Section 4.1 The Rectangular Coordinate System

Objectives
In this section, you will learn to:

- Verify a solution for an equation with two variables.
- Create and interpret the values in an ordered pair.
- Plot points in the x-y-plane.
- Recognize points in a quadrant and on an axis.
- Plot points that are on the same line and draw the line that passes through them.
- Identify points on a line.

To successfully complete this section, you need to understand:

- Number lines (1.1)
- Adding and subtracting signed numbers (1.2 and 1.3)
- Solving equations (2.1-2.3)
- Checking equations (2.1-2.3)

INTRODUCTION

While watching the local news recently, Sergio began to realize that the temperature in Sunny Meadows seemed to always be 4°C warmer than the temperature in Green Valley. Curious about that, he did a little on-line research and found this to be true.

Sergio wrote down of the temperatures from six days throughout the year and made this chart of his findings. He also wrote in four other temperatures and searched for days that matched what he wrote.

Temperature in Sunny Meadows	Temperature in Green Valley
27	23
7	3
5.5	1.5
4	0
1	-3
-3	-7
	16
	-2.5
0	
-5.5	

YTI 1 Knowing that the temperature in Sunny Meadows is always 4° warmer than the temperature in Green Valley, fill in the rest of Sergio's chart.

As Sergio discovered, the relationship between the two temperatures is consistent. Because the difference in the temperatures is always 4°, we can represent this relationship using algebra.

For example, we could let x = the temperature in Sunny Meadows and y = the temperature in Green Valley. This allows us to write an equation that represents their relationship:

$$x - y = 4.$$

As you can see, $x - y = 4$ is an equation with two variables in it. From our experience, equations are to be solved, but how do we solve an equation that contains two variables?

EQUATIONS WITH TWO VARIABLES

In Chapter 2 you learned how to solve equations with one variable, such as $x - 1 = 4$.

Without too much work you can find that the solution is 5, and this is the one and only value of x that makes the equation true:

$$x - 1 = 4$$
$$5 - 1 \overset{?}{=} 4$$
$$4 = 4 \quad \text{True!}$$

However, an equation with two variables can have many solutions. For example, consider an equation that represents The *difference* of x and y is 4: $x - y = 4$.

This equation has many solutions because there are many combinations of x-and y-values whose difference is 4. Each pair of numbers will have one x-value and one y-value, as shown in the table at right.

There are other pairs of numbers that are solutions to this equation, as demonstrated in Example 1

x	y	$x - y = 4$
7	3	$7 - 3 = 4$ True!
5.5	1.5	$5.5 - 1.5 = 4$ True!
4	0	$4 - 0 = 4$ True!
3	-1	$3 - (-1) = 4$ True!
-1	-5	$-1 - (-5) = 4$ True!

Example 1: Show that the given pair of numbers is a solution for $x - y = 4$.

a) $x = 7.25$ and $y = 3.25$ b) $x = 2$ and $y = -2$

Procedure: Replace the variables in the equation with the given x-and y-values. Evaluate each to show that the pair is a solution.

Answer:

a) $x = 7.25$ and $y = 3.25$

$$7.25 - 3.25 \overset{?}{=} 4$$
$$4 = 4 \quad \text{True!}$$

b) $x = 2$ and $y = -2$

$$2 - (-2) \overset{?}{=} 4$$
$$2 + 2 \overset{?}{=} 4$$
$$4 = 4 \quad \text{True!}$$

YTI 2 Show that the given pair of numbers is a solution for $x - y = 4$. Use Example 1 as a guide.

a) $x = 5.4$ and $y = 1.4$ b) $x = -1$ and $y = -5$

ORDERED PAIRS

One solution for the equation $x - y = 4$ is $x = 5$ and $y = 1$. It is more common to represent this solution as an *ordered pair* (5, 1).

