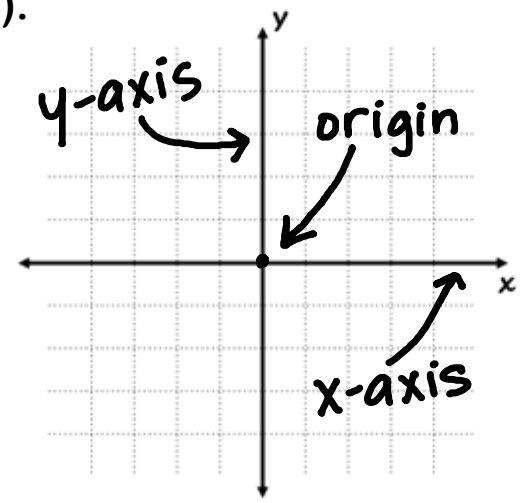
Cartesian Coordinate System

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).

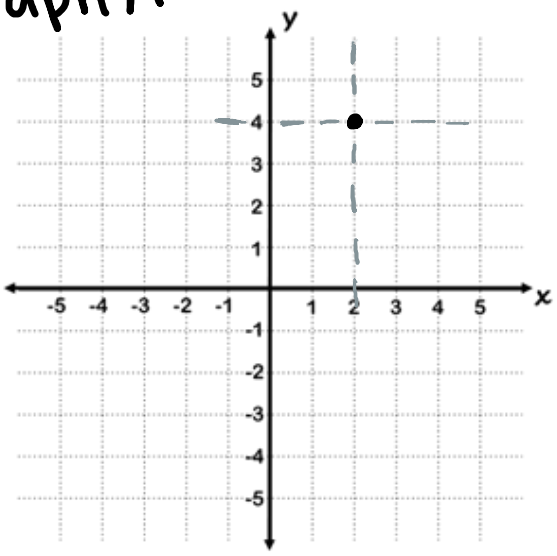
The xy-plane is formed by two lines: one horizontal line (x-axis) and one vertical line (y-axis). The point where the two lines meet is called the origin. We name points on the plane using an ordered pair in the form (x,y).

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

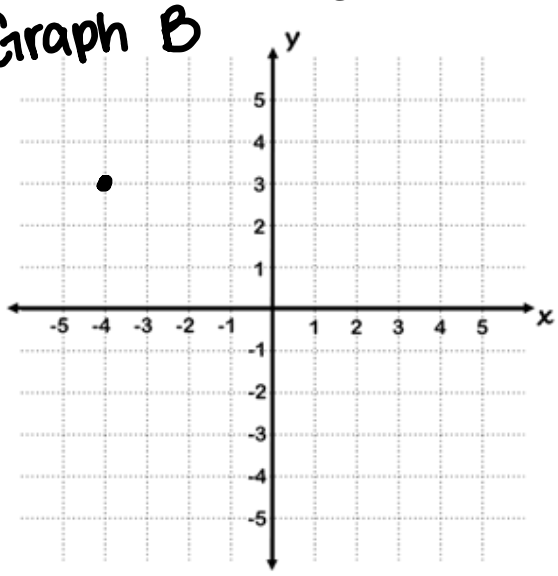


We obtain the x-coordinate of the ordered pair by counting how many spaces left or right from the origin we move. Similarly, we obtain the y-coordinate by counting how many spaces up or down we move from the origin.

Graph A



Graph B



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

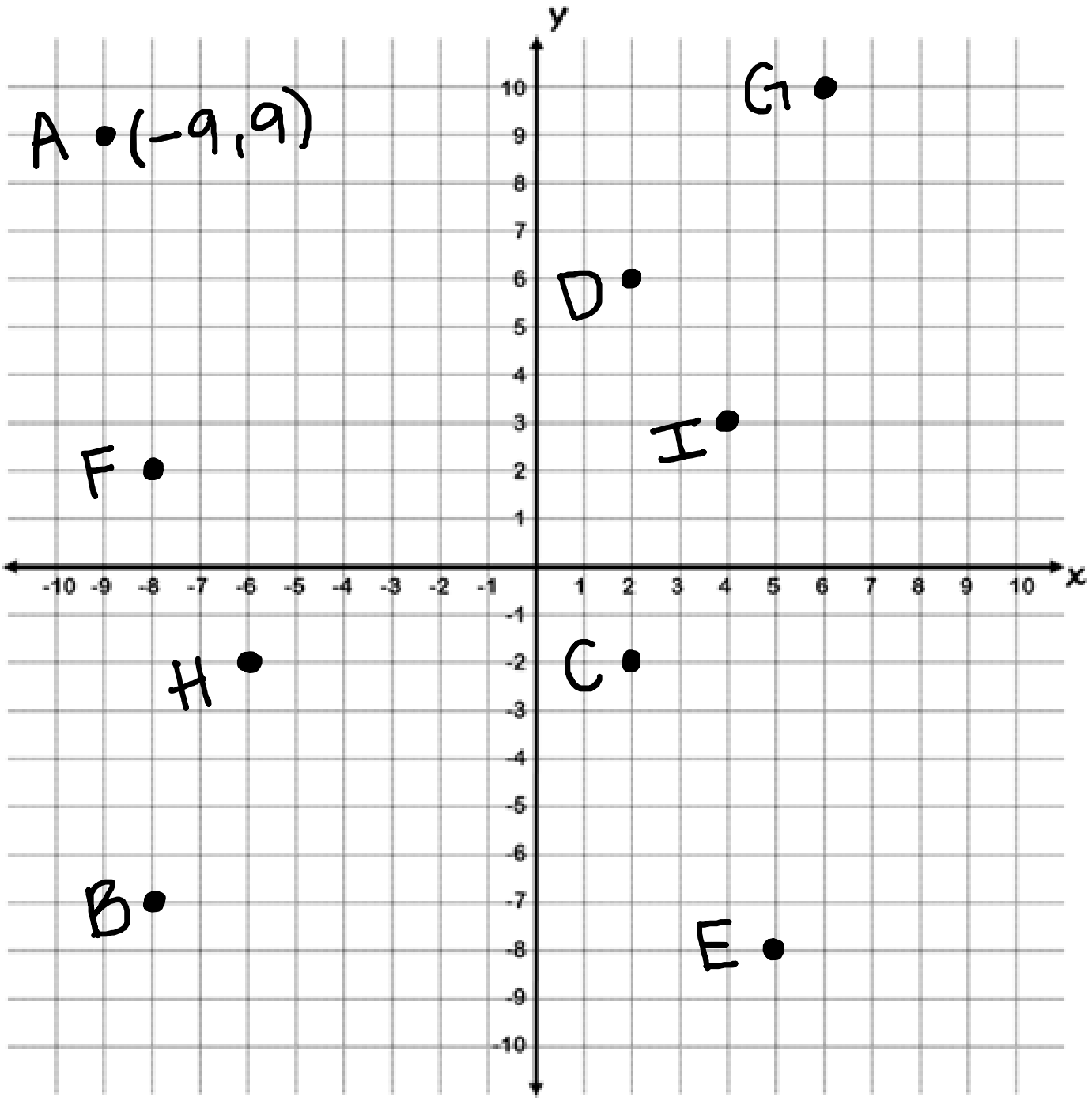
A: The x-coordinate is 2 **and the y coordinate is** 4**.**

The ordered pair is (2, 4)**.**

B: The x-coordinate is ____ and the y coordinate is ____.

The ordered pair is _____.

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



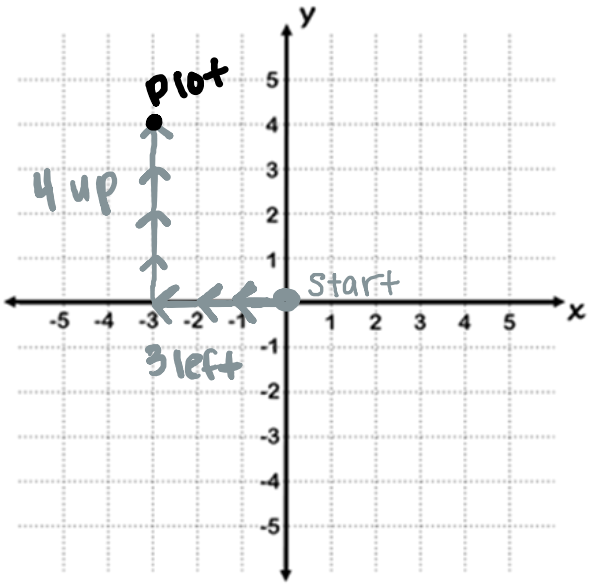
A: (-9,9)	**B:**	**C:**
D:	**E:**	**F:**
G:	**H:**	**I:**

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)

