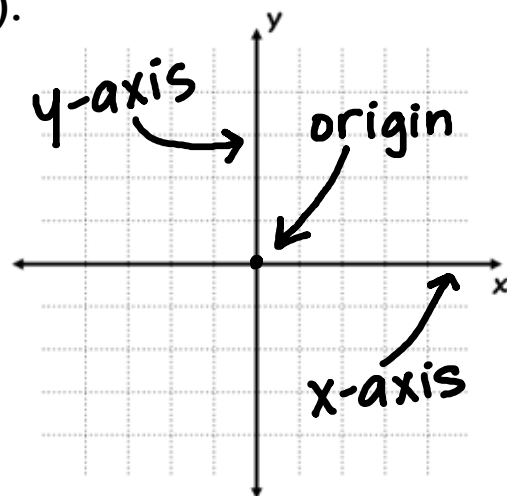


Cartesian Coordinate System

In algebra, we often use a graph to help us picture the solutions to an equation. In this workbook, we'll show the relationship between two variables using a Cartesian coordinate system (also called an xy-plane or coordinate plane).

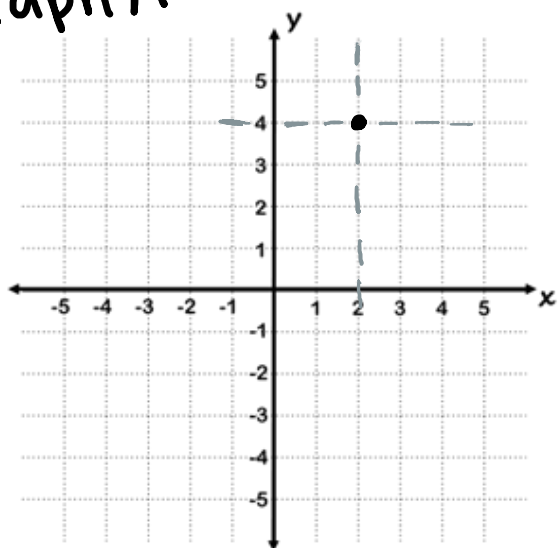
The xy-plane is formed by two lines: one horizontal line (x-axis) and one vertical line (y-axis). The point where the two lines meet is called the origin. We name points on the plane using an ordered pair in the form (x,y) .

*Note: The grid isn't necessary, but it makes it easier to spot points!

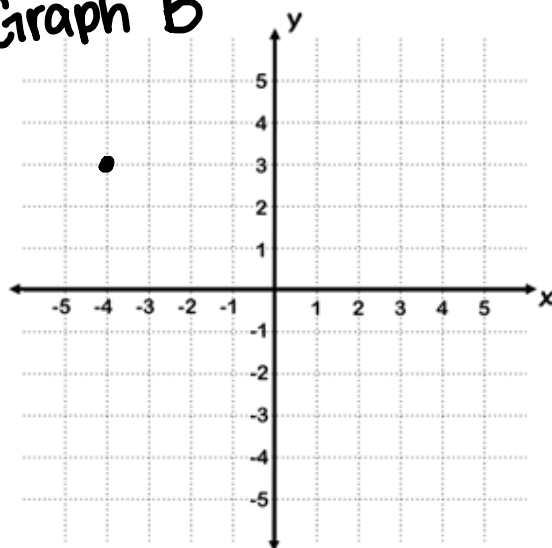


We obtain the x-coordinate of the ordered pair by counting how many spaces left or right from the origin we move. Similarly, we obtain the y-coordinate by counting how many spaces up or down we move from the origin.

Graph A



Graph B



Write the individual x and y coordinates and the ordered pair for the point on graph B.

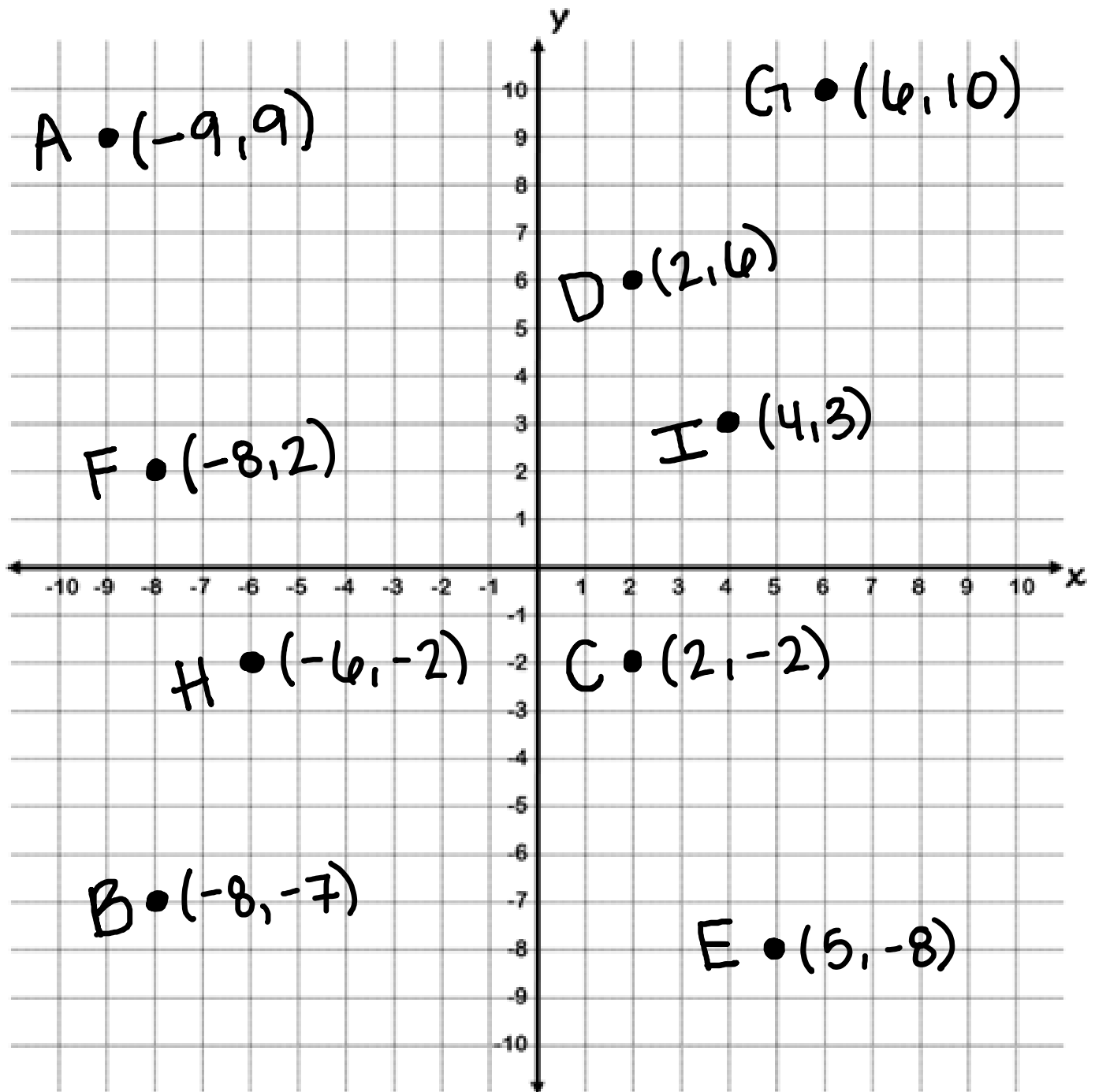
A: The x-coordinate is 2 and the y coordinate is 4.

The ordered pair is (2,4).

B: The x-coordinate is -4 and the y coordinate is 3.

The ordered pair is (-4,3).

Label each point on the xy-plane and write each ordered pair below.

A: $(-9, 9)$ B: $(-8, -7)$ C: $(2, -2)$ D: $(2, 6)$ E: $(5, -8)$ F: $(-8, 2)$ G: $(6, 10)$ H: $(-6, -2)$ I: $(4, 3)$

Plotting Points

Follow the steps to plot a point on the xy-plane.

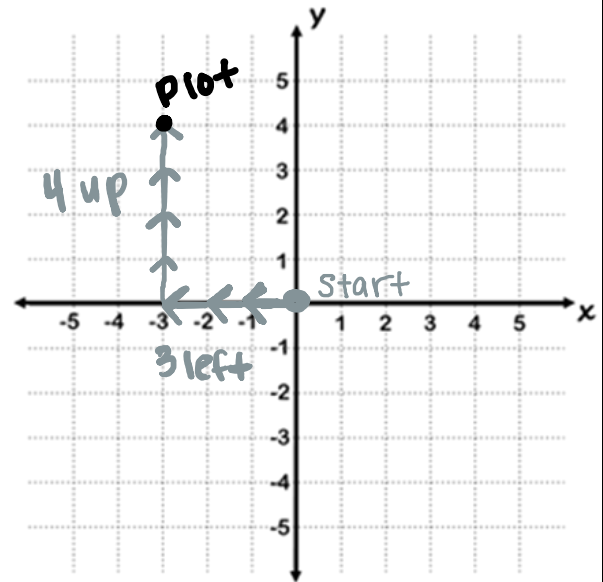
1. Start at the origin. Start at (0 , 0)

2. Move according to the x-coordinate: right for positive x-values & left for negative x-values. Move 3 spaces to the left.

3. Move according to the y-coordinate: up for positive y-values & down for negative y-values. Move 4 spaces up.

4. Plot your point! Plot!

Example: Plot (-3 , 4)



Plot the following points and label them according to the designated letter.