An **ordered pair** is a pair of numbers—grouped in parentheses and separated by a comma—in which the order they are written is important. For an ordered pair of *x*-and *y*-values, the *x*-value is always written first, and the *y*-value is always written second.

Example 2: Write each pair of *x*-and *y*-values as an ordered pair.

a) $y = 8, x = -2$ b) $x = 7.2, y = 3.1$ c) $y = -6, x = 0$ d) $x = \frac{3}{5}, y = -\frac{1}{4}$

Procedure: In every ordered pair, the *x*-value is always written first and the *y*-value is always written second. (Notice that the *x*-value is not always written first in each pair above.)

Answer: a) (-2, 8) b) (7.2, 3.1) c) (0, -6) d) $\left(\frac{3}{5}, -\frac{1}{4}\right)$

YTI 3 Write each pair of *x*-and *y*-values as an ordered pair. Use Example 2 as a guide.

a) $x = 1, y = -4$ b) $y = 0, x = 5.2$ c) $x = -2\frac{5}{8}, y = 1\frac{3}{8}$ d) $y = -10, x = -8$

Example 3: Identify the *x*-and *y*-values in each ordered pair.

a) (-4, -5) b) (3, 0) c) $\left(\frac{1}{8}, \frac{2}{3}\right)$

Procedure: In every ordered pair, the *x*-value is always written first and the *y*-value is always written second.

Answer: a) $x = -4, y = -5$ b) $x = 3, y = 0$ c) $x = \frac{1}{8}, y = \frac{2}{3}$

YTI 4 Identify the *x*-and *y*-values in each ordered pair. Use Example 3 as a guide.

a) (-5.1, -3) b) (0, 4) c) $\left(-6, -\frac{7}{10}\right)$

Think about it 1: What would you tell a classmate is the best way to remember which is the *x*-value, and which is the *y*-value in an ordered pair?

_____

_____

An ordered pair (*x*, *y*) is a set of two replacement values, one for *x* and the other for *y*. It's possible that an ordered pair is not a solution to a particular equation.

To determine if an order pair is a solution to an equation, we first identify the *x*-and *y*-values and then place those values into the equation. If we get a true statement, then the ordered pair is a solution. If not, then the ordered pair is not a solution.

Example 4: Determine if the given ordered pair is a solution to the equation $2x - y = 5$.

a) $(3, 2)$ b) $\left(\frac{1}{2}, -4\right)$

Procedure: First identify the x-value and the y-value in each ordered pair; then place those values into the equation.

Answer:

a) $x = 3$ and $y = 2$

$$2(3) - 2 \stackrel{?}{=} 5$$

$$6 - 2 \stackrel{?}{=} 5$$

$$4 = 5 \text{ False!}$$

No, $(3, 2)$ is *not* a solution.

b) $x = \frac{1}{2}$ and $y = -4$

$$2\left(\frac{1}{2}\right) - (-4) \stackrel{?}{=} 5$$

$$1 + 4 \stackrel{?}{=} 5$$

$$5 = 5 \text{ True!}$$

Yes, $\left(\frac{1}{2}, -4\right)$ is a solution.

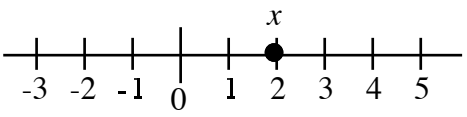
YTI 5 Determine whether the given ordered pair is a solution to the equation $3x + 2y = 6$. Use Example 4 as a guide.

a) $(4, -3)$ b) $(2, -6)$ c) $\left(\frac{2}{3}, 2\right)$

THE *x*-*y*-PLANE AND PLOTTING POINTS

Recall, from Section 2.6, that we were introduced to the idea that the solution to a linear equation can be represented on the number line.

For example, the equation $2x + 3 = x + 5$ has a solution of 2, and $x = 2$ can be represented on a number line, as shown at right.