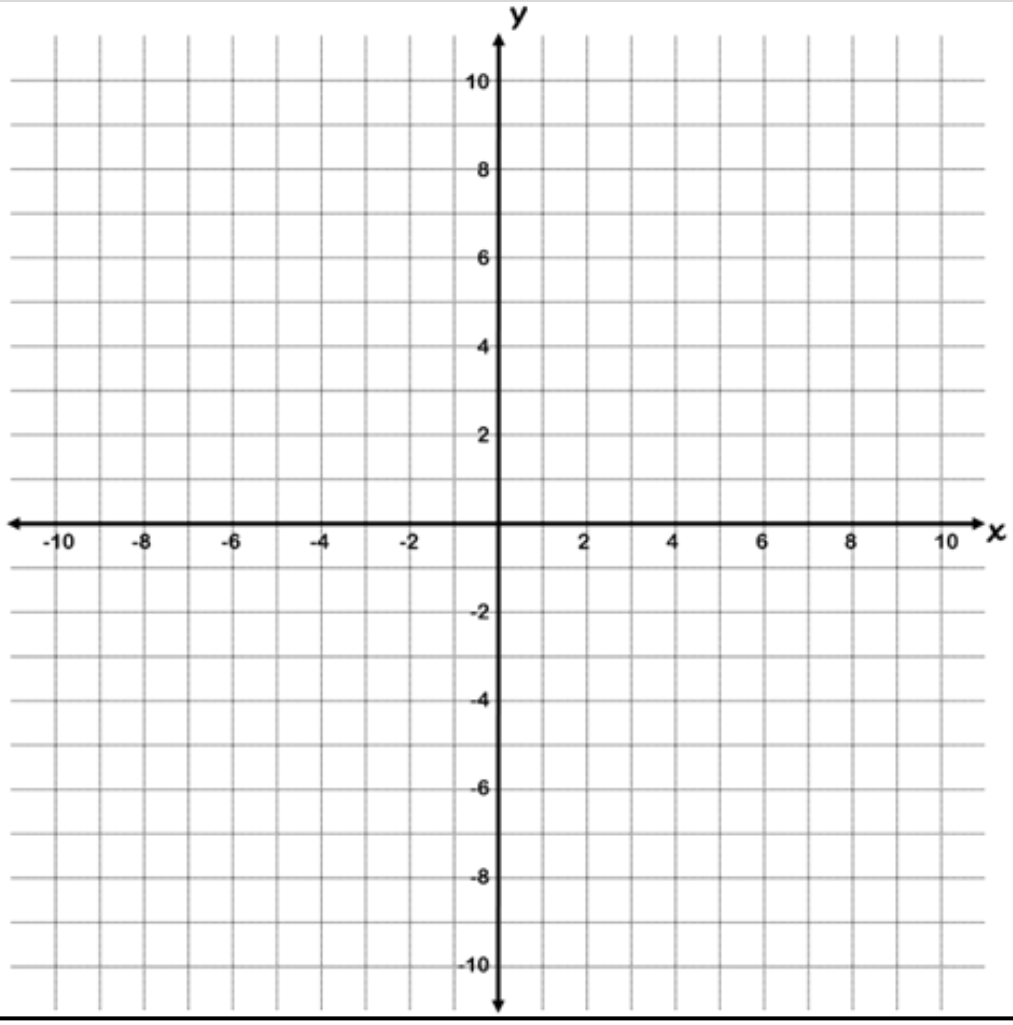
D. (2 , -2)

E. (-10 , -10)

F. (9 , 8)

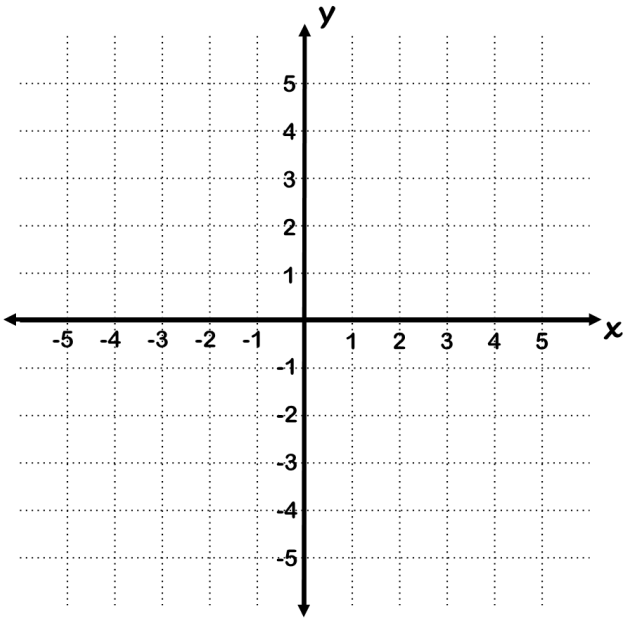
G. (-6 , 5)

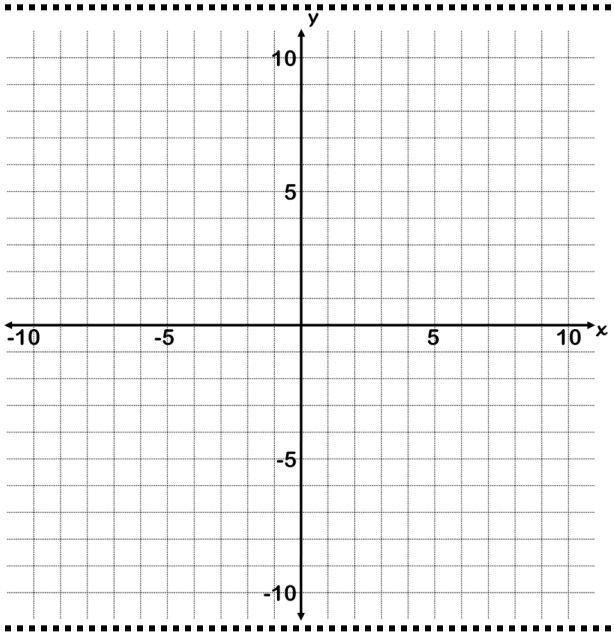
H. (6 , -10)



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

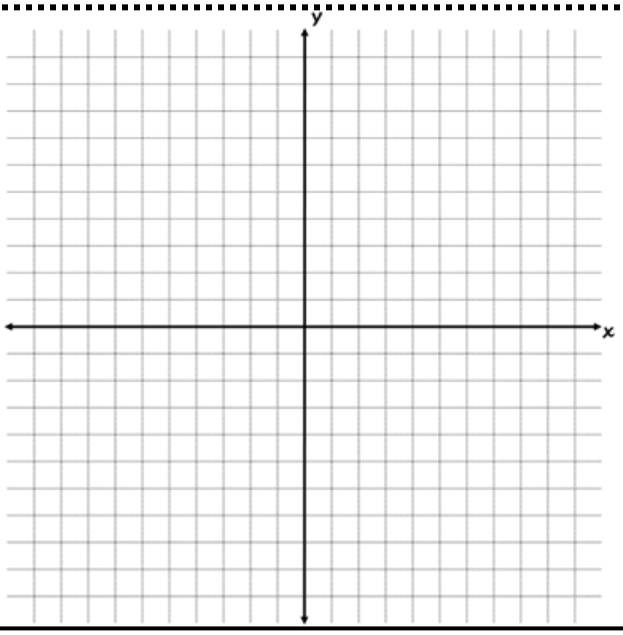
1) (-2 , -2)
2) (2 , -1)
3) (3, -4)
4) (-1 , 4)
5) (-4 , 0)
6) (5 , 4)





1) (-7 , 2)
2) (5 , -6)
3) (-10 , 9)
4) (2 , 2)
5) (3 , -4)
6) (1 , 8)

1) (0 , 9)
2) (-3 , -10)
3) (6 , 0)
4) (-8 , 0)
5) (1 , -2)
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

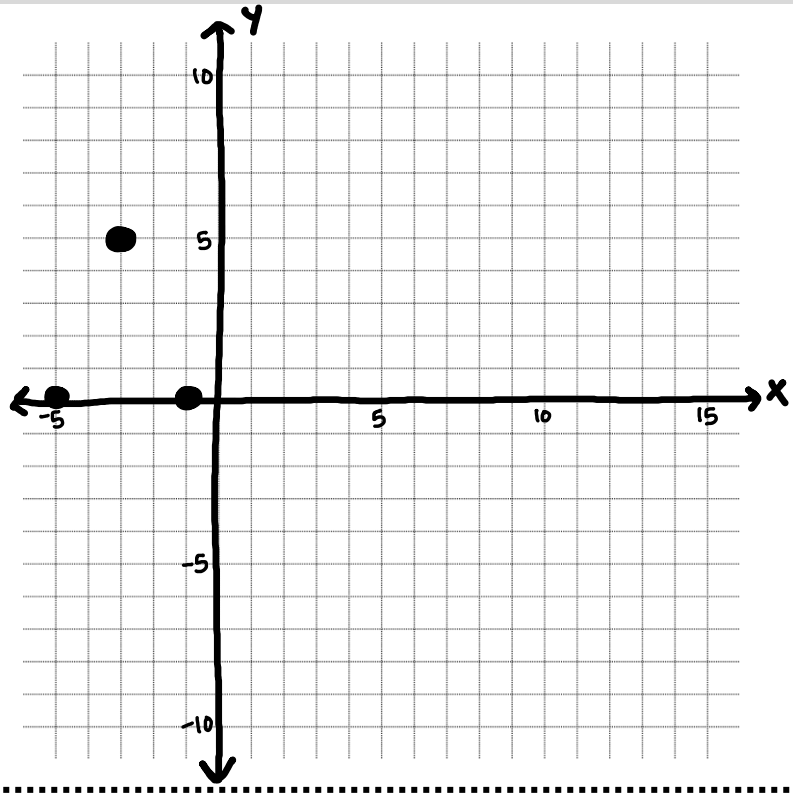
from -5 to 15.