A. (2 , 3)

B. (-5 , -7)

C. (-8 , 1)

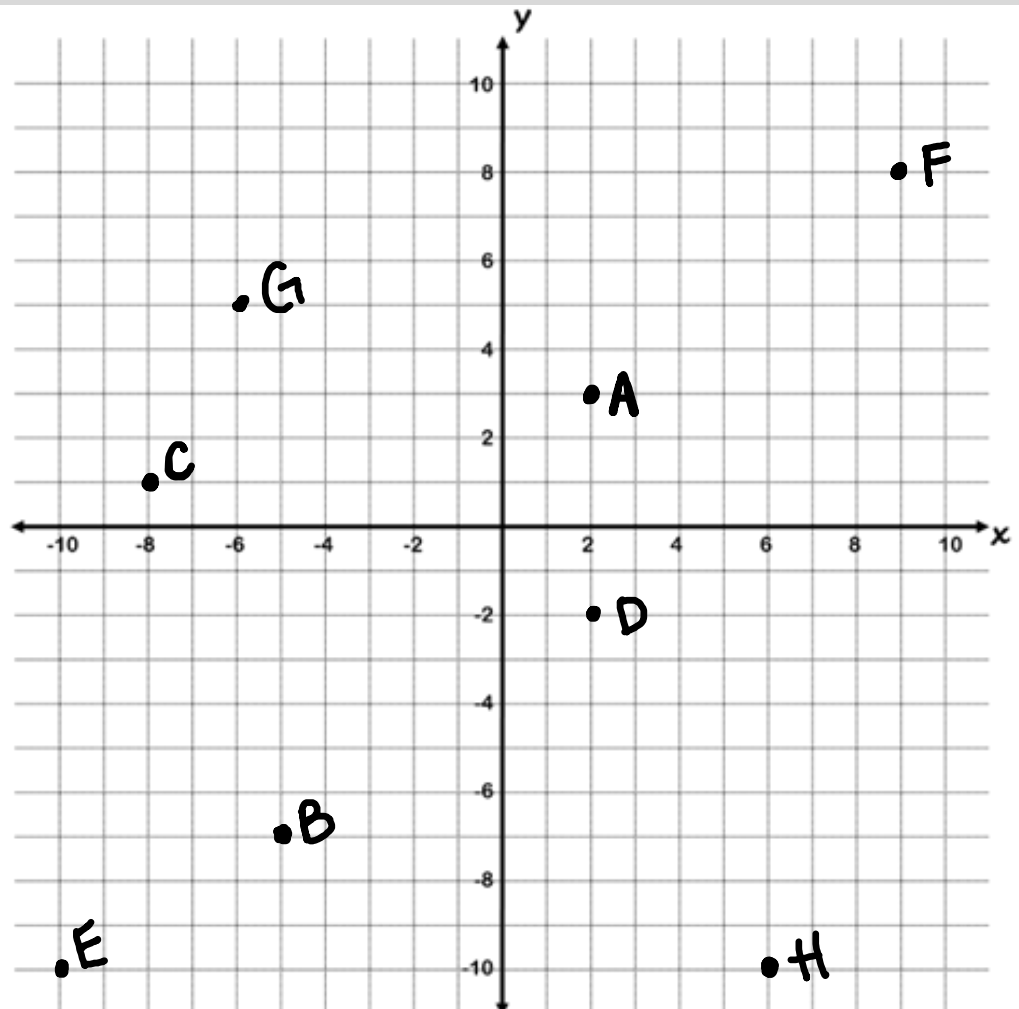
D. (2 , -2)

E. (-10 , -10)

F. (9 , 8)

G. (-6 , 5)

H. (6 , -10)

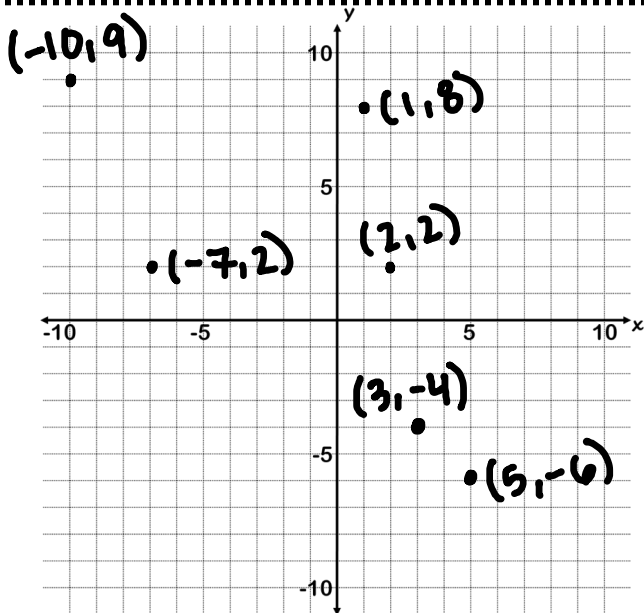
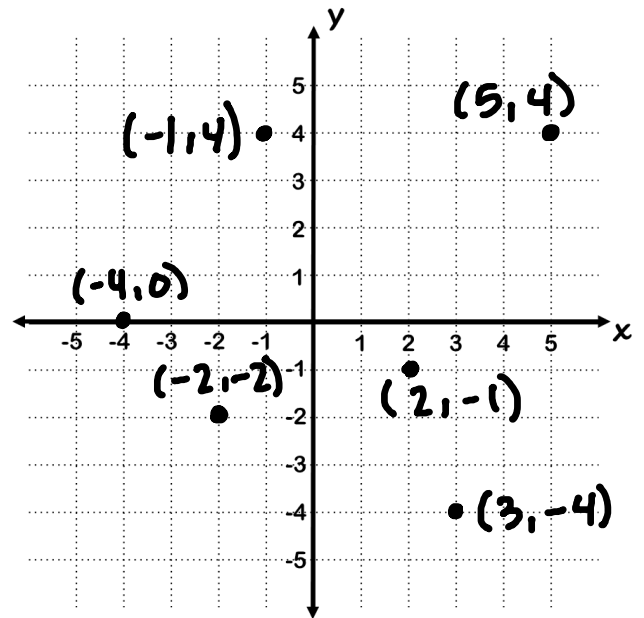


Plot each point. Then, label each point with its coordinates.

1) $(-2, -2)$ 4) $(-1, 4)$

2) $(2, -1)$ 5) $(-4, 0)$

3) $(3, -4)$ 6) $(5, 4)$



1) $(-7, 2)$ 4) $(2, 2)$

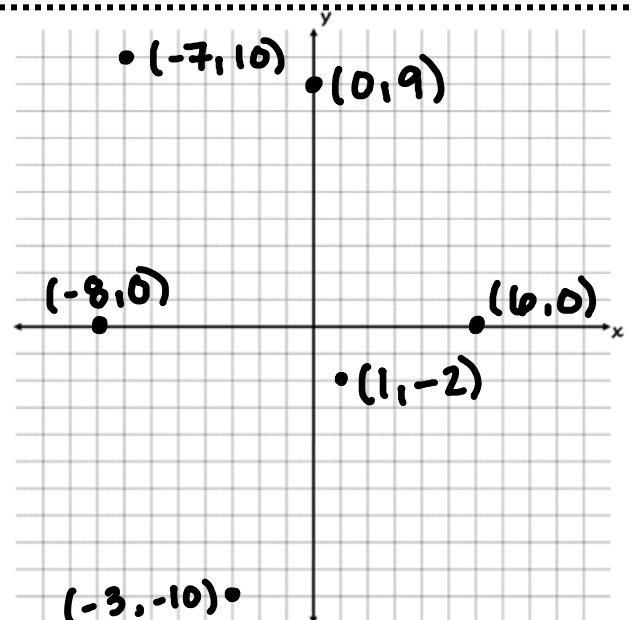
2) $(5, -6)$ 5) $(3, -4)$

3) $(-10, 9)$ 6) $(1, 8)$

1) $(0, 9)$ 4) $(-8, 0)$

2) $(-3, -10)$ 5) $(1, -2)$

3) $(6, 0)$ 6) $(-7, 10)$



Graphing with a Table of Values

The reason to use an xy-plane is not generally to plot random points, but instead to visualize data or to show a picture of the solutions to an equation.

First, decide where to draw the x and y axes. Then, plot the points given in each xy-table.

