quadrants.

Ordered Pair: Each point in a coordinate plane is represented by an ordered pair. In other words, ordered pairs are the locations, or points.

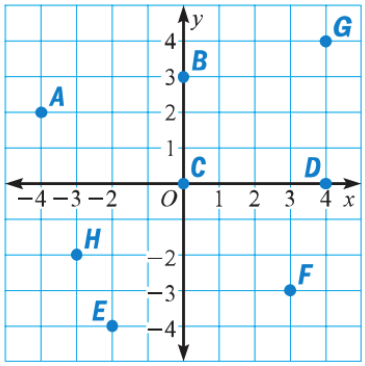
To plot an ordered pair, begin at the origin, the point (0,0), which is the intersection of the x-axis and the y-axis. The first number is the x-coordinate, and the second number is the y-coordinate. The x-coordinate and y-coordinate of an ordered pair tell the direction and number of units to move.

(x, y)
x-coordinate → move right or left
y-coordinate → move up or down



Point *P* is represented by the ordered pair (-3, -2).
Point *P* is in Quadrant III.

Give the coordinates of each point.



a) B =

b) C =

c) D =

d) E =

e) G =

Equations with Two Variables

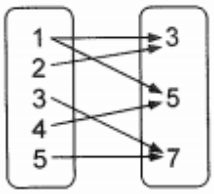
Equations with Two Variables: Sometimes an equation contains two variables *x* and *y*. *X* is called an independent variable and *y* is called a dependent variable because the value of *y* depends on the value of *x.*

Example: If *x = 1,* then *y = 2.* This is one solution for the equation and we can express the solution as an ordered pair (1, 2).

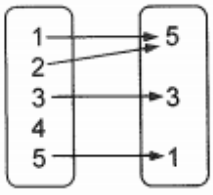
Functions

Function: A function is a rule that relates two quantities so that each input or domain corresponds to exactly one output or range. Functions can be represented in many ways, including tables, graphs, and equations.
Domain: The domain is the set of all possible input values.
Range: The range is the set of all possible output values.

Example:



The relation is not a function because the input 1 has two outputs



The relation is a function. The domain is {1, 2, 3, 5} and the range is {1, 3, 5}

{(−2, 5), (2, 5), (3, 5)}

The relation is a function. The domain is {-2, 2, 3} and the range is {5}

{(−1, 3), (−1, 5), (−1, −1)}

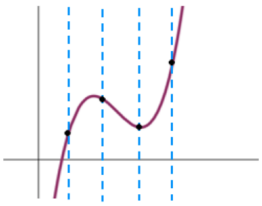
The relation is not a function because the input -1 has three outputs

Is this relation a function? Explain.

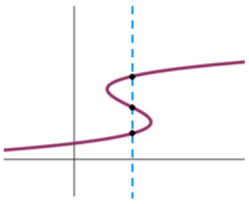
{(1, 5), (8, 4), (3, -2), (1, 0), (6, -3)}

Vertical-Line Test

Vertical-Line Test: It is a test to determine if a graph is a function or not. If a vertical line passes through two or more points on any part of the graph, it is *not* a function.

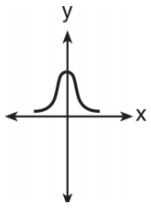


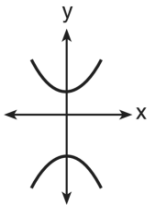
Is a Function
No vertical line will cross the graph more than once.

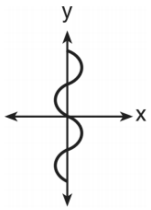


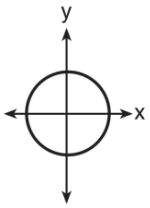
NOT a Function
There is a vertical line that crosses the graph more than once.

1. Which of the graphs represents a function?

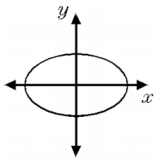
A. 

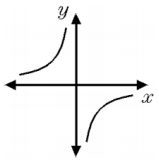
B. 

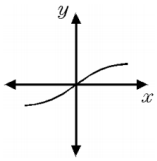
C. 

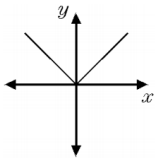
D. 

2. Which diagram is not the graph of a function?

A. 

B. 

C. 

D. 