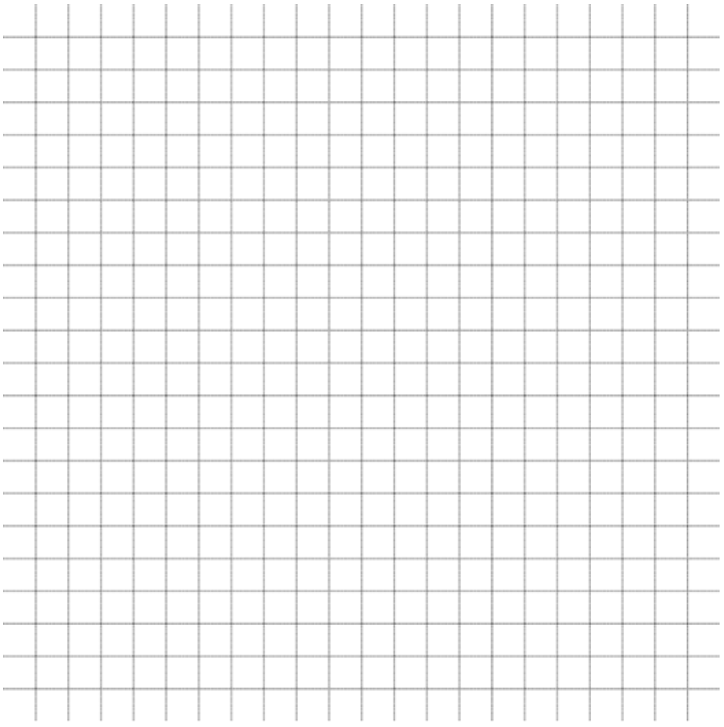
* we should leave more room for positive x-values.

y-values range

from -10 to 10.

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





x	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

x-values range

from ___ to ___.

y-values range

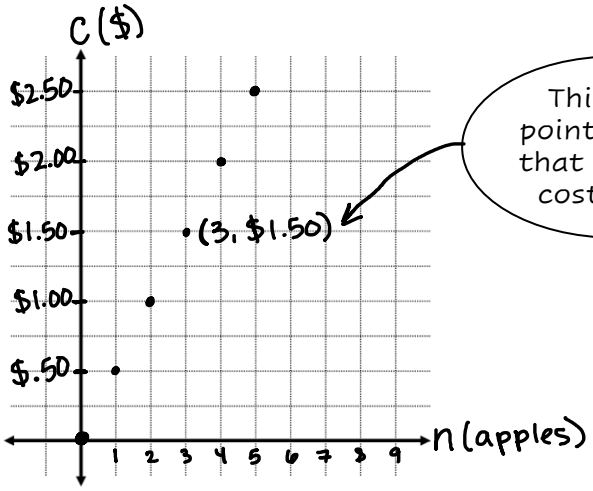
from ___ to ___.

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.

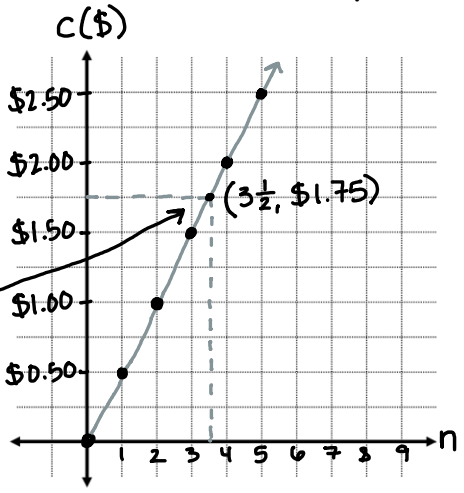
These graphs show the cost (c) of n number of apples.

The first graph shows <u>discrete data</u> (points are not connected). The second graph shows <u>continuous data</u> (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.



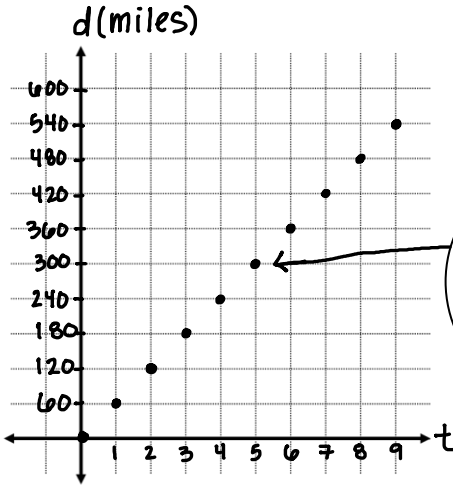
Does it make sense to buy a half an apple from the grocery store?

_____

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

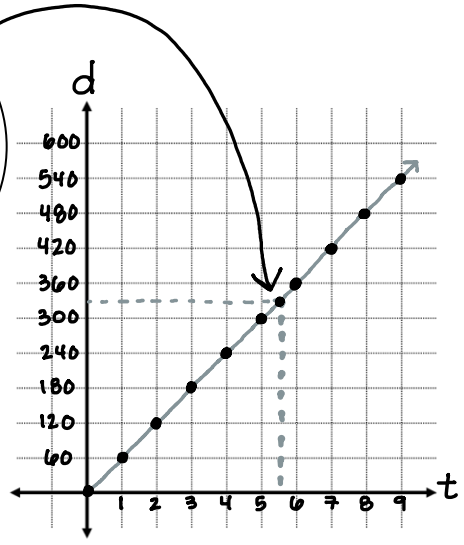
_____

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?

_____

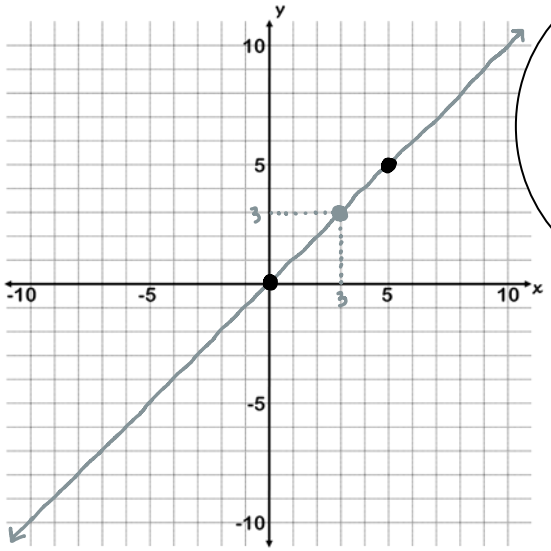
Is the distance data meant to be discrete or continuous?

_____

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

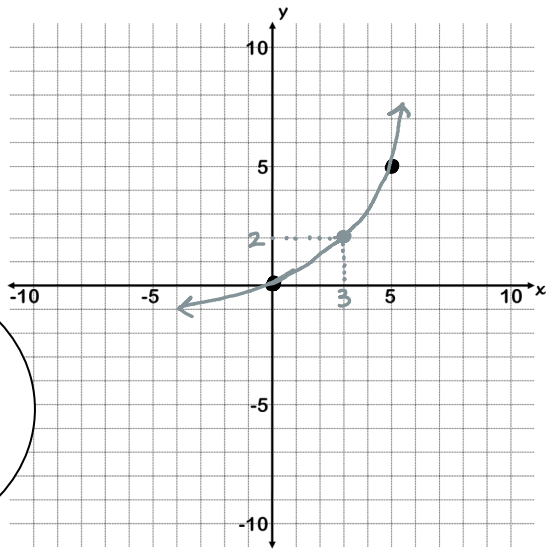
This graph shows a relationship between x and y where x = y.

The first graph shows a <u>linear</u> relationship between x an 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.

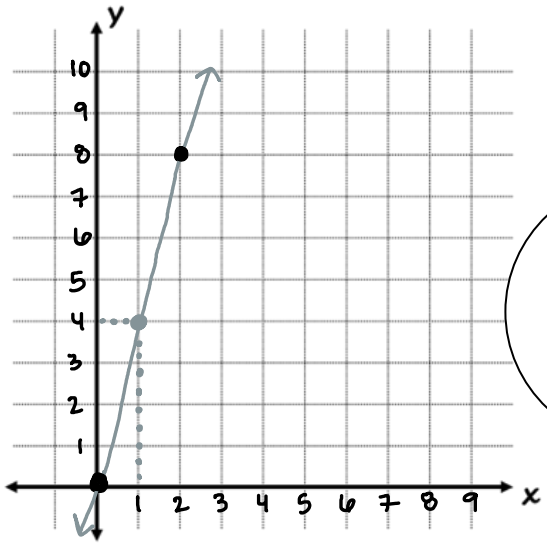
If we connect the points using a curved line, (3 , 2) is a point on the graph.