x	y
-5	0
-3	5
-1	0
1	-5
3	-10
5	-5
7	0
9	5
11	10
13	5
15	0

x-values range

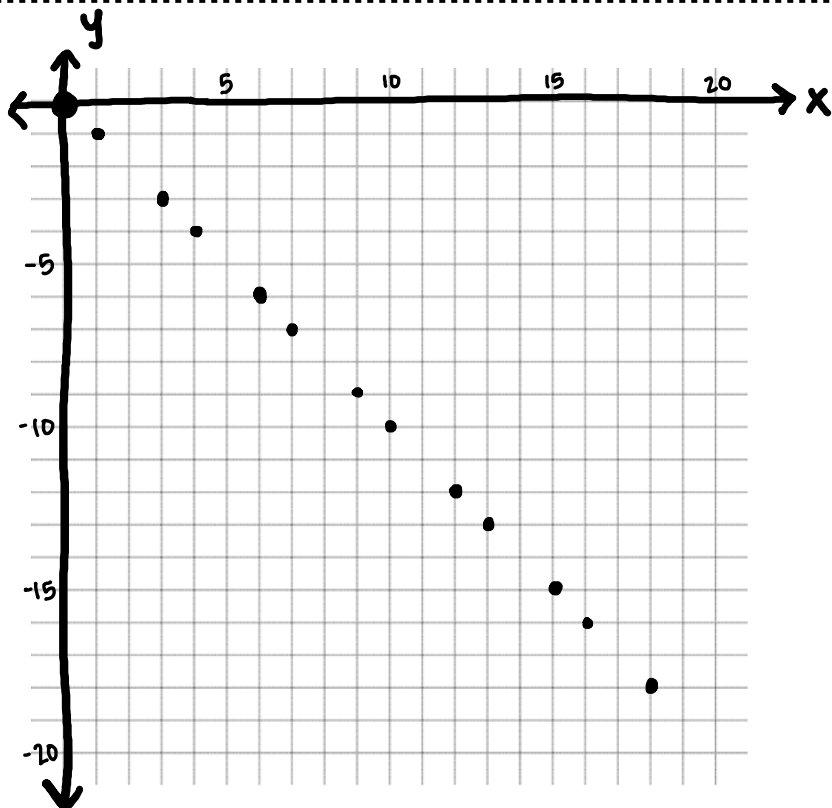
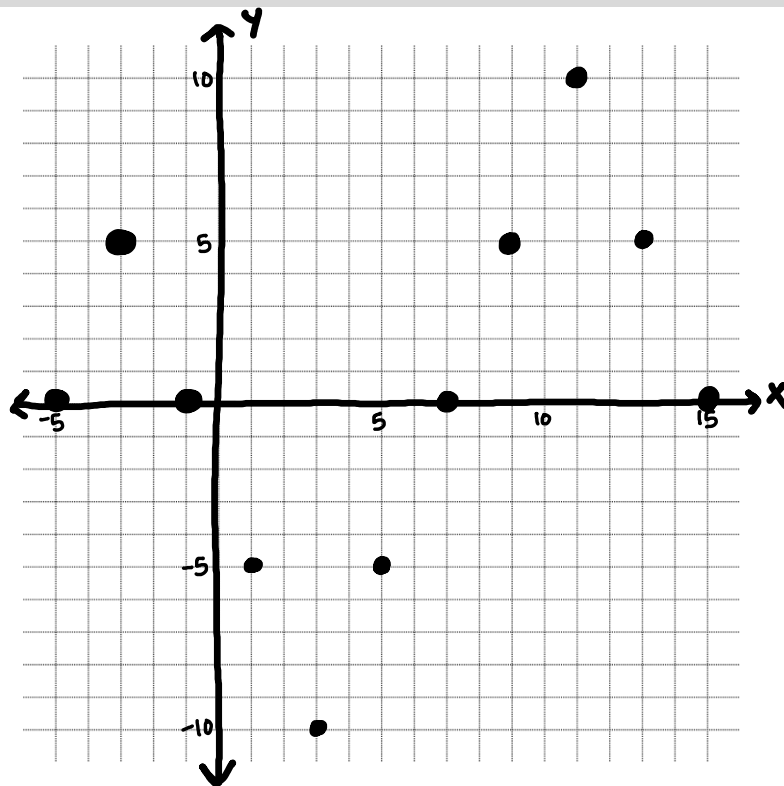
from -5 to 15.

* we should leave more room for positive x-values.

y-values range

from -10 to 10.

* we should draw the y-axis in the middle.



x-values range

from 0 to 18.

y-values range

from -18 to 0.

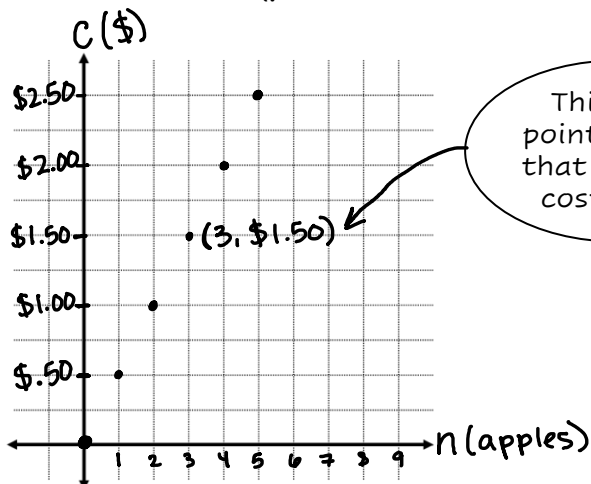
x	y
0	0
1	-1
3	-3
4	-4
6	-6
7	-7
9	-9
10	-10
12	-12
13	-13
15	-15
16	-16
18	-18

Connecting the Dots

Sometimes when we plot points on a graph we connect the points, other times we don't. If we do connect the points, we can either use a straight line or a curve. First, let's discover when to connect the points, and when not to.

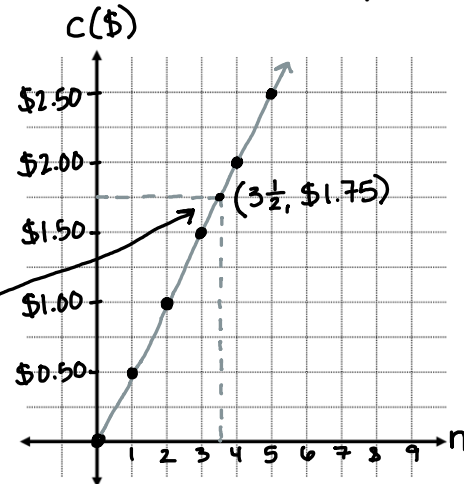
These graphs show the cost (c) of n number of apples.

The first graph shows discrete data (points are not connected). The second graph shows continuous data (points are connected). Any point along the line should be taken as a data point.



This data point tells us that 3 apples cost \$1.50.

This data point tells us that $3\frac{1}{2}$ apples cost \$1.75.



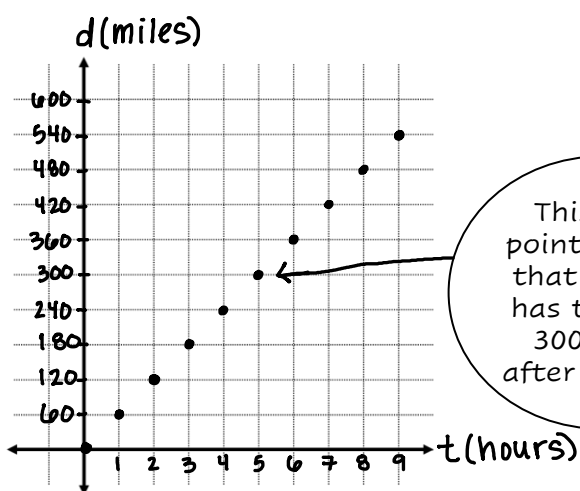
Does it make sense to buy a half an apple from the grocery store?

no

Is the cost of apples data meant to be discrete or continuous?

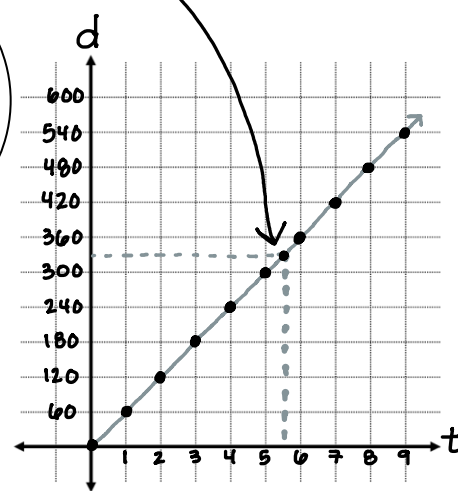
discrete

These graphs show the distance in miles (d) a car moving at 60 mph has traveled after t hours.



This data point tells us that the car has traveled 300 miles after 5 hours.

This data point tells us that the car has traveled 330 miles after $5\frac{1}{2}$ hours.



Does it make sense for the car to have traveled 30 miles in the additional half hour of driving?

yes

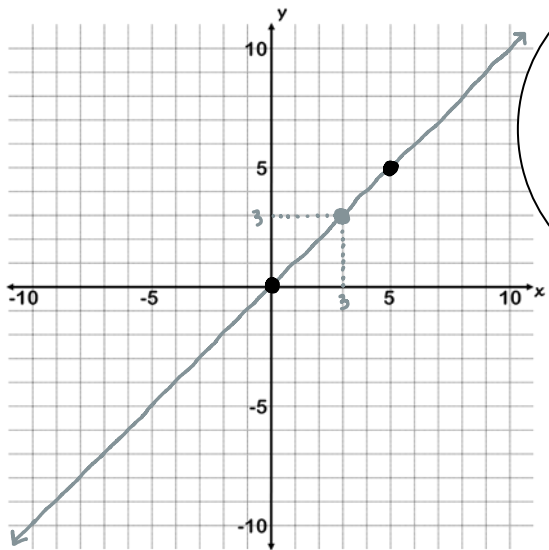
Is the distance data meant to be discrete or continuous?

continuous

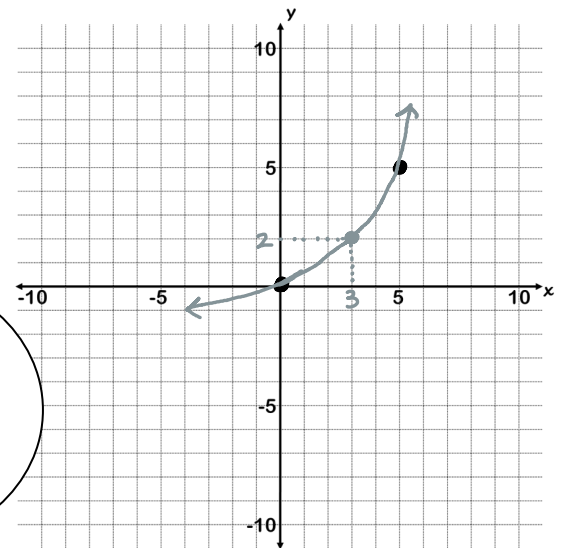
Now, let's figure out when to connect the points using a straight line, and when to use a curved line.

This graph shows a relationship between x and y where $x = y$.

The first graph shows a linear relationship between x and y . The second graph shows the points connected with a curved line.



If we connect the points with a straight line, $(3, 3)$ is a point on the graph.