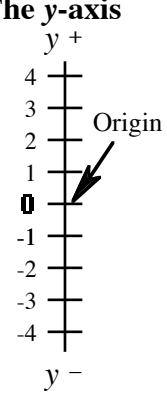


Because we now consider equations with two variables, it is appropriate to use two number lines to represent the solutions. To represent the *x*-values, we use a horizontal number line, called the ***x*-axis**; to represent the *y*-values, we use a vertical number line, called the ***y*-axis**, Each of these number lines has an *origin*, at 0, which separates the positive values from the negative values.

(The plural of axis is *axes*, pronounced "ax-eze".)

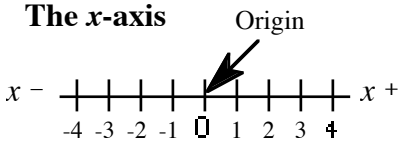
The vertical number line:

The *y*-axis



The horizontal number line:

The *x*-axis

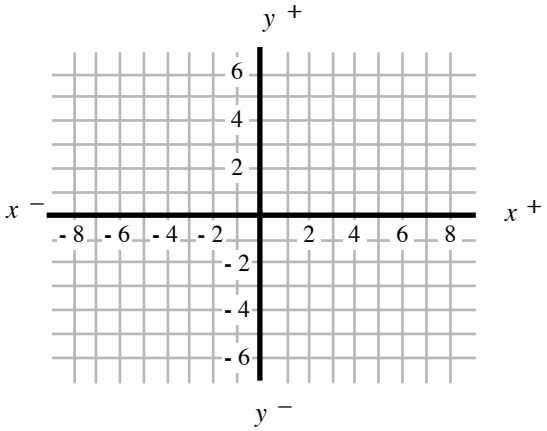


Notice that on the *y*-axis, positive numbers are above 0 and negative numbers are below 0. On a horizontal number line, positive numbers are to the right of 0, and negative numbers are to the left of 0.

We can join these two number lines at the origins to create a grid called the ***x*-*y*-plane**.

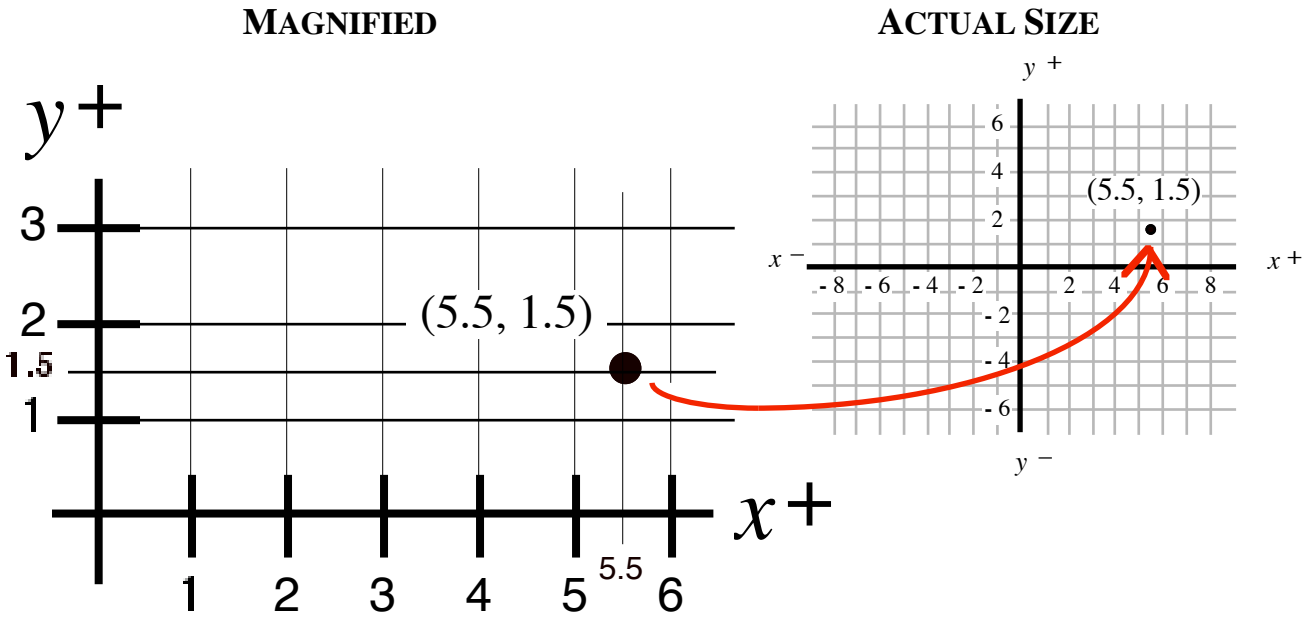
Note: A plane is any flat surface that extends forever in each direction, and this is true of the *x*-*y*-plane.