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

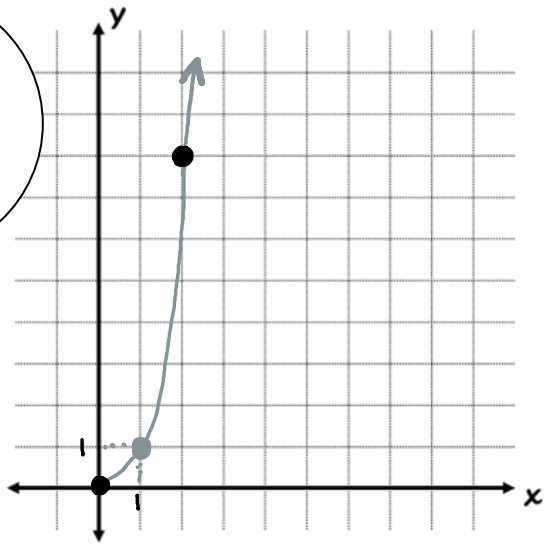
_____

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.

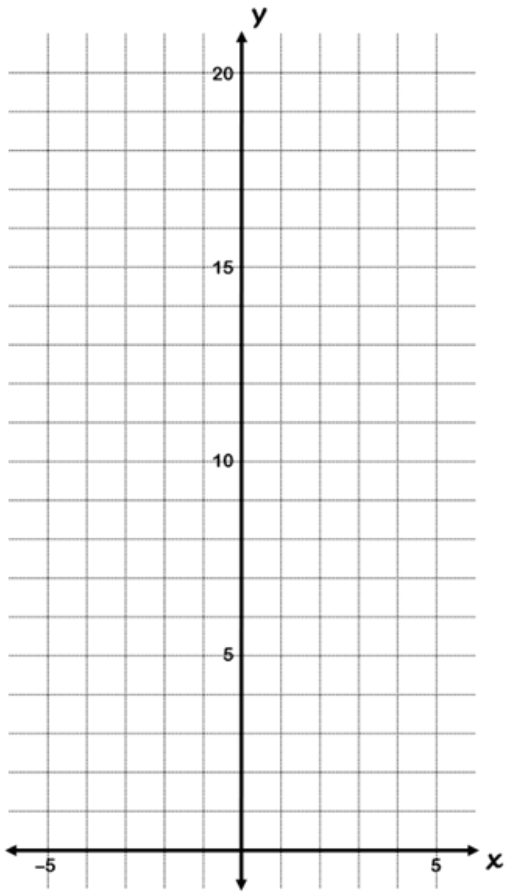


Since we know the graph is meant to represent $y = x^3$, should we use a straight or curved line to graph this relationship?