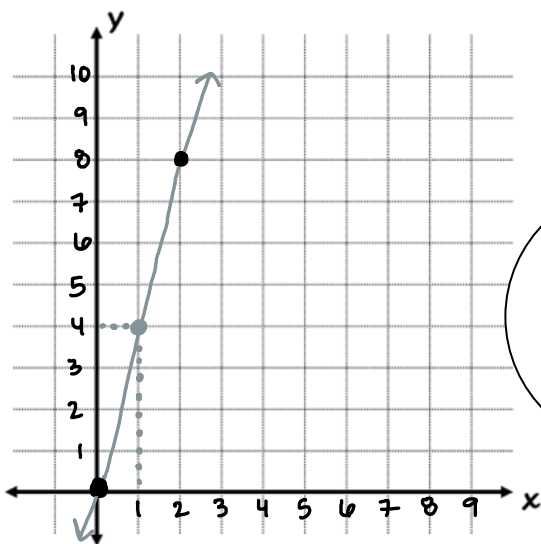


If we connect the points using a curved line, $(3, 2)$ is a point on the graph.

Since we know the graph is meant to represent $x = y$, should we use a straight or curved line to graph this relationship?

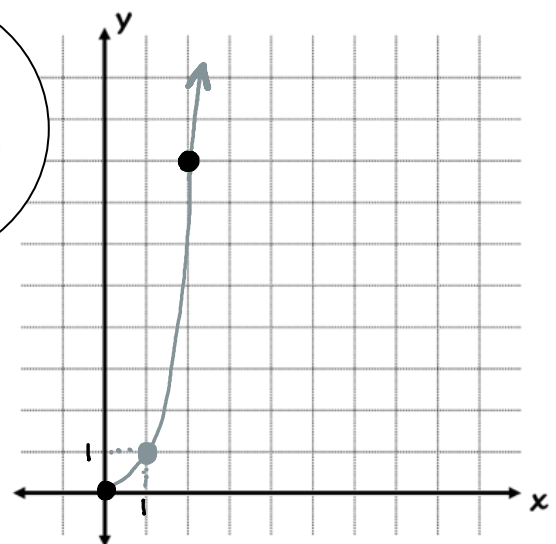
straight line

This graph is meant to show a relationship between x and y where $y = x^3$.



Using a straight line, we can see that $(1, 4)$ is a point on the graph.

Using a curved line, we can see that $(1, 1)$ is a point on the graph.

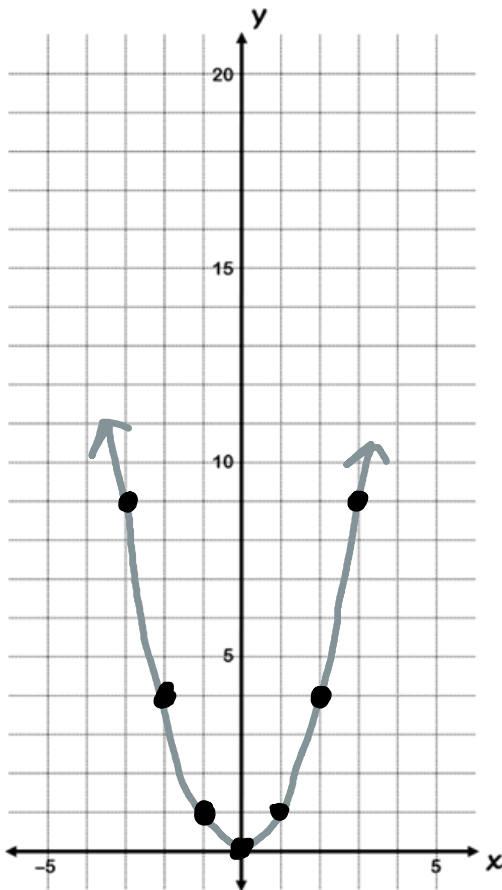


Since we know the graph is meant to represent $y = x^3$, should we use a straight or curved line to graph this relationship?

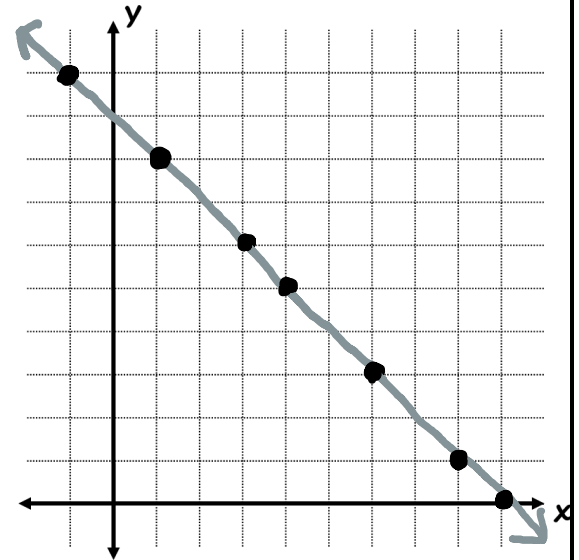
curved line

Plot the points given in each table, then connect the points with a curved line or a straight line.

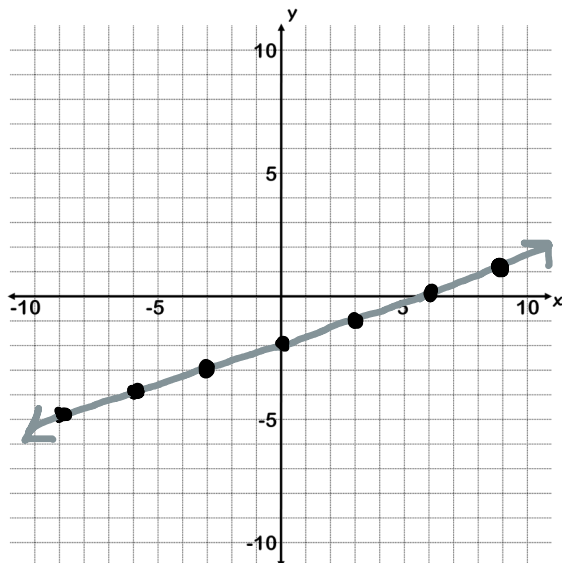
x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



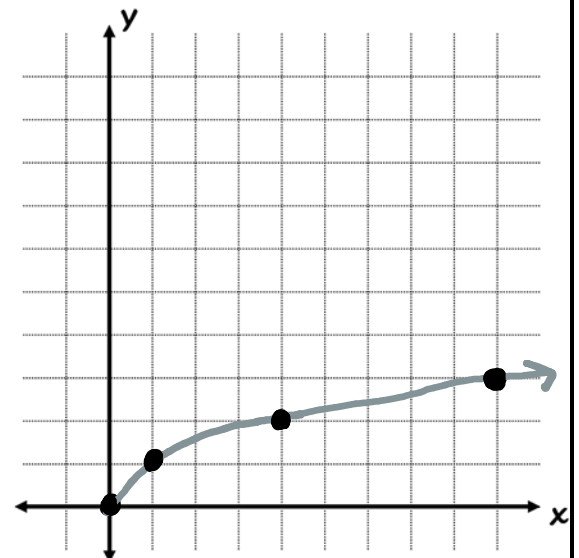
x	y
-1	10
1	8
3	6
4	5
6	3
8	1
9	0



x	y
-9	-5
-6	-4
-3	-3
0	-2
3	-1
6	0
9	1



x	y
9	3
4	2
1	1
0	0



Graphing Equations

You already know how to plot a graph given a table of ordered pairs, now start with an equation and make your own table. Solve for y for each given value of x and then write the solution in the table. Graph your coordinates

$$-2(-8) + y = 5$$

$$\begin{array}{r} 16 + y = 5 \\ -16 \quad -16 \\ \hline y = -11 \end{array}$$

$$(-8, -11)$$

$$-2(-6) + y = 5$$

$$12 + y = 5$$

$$y = -7$$

$$(-6, -7)$$

$$-2(-3) + y = 5$$

$$6 + y = 5$$

$$y = -1$$

$$(-3, -1)$$

$$-2x + y = 5$$

x	y
-8	-11
-6	-7
-3	-1
1	7
4	13
6	17

$$-2(1) + y = 5$$

$$-2 + y = 5$$

$$y = 7$$

$$(1, 7)$$

$$-2(4) + y = 5$$

$$-8 + y = 5$$

$$y = 13$$

$$(4, 13)$$

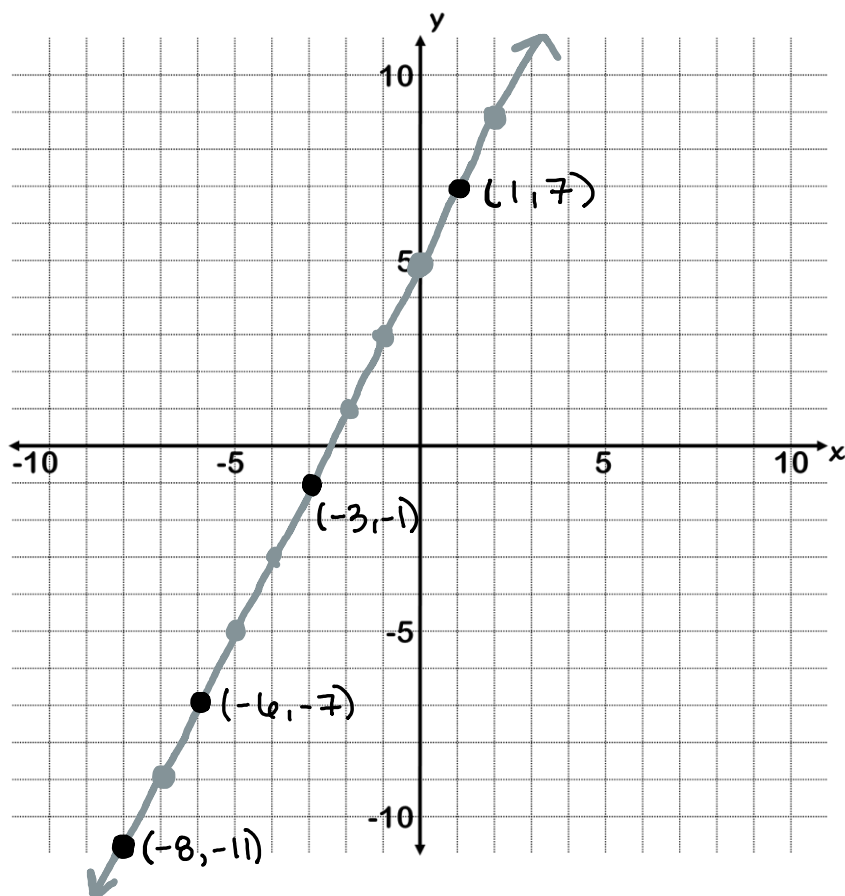
$$-2(6) + y = 5$$

$$-12 + y = 5$$

$$y = 17$$

$$(6, 17)$$

* note: you don't need to graph points that exceed the graph size.