Notice that each axis is labeled with either *x* or *y*, and notice where each axis is positive (+) and negative (–). This grid is called the **rectangular coordinate system.**



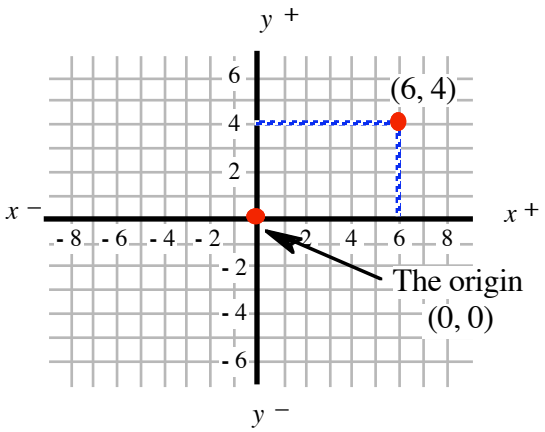
On the grid, there are infinitely many places where the vertical and horizontal lines intersect. Each place of intersection is called a **point** and it represents exactly one ordered pair, such as (6, 4) or (-5, -3).

The grid lines in this graph show only integer values, but it's also possible to have points with fractional or decimal values. For example, (5.5, 1.5) is one of the solutions to the equation $x - y = 4$, and it can also be represented by a point in the *x*-*y*-plane:



When we speak of an ordered pair as a *solution* to an equation, such as (6, 4), the numbers are called values: the *x-value* is 6 and the *y-value* is 4. However, when we consider the ordered pair (6, 4) as a *point* in the *x*-*y*-plane, the numbers are called **coordinates**: the *x-coordinate* is 6 and the *y-coordinate* is 4.

One special point is the **origin** of the *x*-*y*-plane. It is where the two axes meet, and the ordered pair it represents is (0, 0). In other words, the origin has an *x*-coordinate of 0 and a *y*-coordinate of 0.



Notice that the point (6, 4) forms a rectangle with the *x*-axis, the *y*-axis and the origin (0, 0). This is why the grid is called the rectangular coordinate system.

Placing and labeling points in the x-y-plane is called **plotting points**. We have seen the point (6, 4) placed in the plane, but how did it get there?

To plot a point we must understand the following:

1. In the ordered pair, x is always the first value and y is always the second value.
2. The x-axis is the horizontal axis, and the y-axis is the vertical axis.
3. On the x-axis,
   a) the positive values are to the right of the origin
   b) the negative values are to the left of the origin
4. On the y-axis,
   a) the positive values are above the origin
   b) the negative values are below the origin

Guidelines for plotting a point:

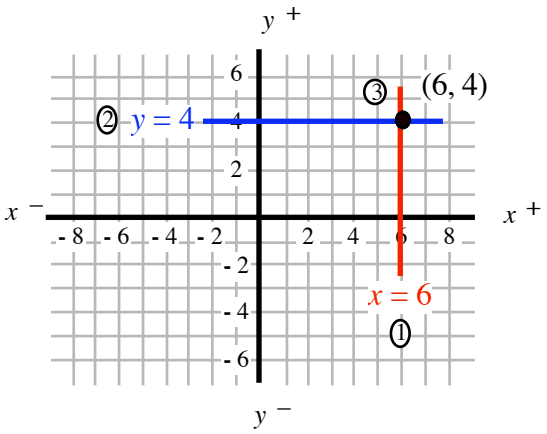
1. Recognize the values of x and y; locate the position of the x-value on the x-axis.
2. From there, move straight up or down, to match the y-value.
3. Place a dot at the intersection of the x- and y-values; label the point with its ordered pair.