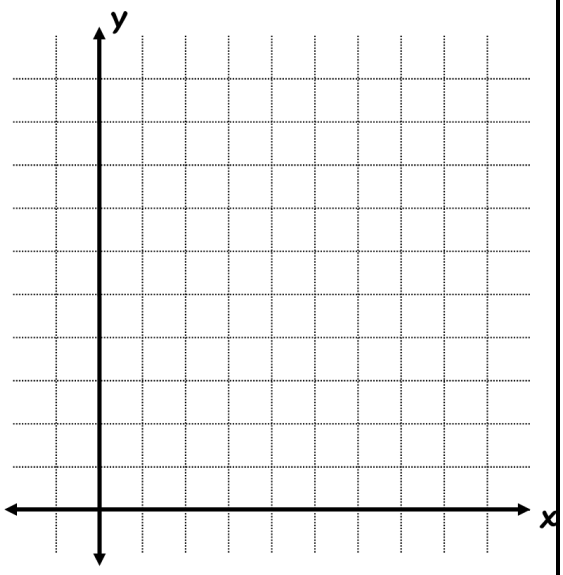
_____

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

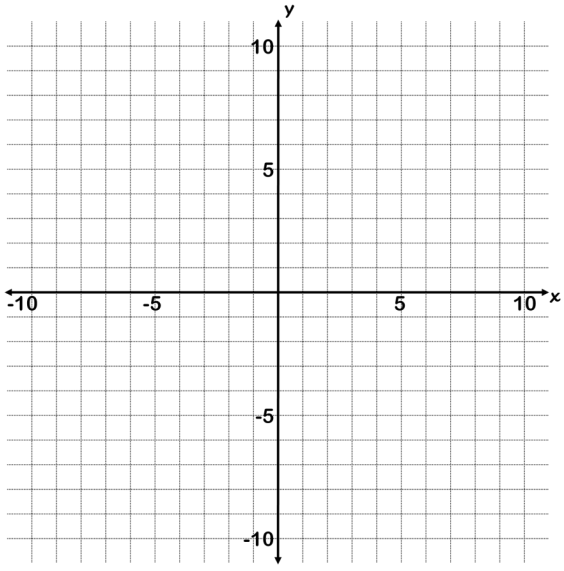
x	y
-3	9
-2	4
-1	1
0	0
1	1
2	4
3	9



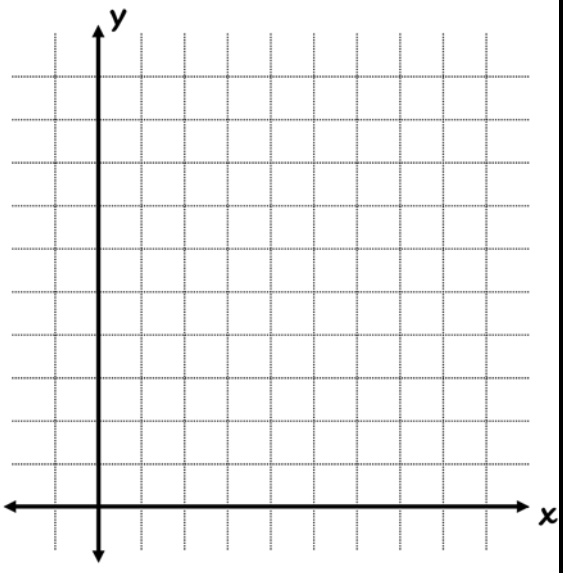
x	y
-1	10
1	8
3	6
4	5
6	3
8	1
9	0



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

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

$16 + y = 5$

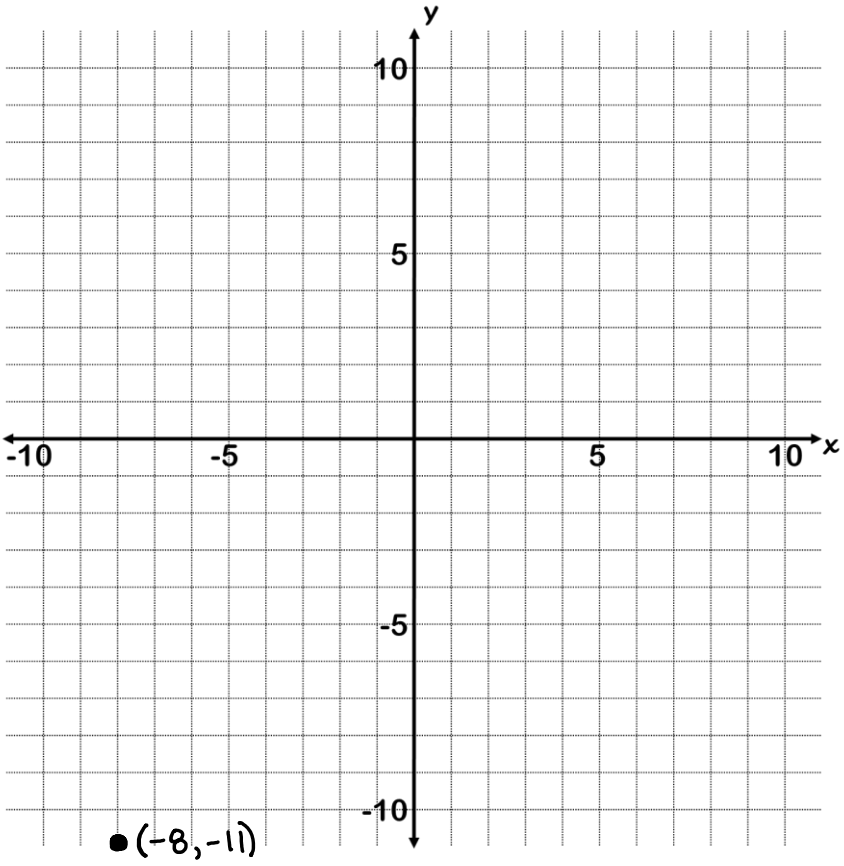
$-16 \quad -16$

$y = -11$

$(-8, -11)$

$-2x + y = 5$

x	y
-8	-11
-6	
-3	
1	
4	
6	



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

1. _____

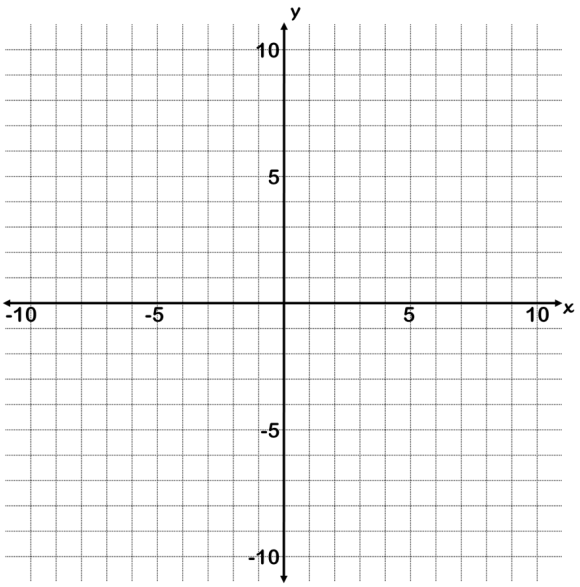
2. _____

3. _____

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	
-1	
0	
1	
2	



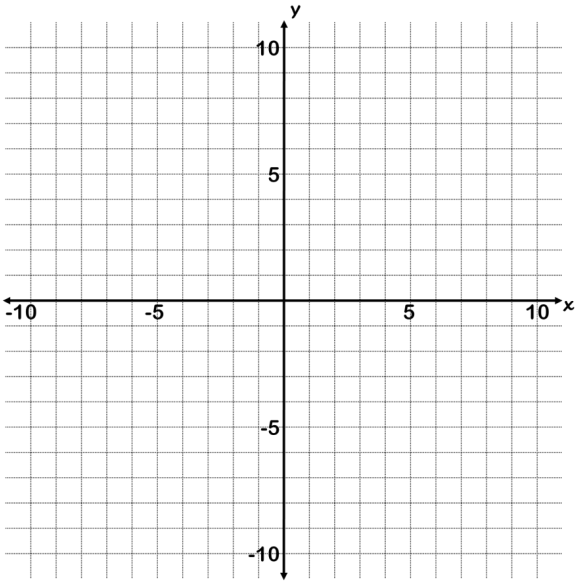
2 additional points:

1. _____

2. _____

x + 2y = 6

x	y
-2	
-1	
0	
1	
2	



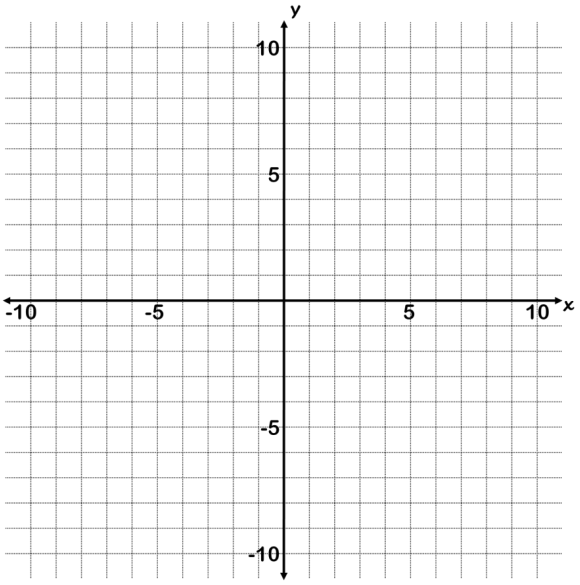
2 additional points:

1. _____

2. _____

3x - y = -2

x	y
-2	
-1	
0	
1	
2	



2 additional points:

1. _____

2. _____

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.) 5x - y = 8

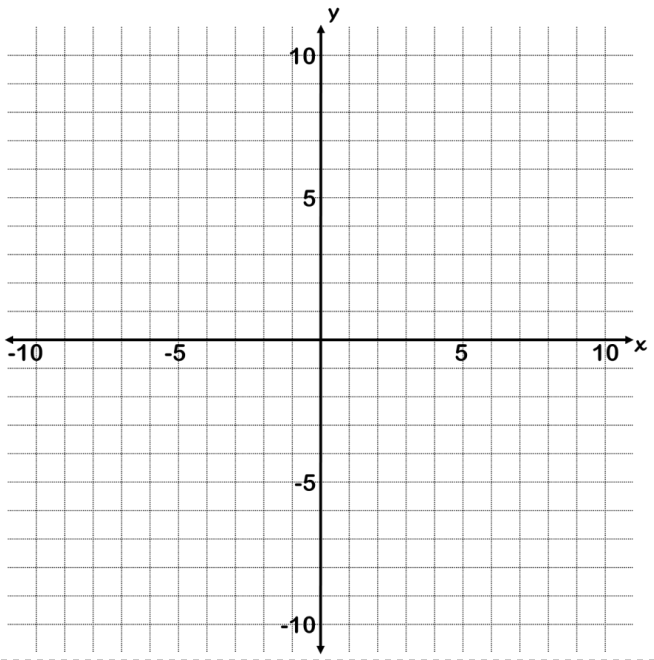
x	y

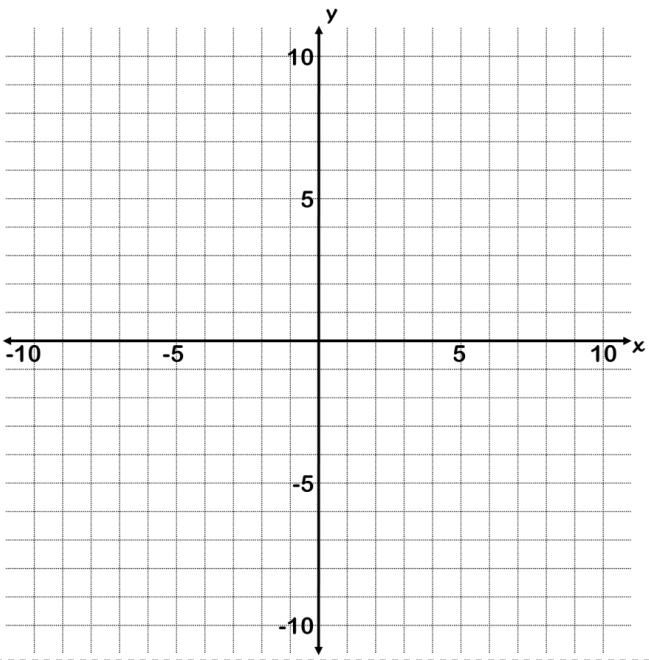
3.) x = 2y

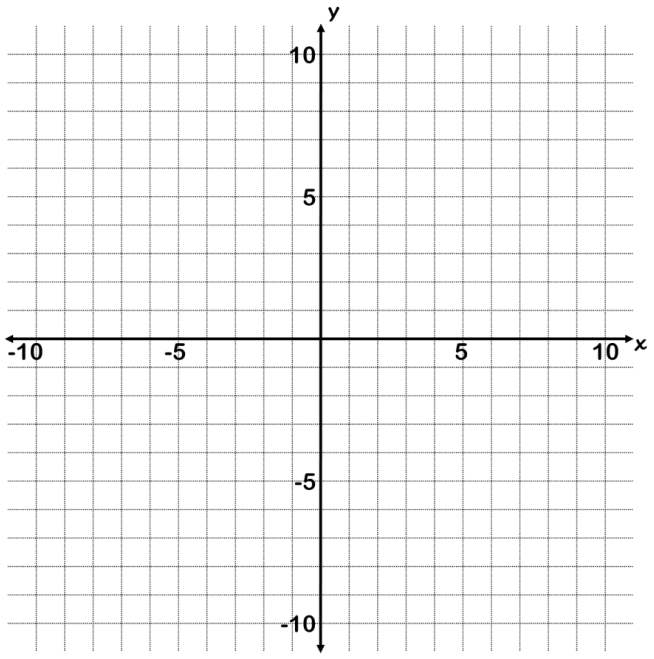
x	y

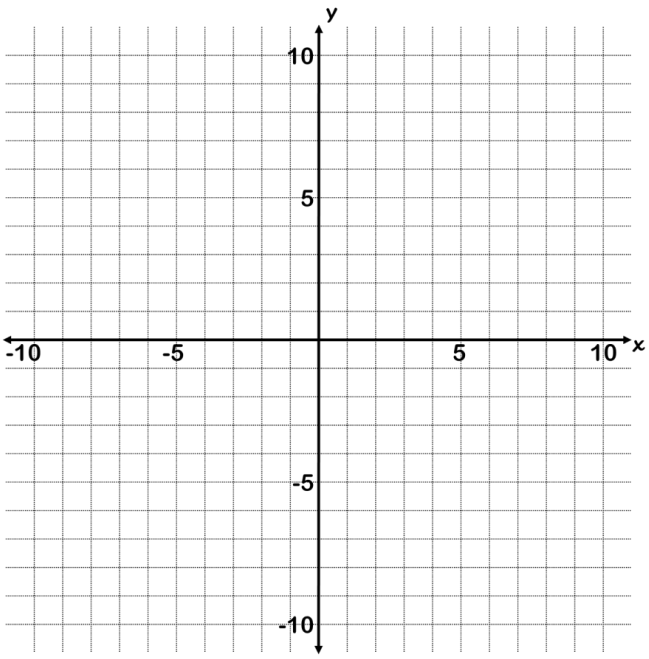
4.) 2x + y = 0

x	y





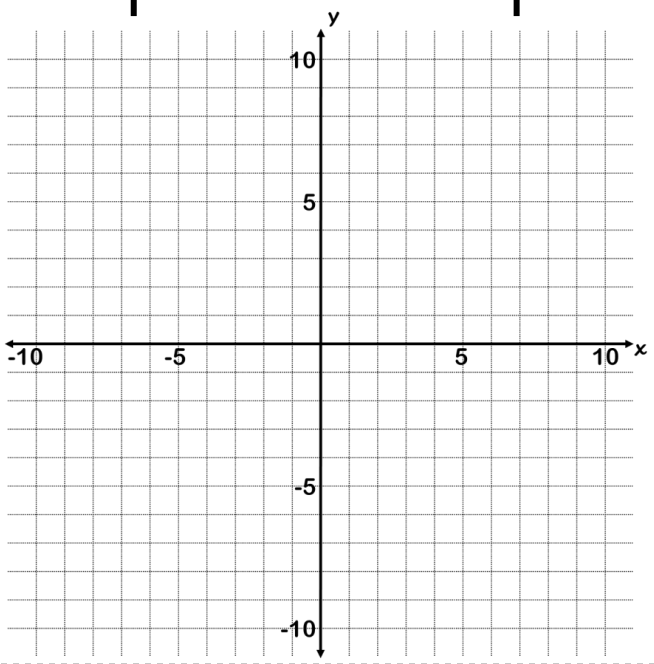




Make a table of solutions. Your x-coordinates should include: a negative coordinate, a positive coordinate, and 0. Then, graph your solutions.