Using the graph, find 3 additional solutions to $-2x + y = 5$.

1. $(-2, 1)$

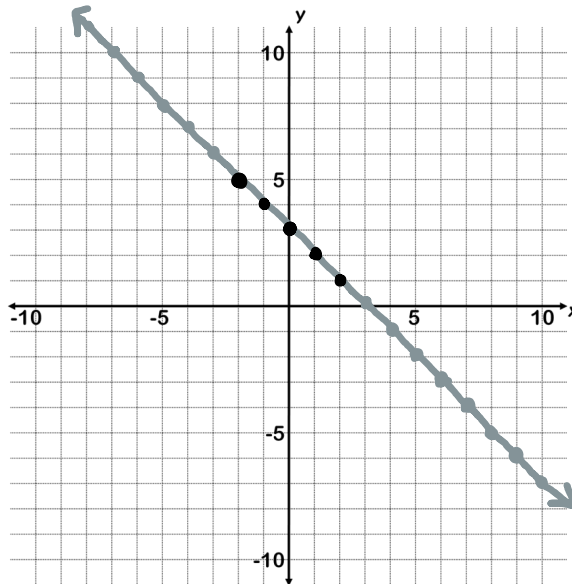
2. $(0, 5)$

3. $(2, 9)$

Finish each table of solutions, graph each equation, and find 2 additional solutions to each equation using the graph.

$$x + y = 3$$

x	y
-2	5
-1	4
0	3
1	2
2	1



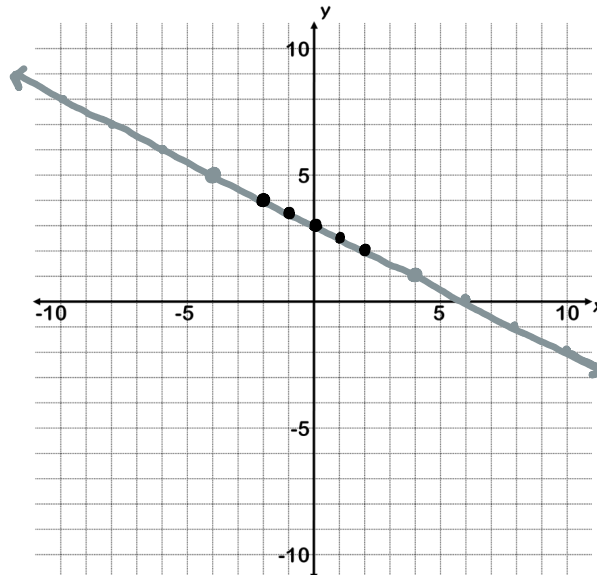
2 additional points:

1. (10, -7)

2. (-5, 8)

$$x + 2y = 6$$

x	y
-2	4
-1	3.5
0	3
1	2.5
2	2



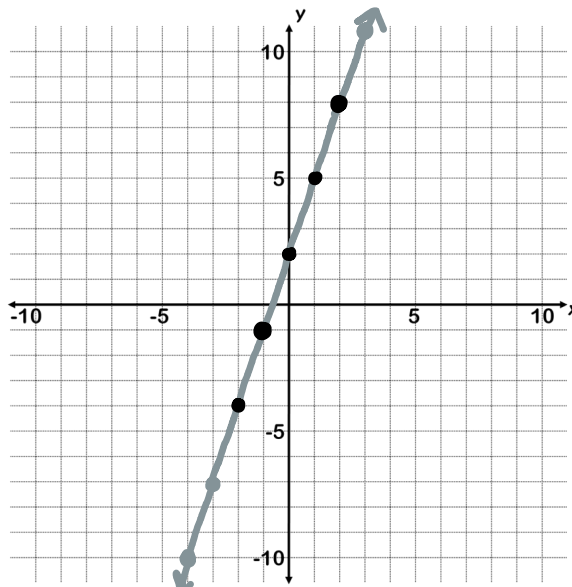
2 additional points:

1. (-4, 5)

2. (4, 1)

$$3x - y = -2$$

x	y
-2	-4
-1	-1
0	2
1	5
2	8



2 additional points:

1. (-3, -7)

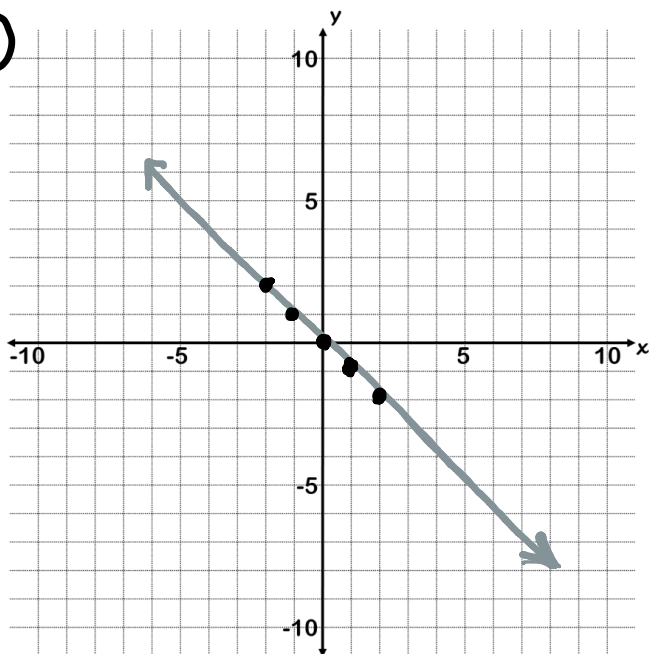
2. (-4, -10)

Make a table of solutions. Your x-coordinates should include: a negative coordinate, a positive coordinate, and 0. Then, graph your solutions.