Function Notation

Functional Notation: A standard notation for the output of the function *f* with the input *x* is *f(x).*

Find the values for f(x) = 5x - 9 with the set of real numbers as the domain.

a. f(-4) = 5(-4) - 9 = -20 - 9 = = -29

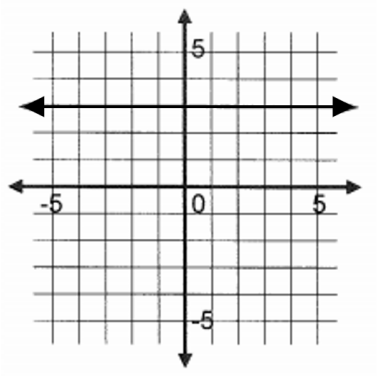
b. f(9) = 5(9) - 9 = 45 - 9 = 36

Horizontal and Vertical Line Graphs

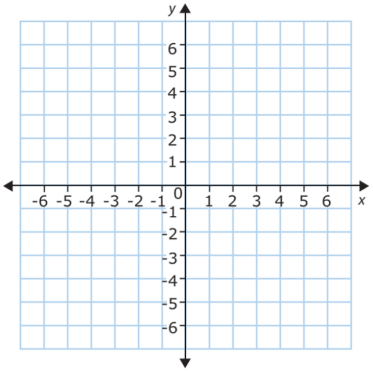
Horizontal Line Graphs: If the equation has the form *y = a,* where *a* is any number, then the graph is a horizontal line on the coordinate plane.

Vertical Line Graphs: If the equation has the form *x = b,* where *b* is any number, then the graph is a vertical line on the coordinate plane.

Example:
Graph the equation: y = 3.



Graph the equation: x = 2.



Slope

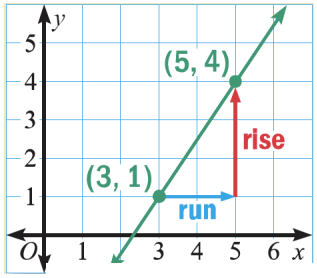
Slope: The slope is the steepness of a line or graph of an equation. It is the ratio of the line's vertical change, called the rise, to its horizontal change, called the run.

Given two points on a nonvertical line,
you can find the slope m of the line using this formula:

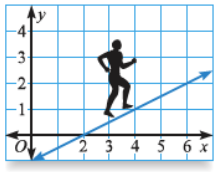
slope $(m) = \frac{rise}{run}$

$= \frac{change\ in\ y}{change\ in\ x}$

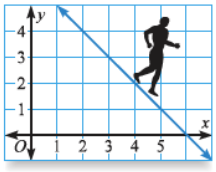
Example: Find the slope of the line.



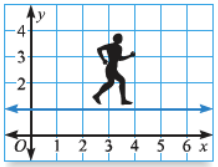
$m = =$



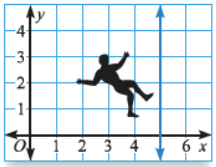
Positive slope
If the line rises,
the slope is *positive*.



Negative slope
If the line falls,
the slope is *negative*.

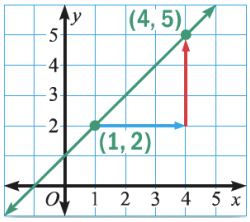


Zero slope
If the line is horizontal,
the slope is *zero*.



Undefined slope
If the line is vertical,
the slope is *undefined*.

Find the slope.

a) 

b) (-2, 5), (6, 1)

Graphing Equations Using Tables

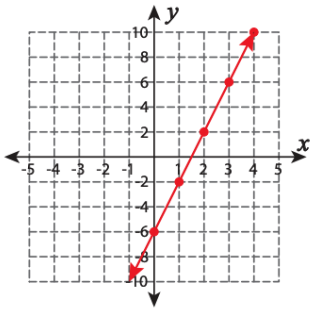
Graphing Equations Using Tables: The graph of an equation is the set of *all* points (x, y) that are solutions of the equation. The most basic method for graphing an equation is by using a table. To graph an equation using a table, plot at least two solutions and draw a line across these points.

Example:
Use a table to graph the equation y = 4x - 6.

x	0	1	2	3	4
y	−6	−2	2	6	10

Step #1. Choose a few values of x to make a table.

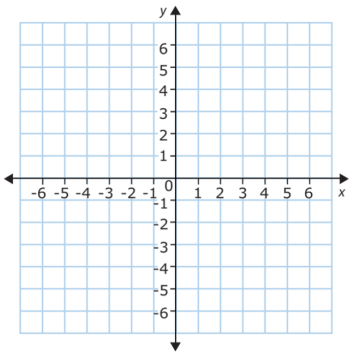
Step #2. Plot the solutions and draw a line across them. Although you can draw the graph with only two points, it is better to have more points to draw a more accurate graph.

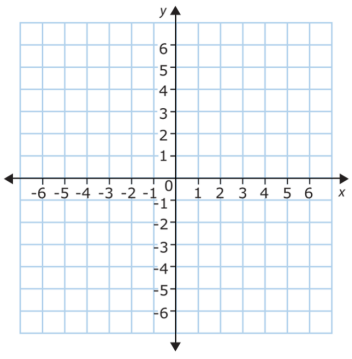


Graph the equation using a table.

a) y = 2x – 3

b) y = −5x + 2

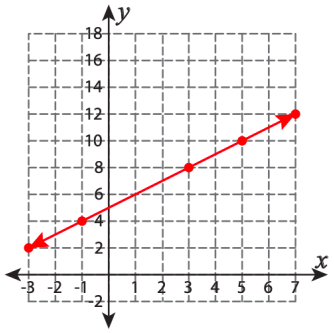




Writing Equations for Graphs

Writing Equations for Graphs: The most basic method is by finding the relationship between the *x*-values and *y*-values.