Example: Plot the point (6, 4).

Procedure: Use the guidelines listed below.

1. Recognize that $x = 6$ and $y = 4$; locate 6 on the x-axis.
2. From here, we will move straight up to match where y is 4.
3. Draw a dot at the final location. Also, write the ordered pair (6, 4) near the point.

Answer:



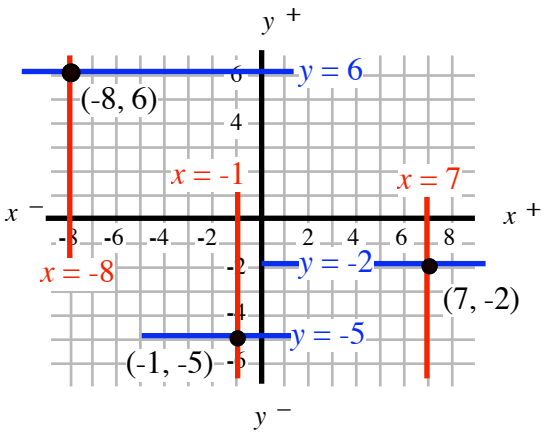
Example: Plot the points (-8, 6), (-1, -5), and (7, -2).

Procedure: Use the guidelines listed below.

1. For each, recognize the value of *x* and *y*. First locate the *x*-value on the *x*-axis.

2. From that *x*-value, move straight up or down to match the corresponding *y*-value.

3. Draw a dot at the final location, and write the ordered pair near the point.

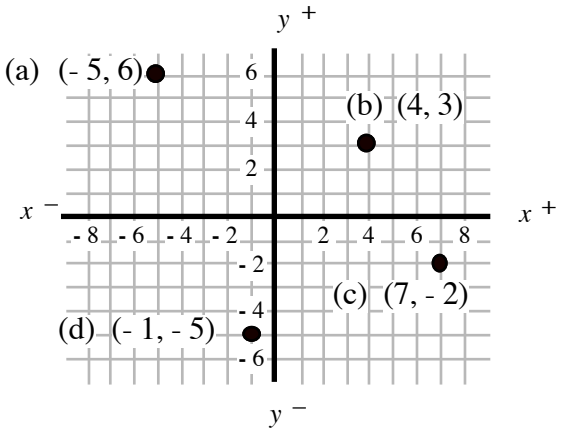


Example 5: Plot each of these points in the *x*-*y*-plane. Be sure to label each one with its ordered pair as well.

a) (-5, 6) b) (4, 3) c) (7, -2) d) (-1, -5)

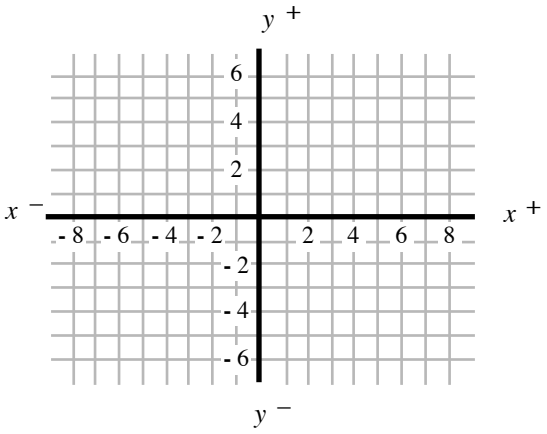
Procedure: In each ordered pair, first recognize the *x*-value and the *y*-value, and verify that these points have been placed properly in the grid.