1.) $x = -y$

x	y
-2	2
-1	1
0	0
1	-1
2	-2

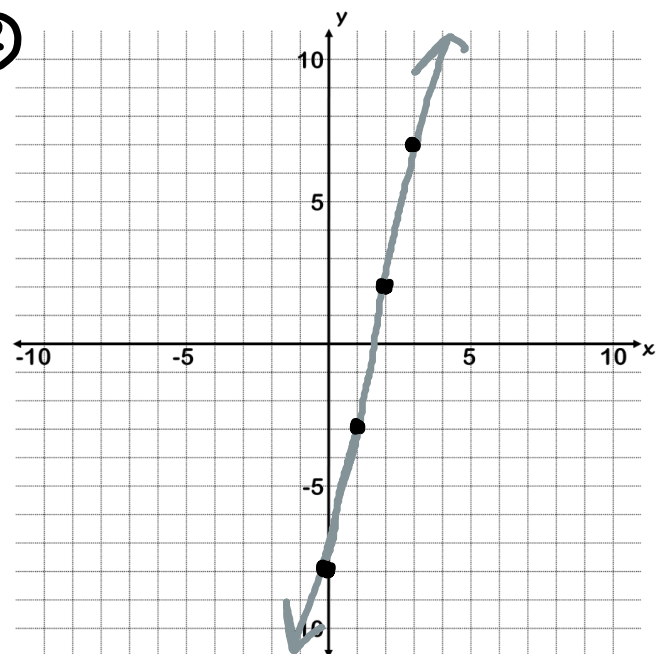
①



2.) $5x - y = 8$

x	y
-1	-13
0	-8
1	-3
2	2
3	7

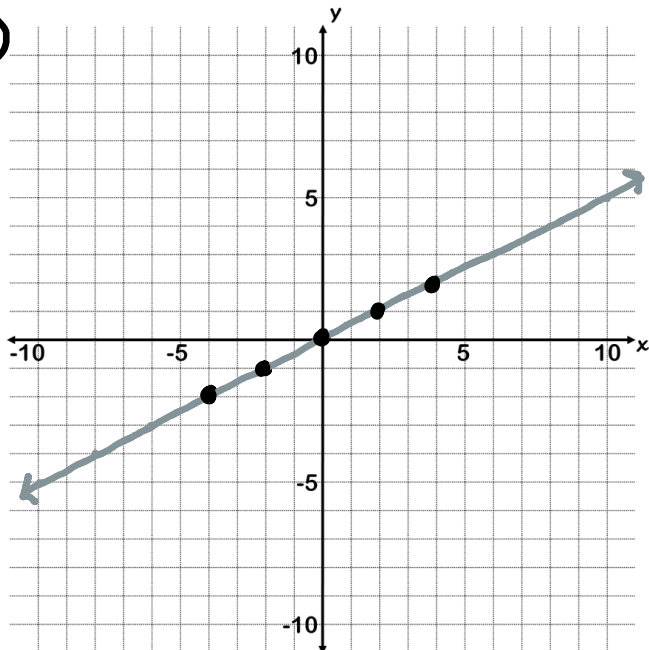
②



3.) $x = 2y$

x	y
-4	-2
-2	-1
0	0
2	1
4	2

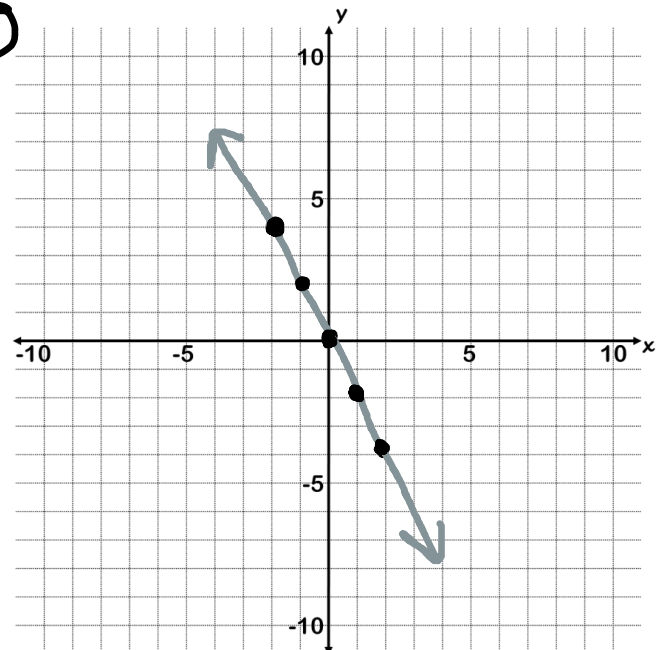
③



4.) $2x + y = 0$

x	y
-2	4
-1	2
0	0
1	-2
2	-4

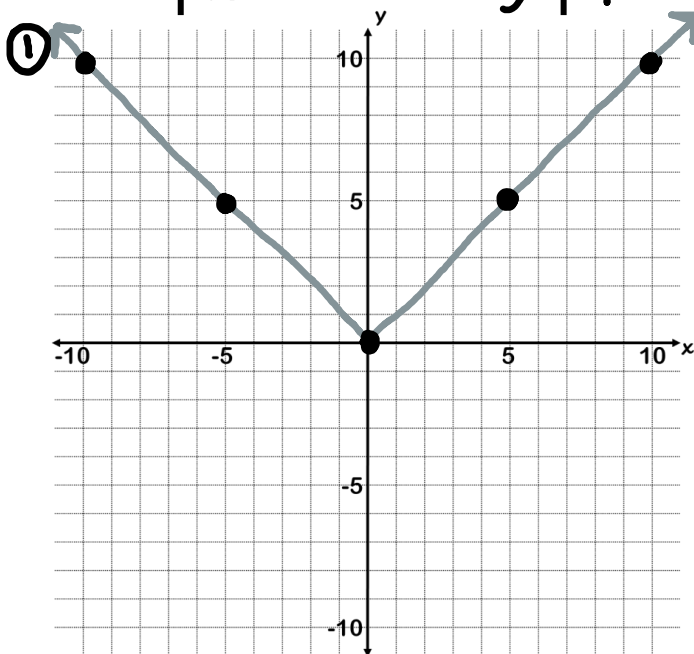
④



Make a table of solutions. Your x-coordinates should include: a negative coordinate, a positive coordinate, and 0. Then, graph your solutions.

1.) $y = |x|$

x	y
-10	10
-5	5
0	0
5	5
10	10



2.) $y = \frac{3x - 1}{2}$

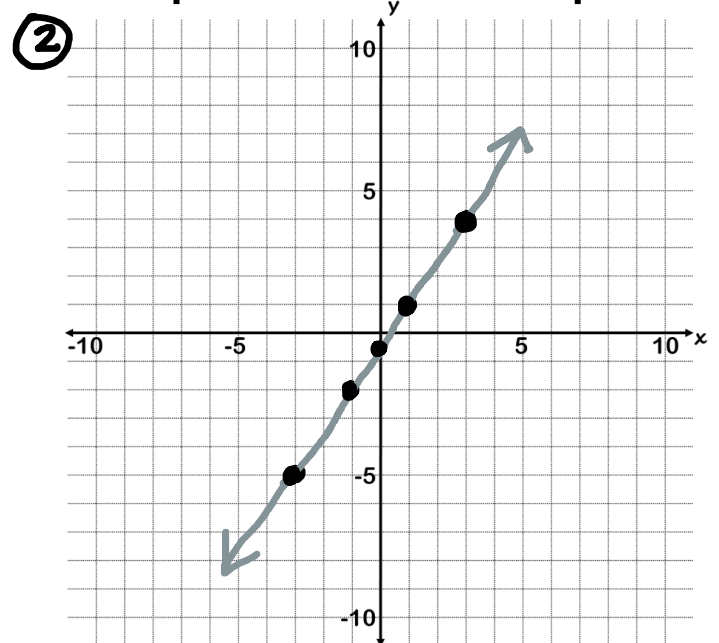
x	y
-3	-5
-1	-2
0	$-\frac{1}{2}$
1	1
3	4

3.) $y = |x - 2|$

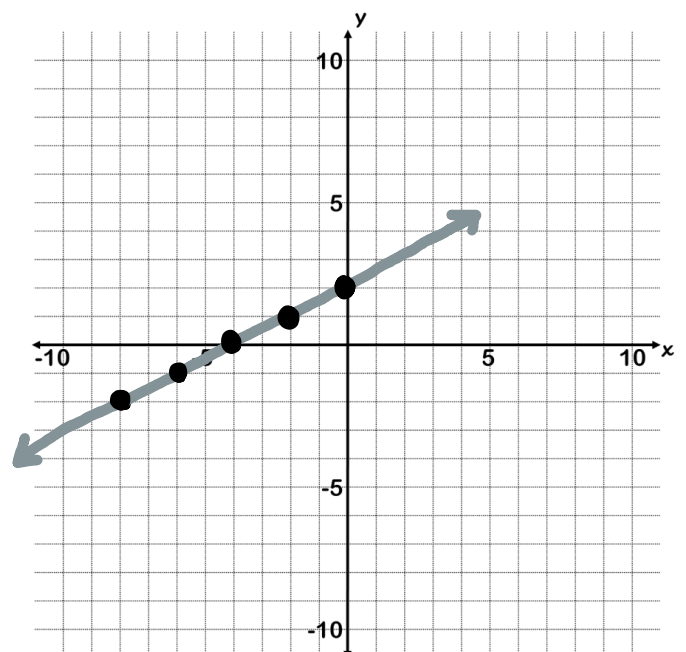
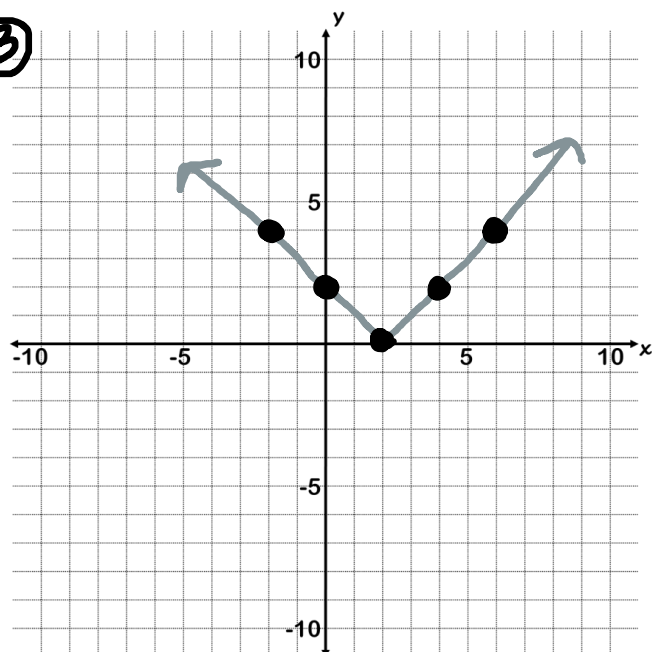
x	y
-2	4
0	2
2	0
4	2
6	4

4.) $y = \frac{x + 4}{2}$

x	y
-8	-2
-6	-1
-4	0
-2	1
0	2



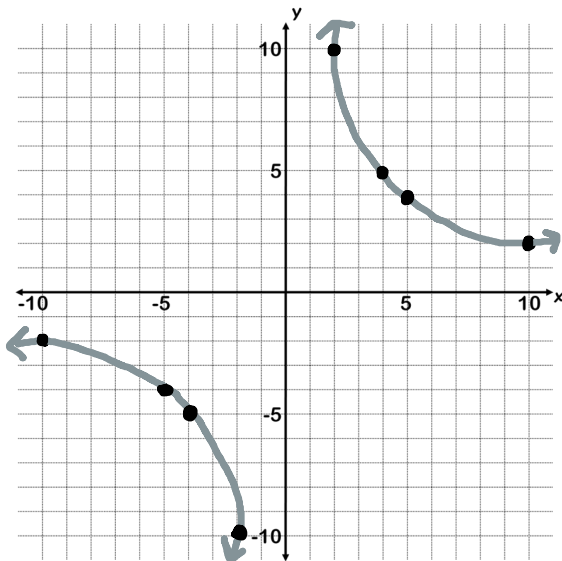
③



Finish each table of solutions. Then, graph your solutions. Be careful on these, none of them should include straight lines.