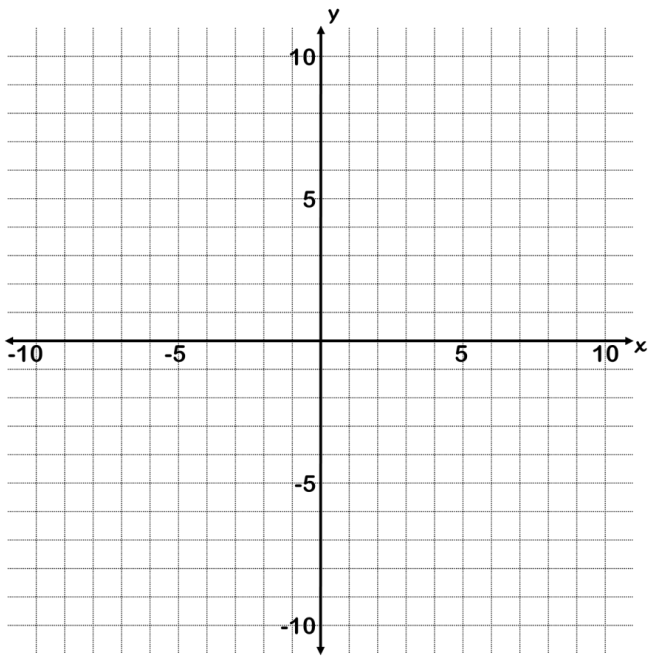
1.) y = |x|

x	y



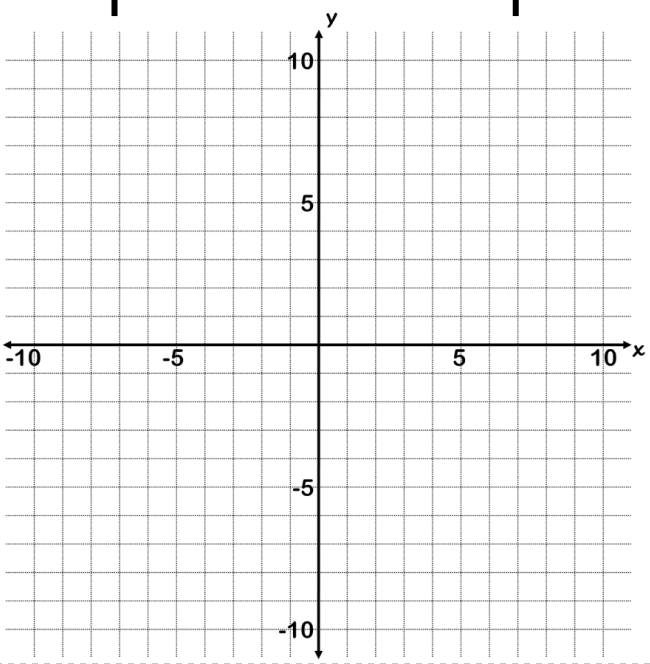
2.) y = $\frac{3x-1}{2}$

x	y



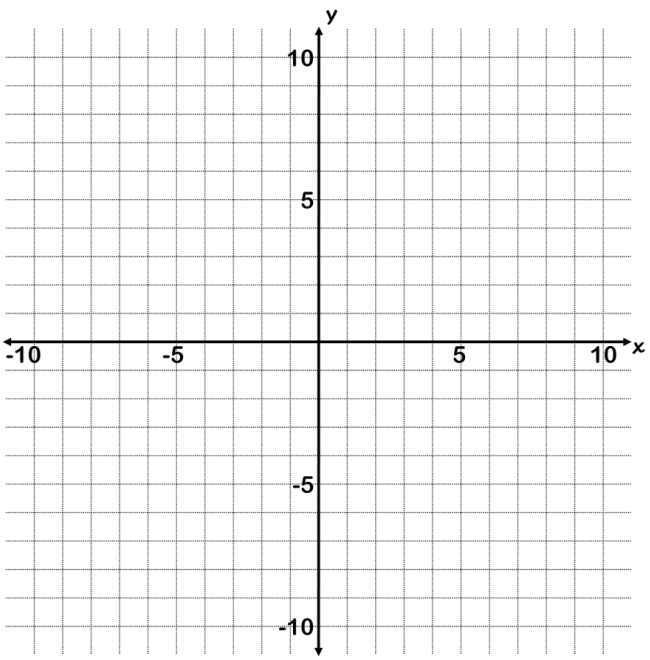
3.) y = |x – 2|

x	y



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

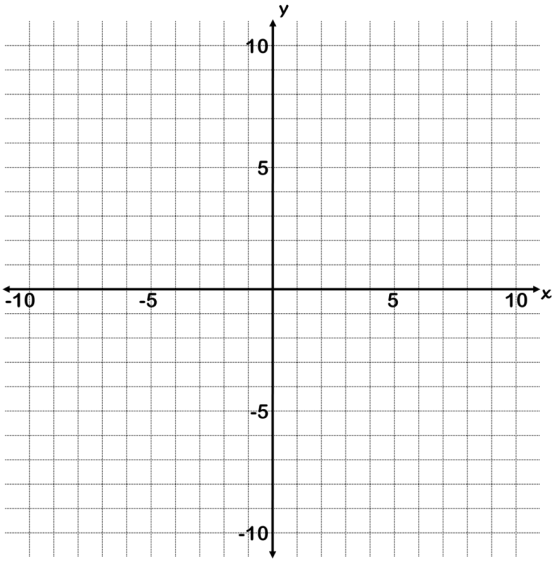
x	y



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

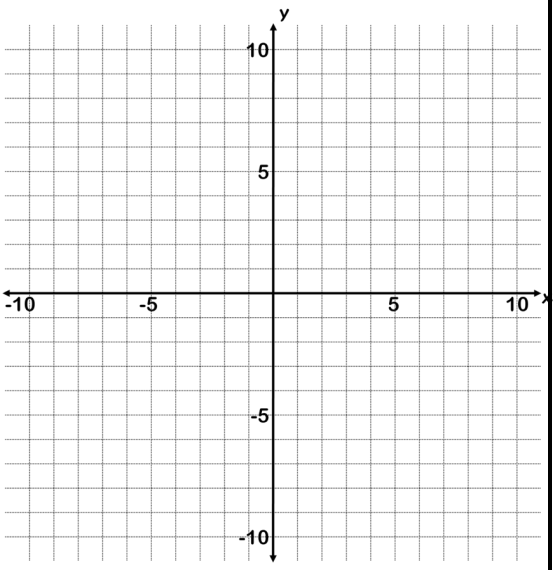
$$y = \frac{20}{x}$$

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



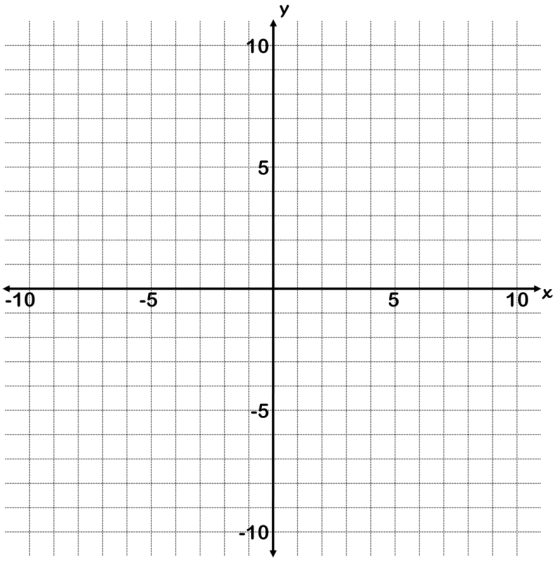
$$y = x^2 - 8$$

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



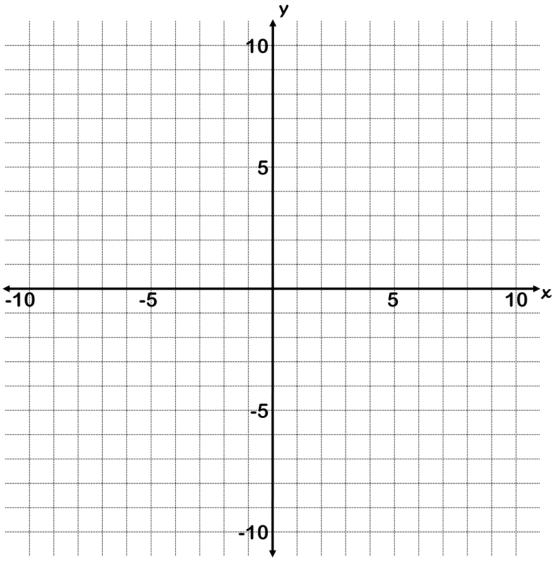
$$y = x^2 - 5x$$

x	y
-1	
0	
1	
2	
3	
4	
5	
6	



$$y = x^3 - 1$$

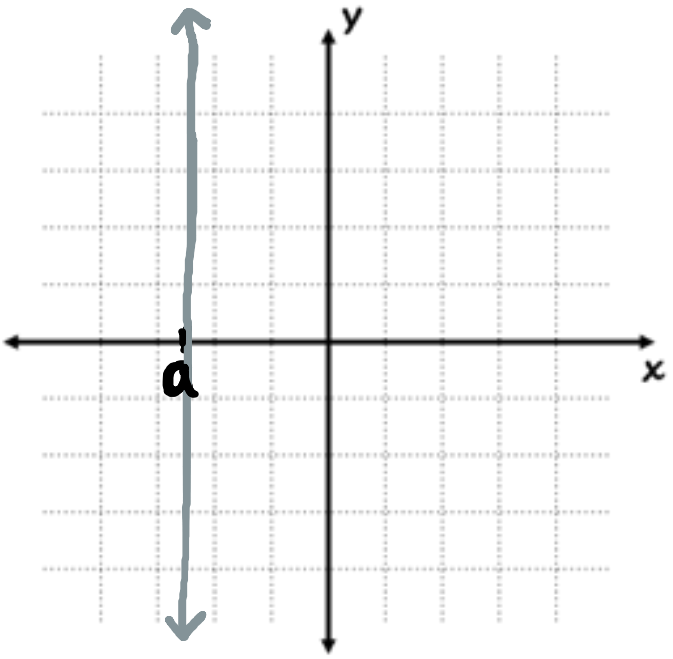
x	y
-2	
-1	
0	
1	
2	



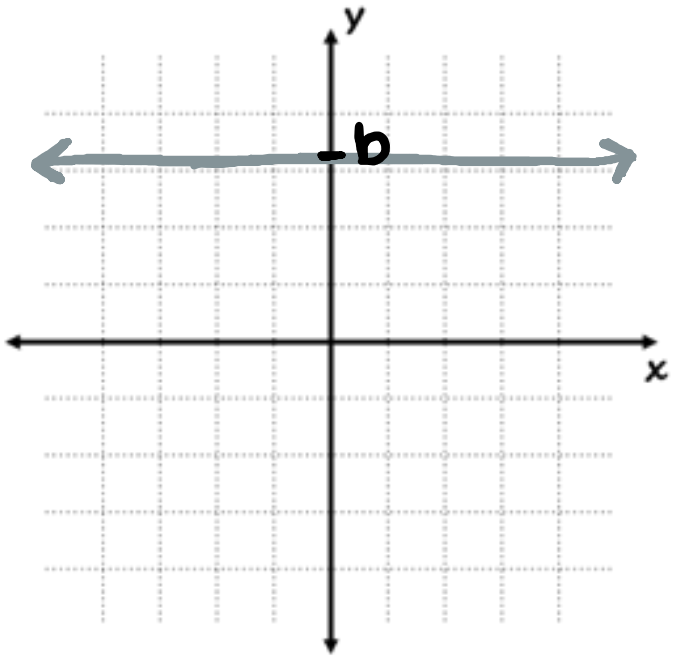
Graphing Vertical and Horizontal Lines

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

Vertical Line: $x = a$



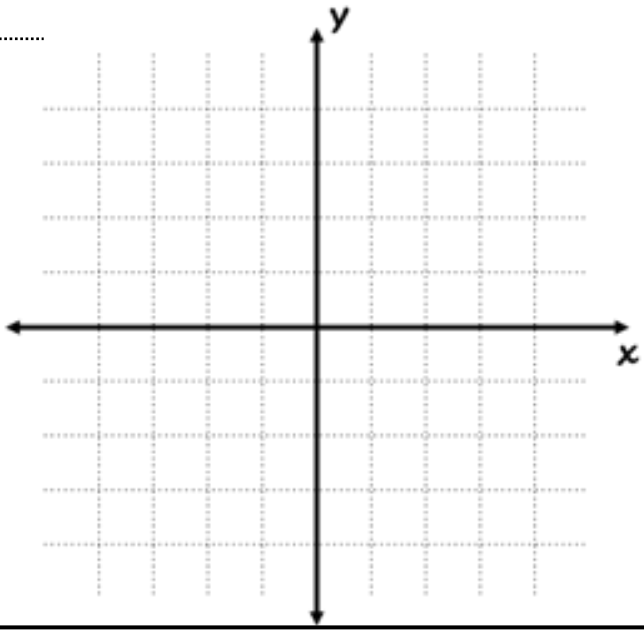
Horizontal Line: $y = b$



Make a table of solutions and graph each line.

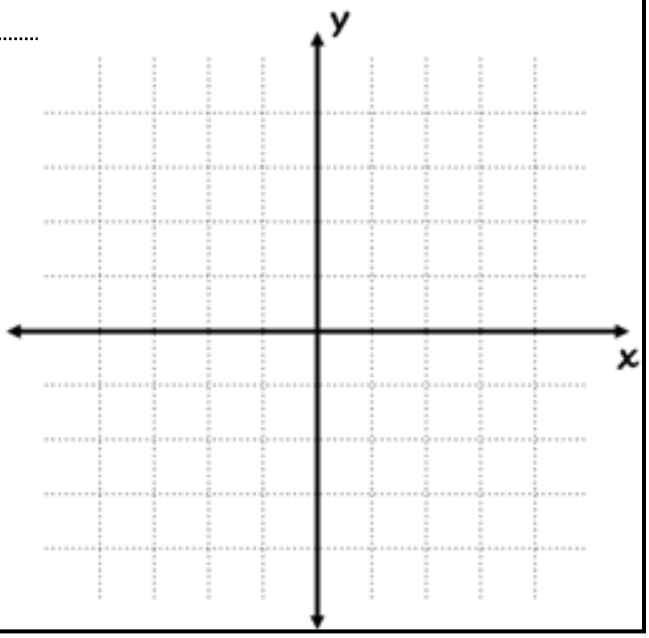
x = 4

x	y
4	-3
4	0



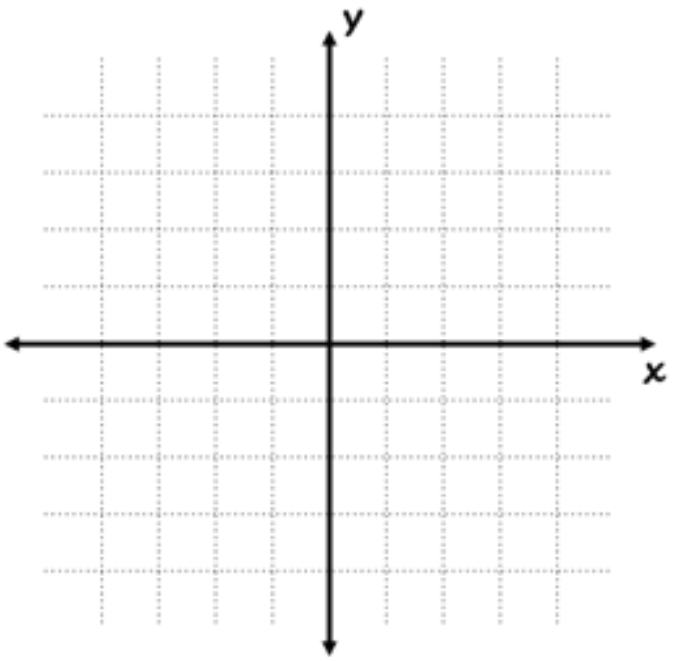
y = -2

x	y

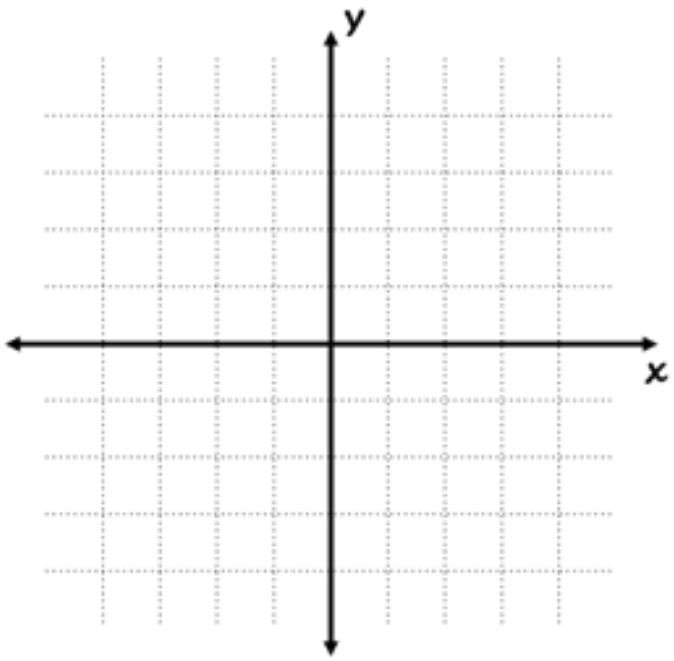


Graph each line.