Answer:



Caution: It is easy to get the *x*-coordinate confused with the *y*-coordinate. One way to avoid this confusion is to place a little (x, y) over each ordered pair, such as $\overset{(x,\ y)}{(2,\ 3)}$.

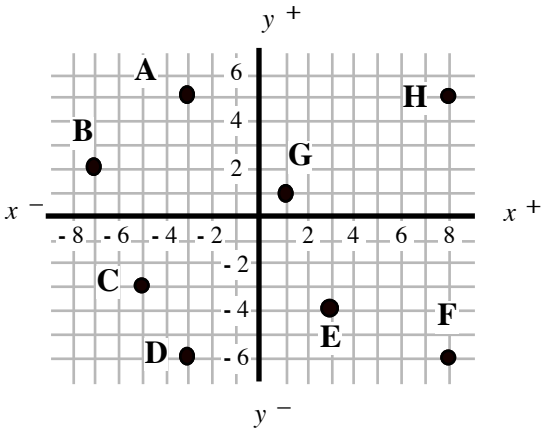
YTI 6 Plot each of these points in the given *x*-*y*-plane . Be sure to label each one with its ordered pair. Use Example 5 as a guide.



a) (3, 2) b) (-1, 5)

c) (6, -3) d) (-7, -4)

YTI 7 Given the graph, identify the ordered pair of each point shown. (Be sure to place parentheses around each ordered pair.)



a) A b) B

c) C d) D

e) E f) F

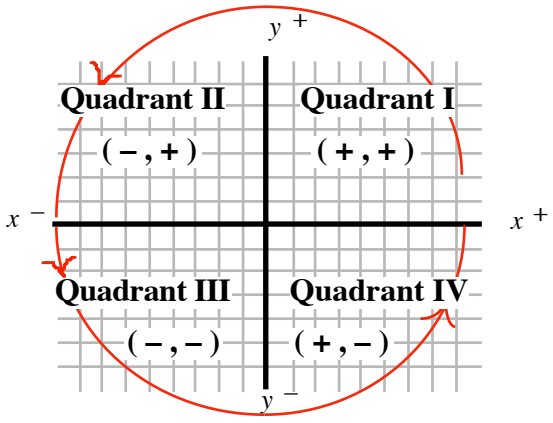
g) G h) H

SPECIAL FEATURES OF THE *x*-*y*-PLANE

The *x*-axis and the *y*-axis divide the *x*-*y*-plane into four distinct regions called **quadrants**. We label the quadrants using Roman numerals I, II, III and IV.

In the diagram on the next page, notice that the first quadrant, Quadrant I, begins in the upper right part, and the other quadrants follow in a counter-clockwise direction (the opposite direction than a clock's hands would move).

Notice, also, that the first quadrant, Quadrant I, is the part of the grid where both *x* and *y* are positive. Similarly, points in Quadrant II represent negative *x*-coordinates but positive *y*-coordinates.



Quadrant I: upper right: **+ *x*** and **+ *y***

Quadrant II: upper left: **– *x*** and **+ *y***

Quadrant III: lower left: **– *x*** and **– *y***

Quadrant IV: lower right: **+ *x*** and **– *y***

Example 6: In which quadrant would you find these points?

a) (2, -3) b) (-5, 4) c) (3, 5) d) (-7, -6)

Procedure: Look at the positive and negative nature of the *x*-and *y*-coordinates to determine the quadrant. You may draw a simple *x*-*y*-plane to help determine where each point lies.