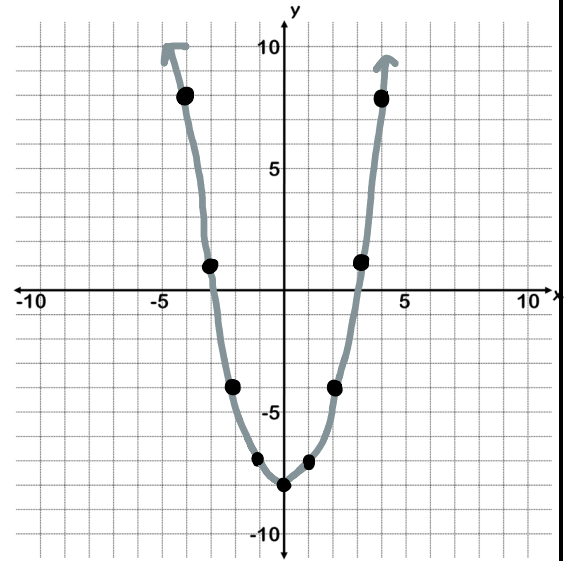
$$y = \frac{20}{x}$$

x	y
-10	-2
-5	-4
-4	-5
-2	-10
2	10
4	5
5	4
10	2



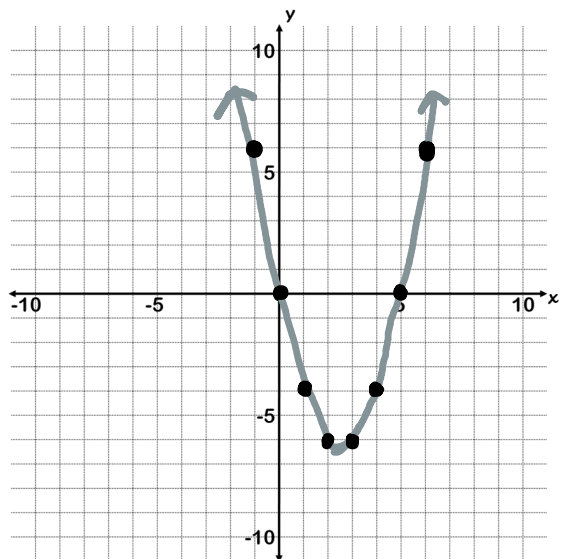
$$y = x^2 - 8$$

x	y
-4	8
-3	1
-2	-4
-1	-7
0	-8
1	-7
2	-4
3	1
4	8



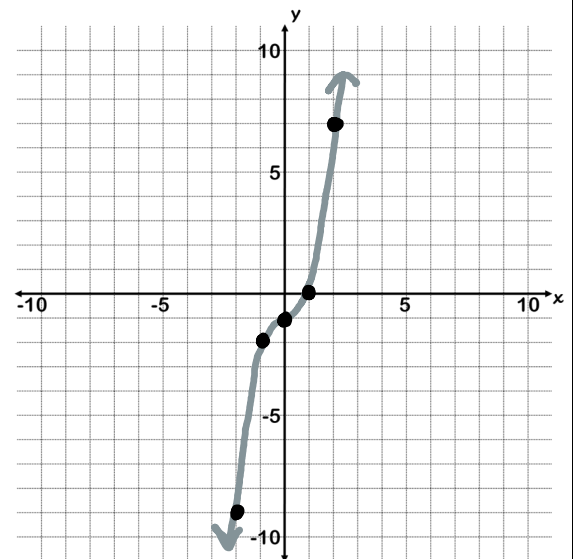
$$y = x^2 - 5x$$

x	y
-1	6
0	0
1	-4
2	-6
3	-6
4	-4
5	0
6	6



$$y = x^3 - 1$$

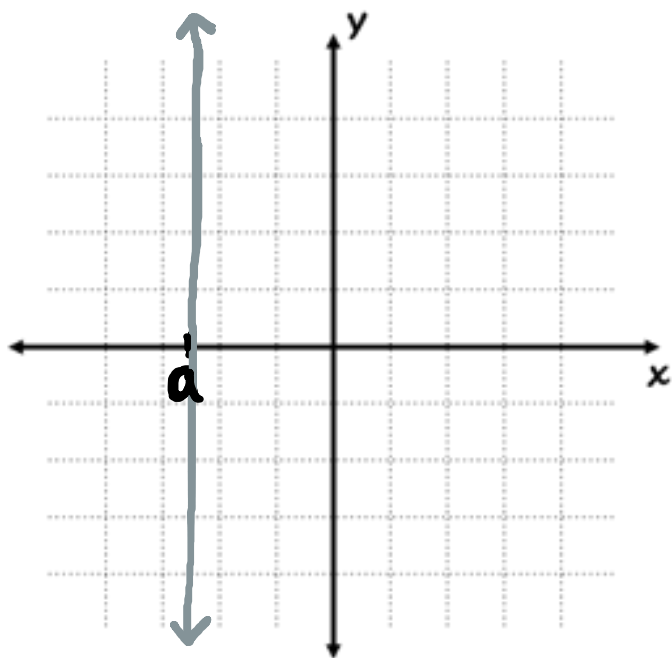
x	y
-2	-9
-1	-2
0	-1
1	0
2	7



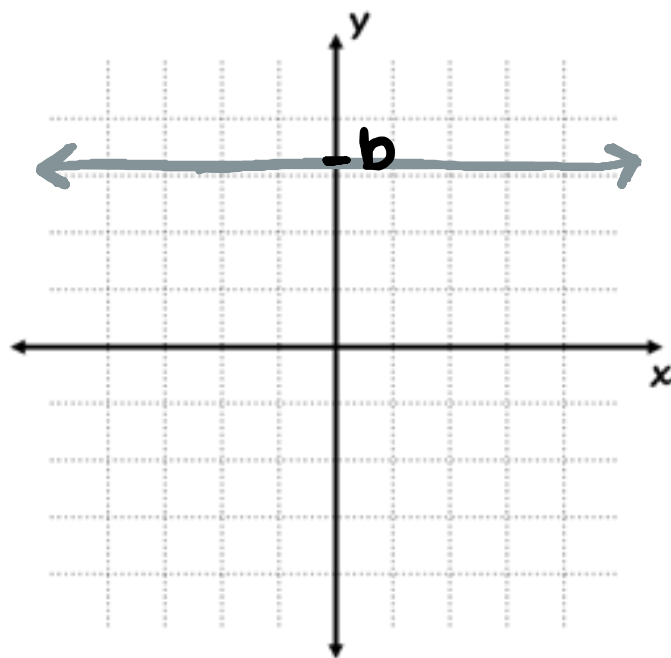
Graphing Vertical and Horizontal Lines

So far, we've graphed equations with two variables, but what happens if we have an equation with only one variable?

Vertical Line: $x = a$



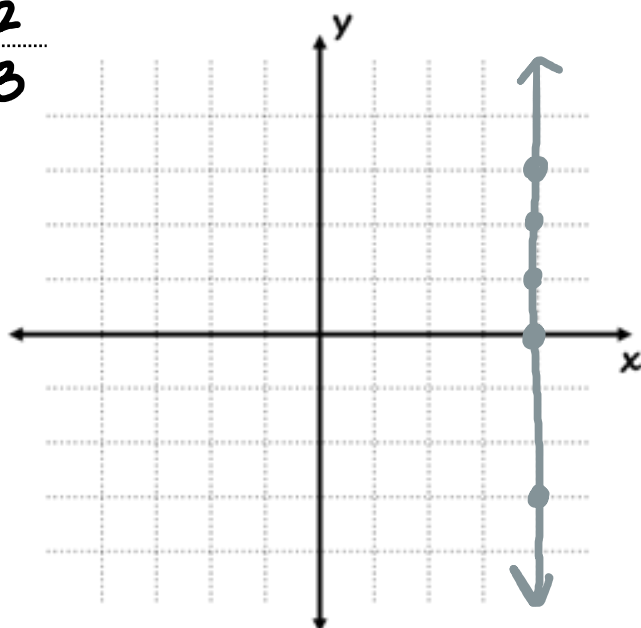
Horizontal Line: $y = b$



Make a table of solutions and graph each line.

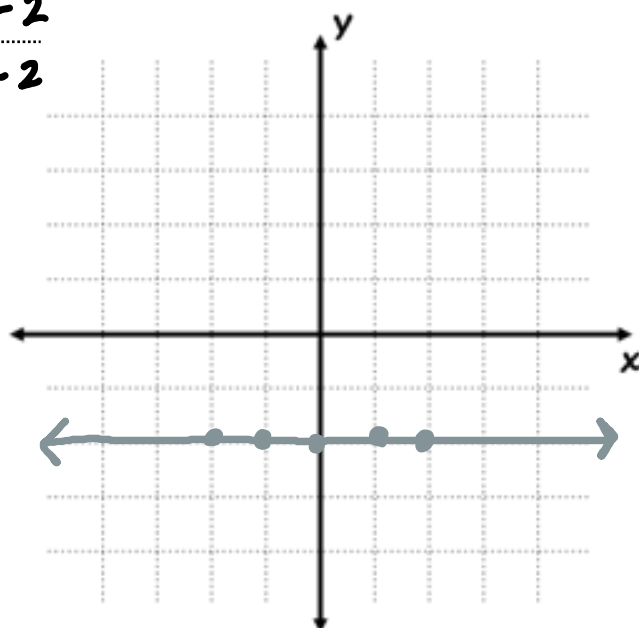
x	y
4	-3
4	0
4	1
4	2
4	3

$x = 4$



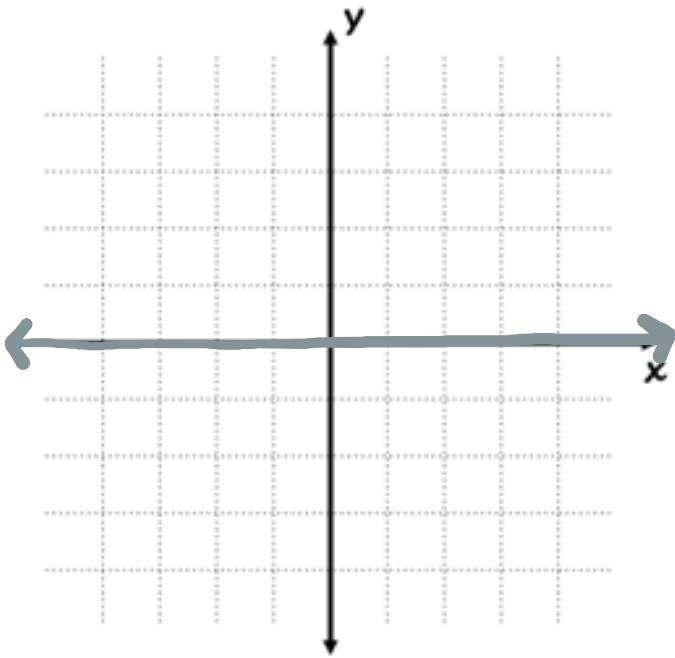
x	y
-2	-2
-1	-2
0	-2
1	-2
2	-2

$y = -2$

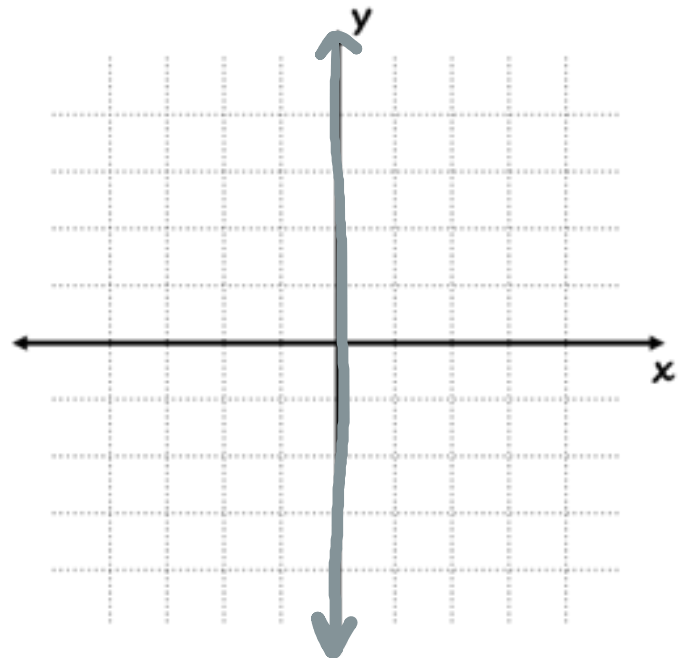


Graph each line.