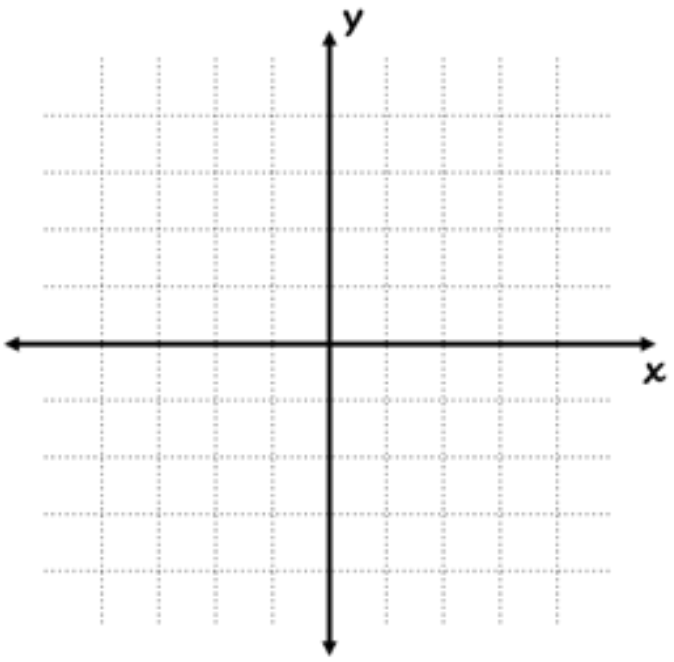
y = 0



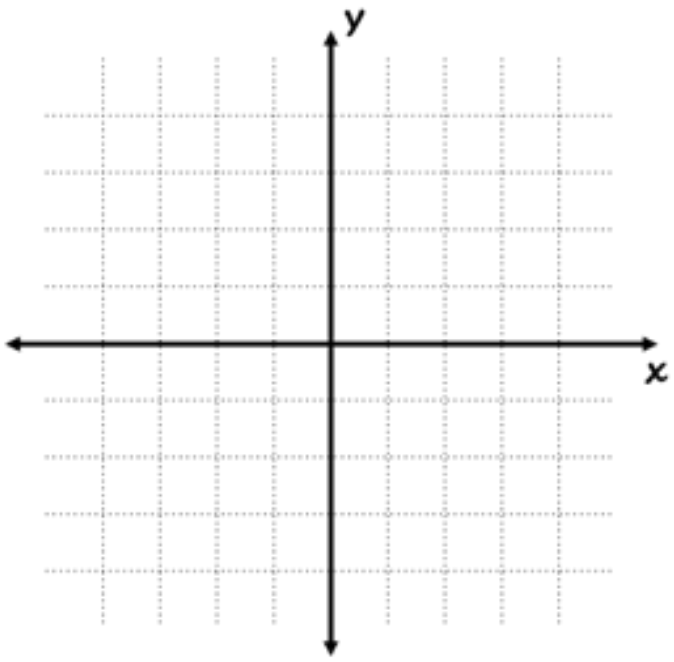
x = 0



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)

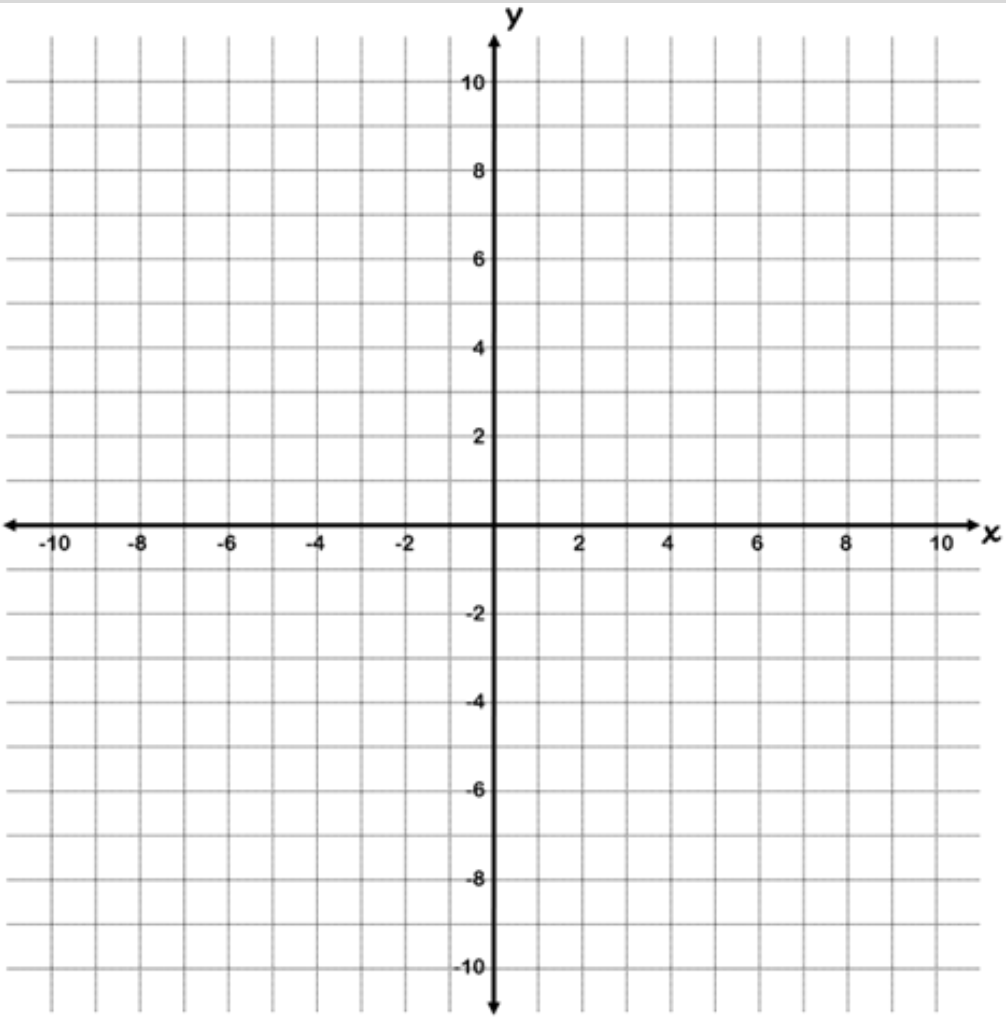
D. (0 , 0)

E. (1 , -1)

F. (8 , -7)

G. (-6 , -3)

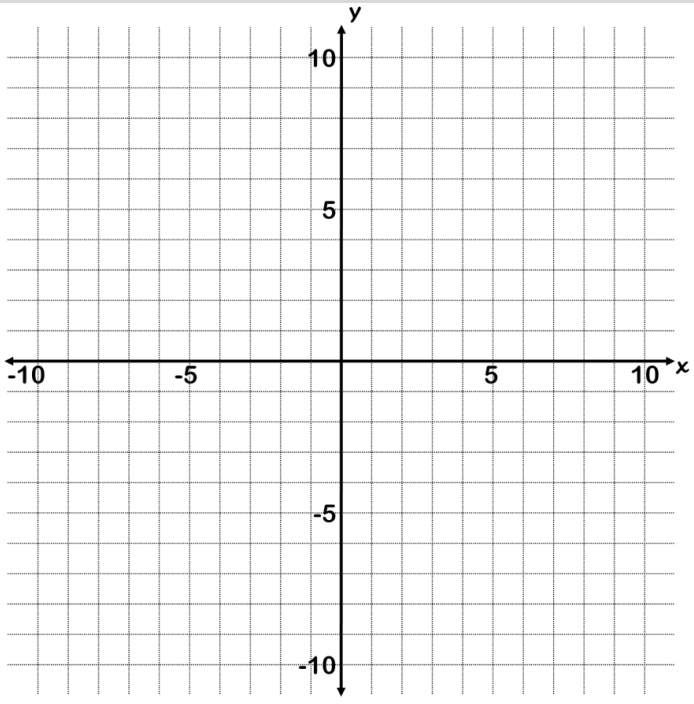
H. (10 , 1)



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

$3x - y = -3$

x	y
-2	
-1	
0	
1	
2	



slope: _____

x-int: _____

y-int: _____