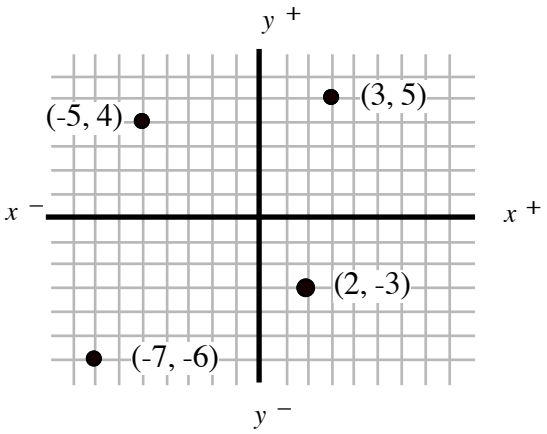
Answer:

a) (2, -3) the *x*-coordinate is positive, the *y*-coordinate is negative; this suggests that the point is in the *lower right* quadrant, **Quadrant IV**.

b) (-5, 4) a negative *x*-coordinate means *left*, and a positive *y*-coordinate means *up*. So, the point is in the *upper left* quadrant, **Quadrant II**.

c) (3, 5) *x*: right; *y*: up; the point is in the *upper right* quadrant, **Quadrant I**.

d) (-7, -6) *x*: left; *y*: down; *lower left* quadrant, **Quadrant III**.



YTI 8 Determine in which quadrant each point lies. Use Example 6 as a guide.

a) (-5, 6) b) (2, -9) c) (-8, -4) d) (10, 2)

OTHER POINTS IN THE *x*-*y*-PLANE

There are points in the *x*-*y*-plane that are not in any of the quadrants; instead, they

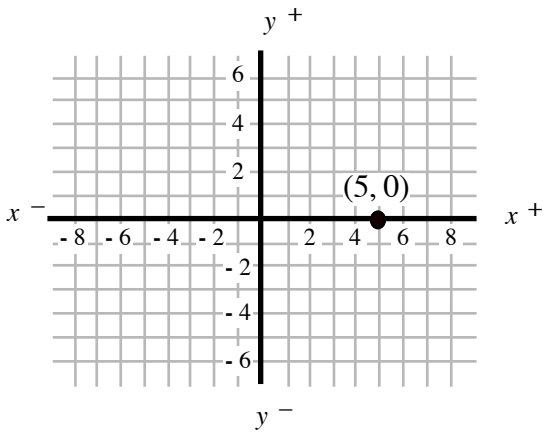
~Instructor Insight~
In general, a point on the *x*- or *y*-axis is not

are on one of the axes. We may plot points on the *x*-axis and, separately, on the *y*-axis. We may even plot the point (0, 0), the origin.

an intercept unless it is a point on a line. I have chosen to call all points on either *x*- or *y*-axis *axial points*.

Points on an axis can be called **axial points**. One special feature of an axial point is that at least one of the coordinates must be 0.

The point (5, 0) is an axial point; the *x*-coordinate is positive, so the point is to the *right*, but the *y*-coordinate is neither positive nor negative, so we can't consider it *up* or *down*. In other words, it is not in Quadrant I, and it is not in Quadrant IV. The point (5, 0) is *on the positive x-axis*.



Example 7: Describe where each point is located in the *x*-*y*-plane.

a) (-3, 0) b) (0, 6) c) (0, -4) d) (7, 0) e) (0, 0)

Procedure: Because at least one of the coordinates in each point is 0, none of these is in one of the quadrants. Each point is on one (or both) of the axes.

Answer:

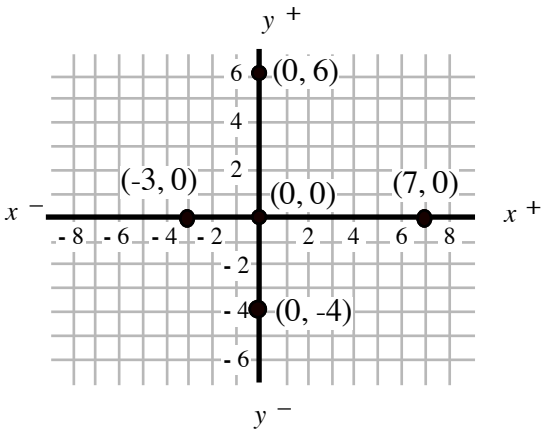
a) (-3, 0) is on the **negative *x*-axis**.

b) (0, 6) is on the **positive *y*-axis**.

c) (0, -4) is on the **negative *y*-axis**.

d) (7, 0) is on the **positive *x*-axis**.

e) (0, 0) is at the **origin**; it is on both the *x*-axis and the *y*-axes.