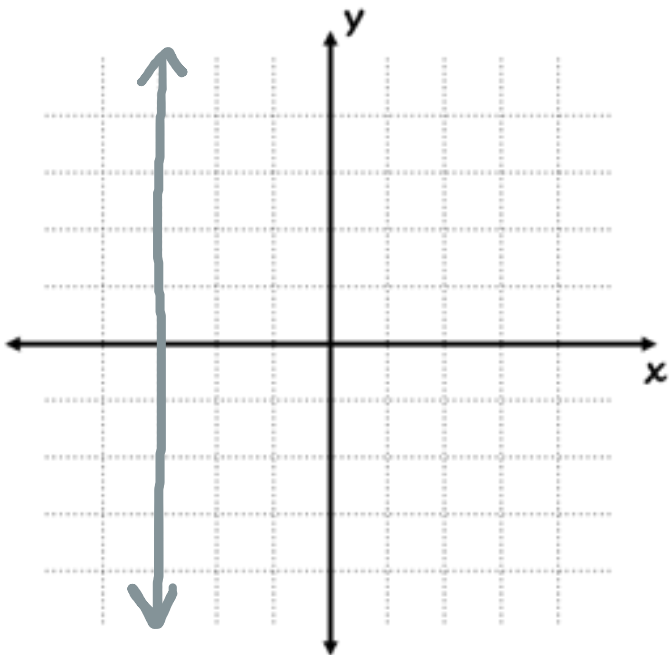
$$y = 0$$



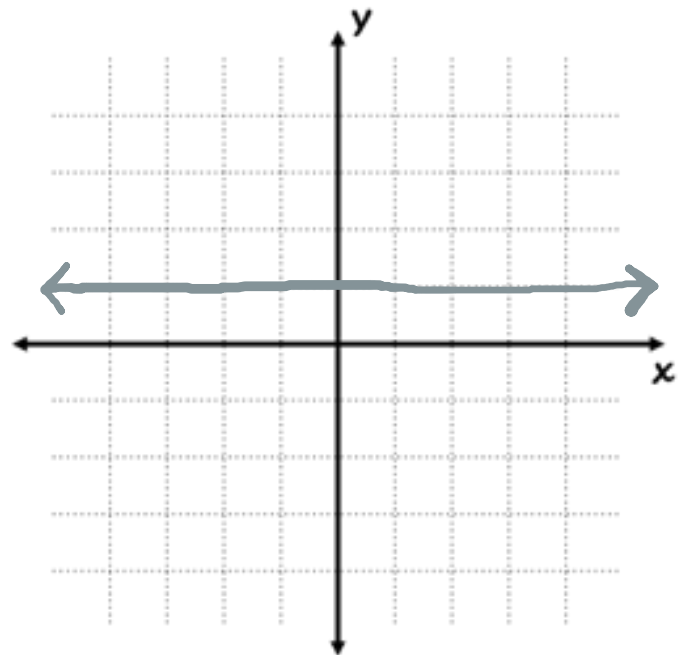
$$x = 0$$



$$x = -3$$



$$y = 1$$



Practice Test

Plot the following points and label them according to the designated letter.

A. (-5 , 1)

B. (3 , -2)

C. (-9 , 10)

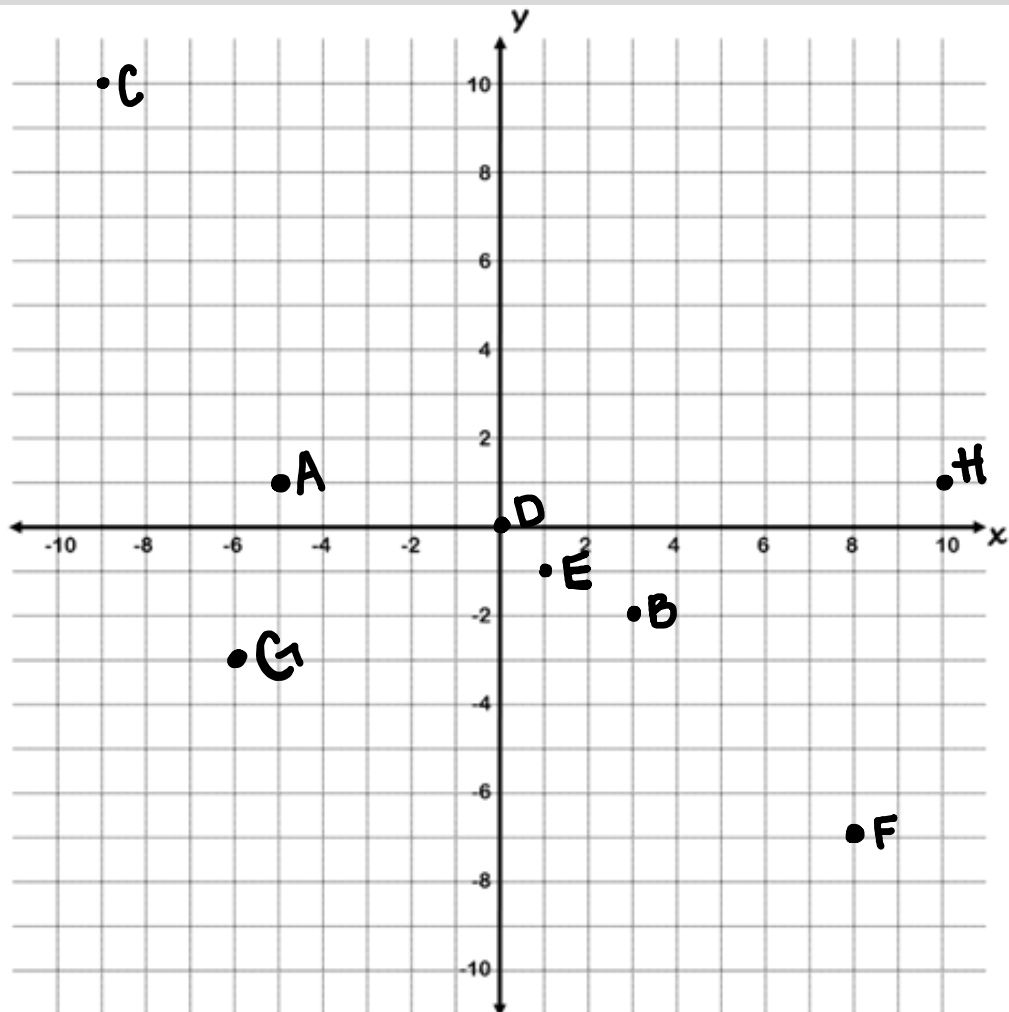
D. (0 , 0)

E. (1 , -1)

F. (8 , -7)

G. (-6 , -3)

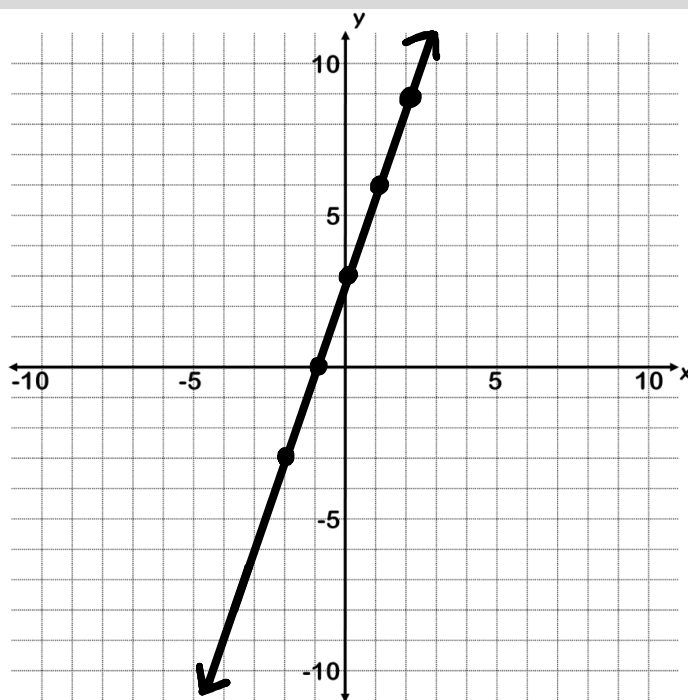
H. (10 , 1)



Finish the table and graph the equation. Then find the slope, x-intercept, and y-intercept.

$$3x - y = -3$$

x	y
-2	-3
-1	0
0	3
1	6
2	9

slope: 3x-int: (-1, 0)y-int: (0, 3)