Example: Find the equation of the graph.

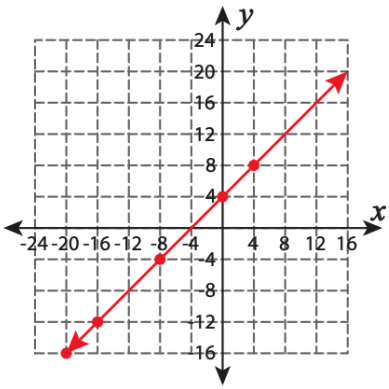


x	–3	–1	3	5	7
y	2	4	8	10	12

The *y*-values are always 5 more than the *x*-values.

So, the equation of the graph is $y = x+5$

Find the equation of the graph.



Intercepts

Intercept: The graph of a linear equation may cross either *x*-axis, or both.
***x*-intercept**: The *x*-coordinate of the point where the graph crosses the x-axis or when x = 0.
***y*-intercept**: The y-coordinate of the point where the graph crosses the y-axis or when y = 0.

Example: Find the intercepts of the graph y = 2x - 4.

- Find the *x*-intercept

$y = 2x - 4$

$0 = 2x - 4$ Find the value of *x* when *y* = 0.

$x = 2$

The *x*-intercept is 2 and the ordered pair is (2, 0).

- Find the *y*-intercept

$y = 2x - 4$

$y = 2(0) - 4$ Find the value of *y* when *x* = 0.

$y = -4$

The *y*-intercept is -4 and the ordered pair is (0, -4).

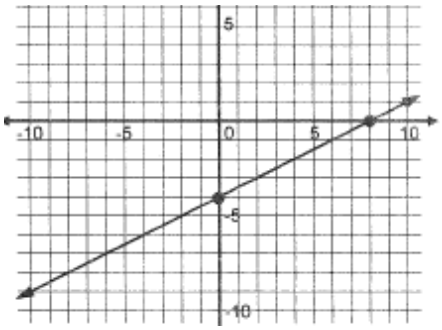
Graphing Equations Using Intercepts

Graphing Equations Using Intercepts: You can graph an equation using its intercepts. Remember that you can graph an equation if you can find at least two points that belong to the graph.

Example: Use the x-intercept and the y-intercept to graph the equation $y = \frac{1}{2}x - 4$.

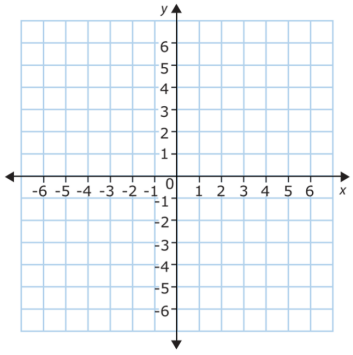
• Find the y-intercept.	• Find the x-intercept.
$y = \frac{1}{2}x - 4$	$y = \frac{1}{2}x - 4$
$y = \frac{1}{2} \cdot (0) - 4$	$0 = \frac{1}{2}x - 4$
$y = -4$	$x = 8$

The ordered pair for the *y*-intercept is (0, -4) and the *x*-intercept is (8, 0). Plot these two points on the coordinate plane and draw a line across these two points.



1. Find the intercepts of the equation's graph. Then graph the equation.

   a) 1.9x – 1.9y = 3.8



2. Determine whether each relation is a function. If it is, give the domain and the range.

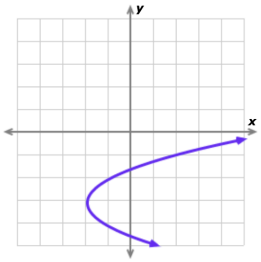
   a) {(-5, 5), (-3, 3), (0, 0), (-3, 6), (4, 4)}

   b) {(-2, 4), (-1, 1), (0, 0), (1, 1), (2, 4), (3, 9)}

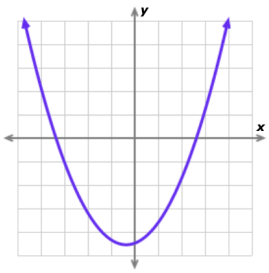
3. One solution for the equation $y = mx - 7$ is (2, 5). Find m.

4. Use the vertical-line test to tell whether the relation is a function.

a)



b)



c)

Input	Output
–7	3
–5	1
–5	–1
–7	–3

5. Find the values for each given function with the set of real numbers as the domain.

$$\mathbf{f(x) = x^2 + 3x}$$

a) $f(5)$

b) $f(-7)$

c) $f(0)$

6. Find the slope of the line that contains each pair of points.

a) (5, 3), (-1, 1)

b. (-3, 1), (4, 5)