YTI 9 Describe where each point is located in the *x*-*y*-plane. Use Example 7 as a guide.

a) (-5, 0)

b) (0, 9)

c) (0, -4)

d) (10, 0)

YTI 10 Plot each of these points in the *x*-*y*-plane. Be sure to label each one as well.

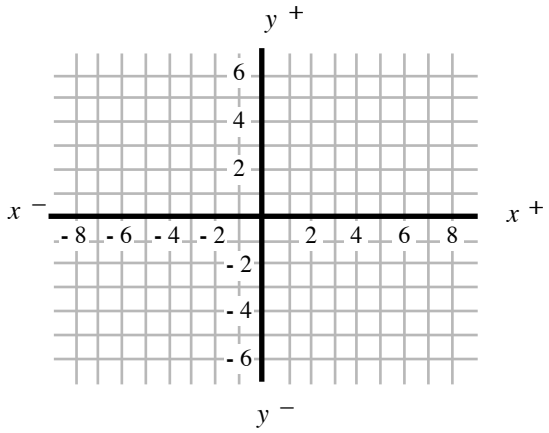
a) (0, 5)

b) (-4, 0)

c) (0, 0)

d) (5, 0)

e) (0, -3)



YTI 11 Given the graph at the right, identify the ordered pair of each point.

a) A

b) B

c) C

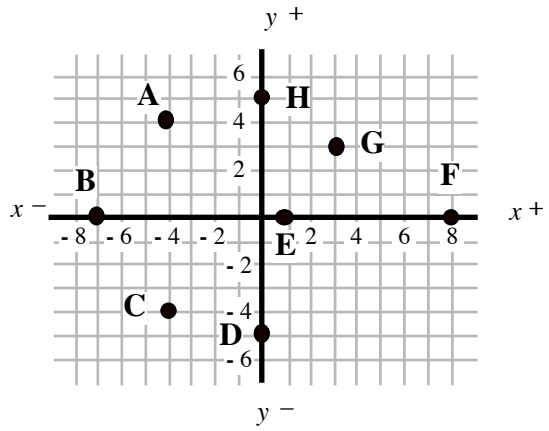
d) D

e) E

f) F

g) G

h) H



LOCATING NEW POINTS

This next exercise will be helpful to the discussion in Section 4.3. In it, you are given a point and then asked to find another point by following some simple directions.

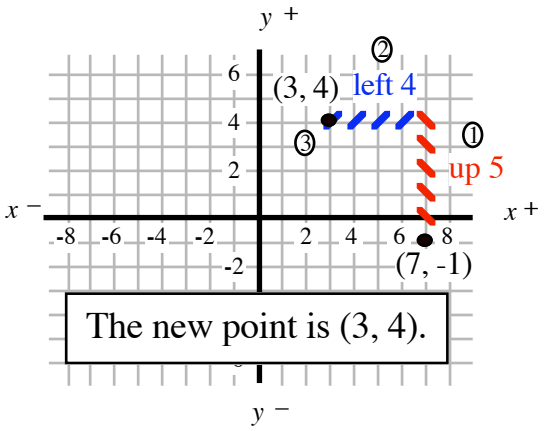
Example 8: From a given point, locate and label a new point in the *x*-*y*-plane according to the directions.

Procedure: Plot the given point and then follow the directions to find *one* other point, and label it.

a) The given point is (7, -1).

Directions:

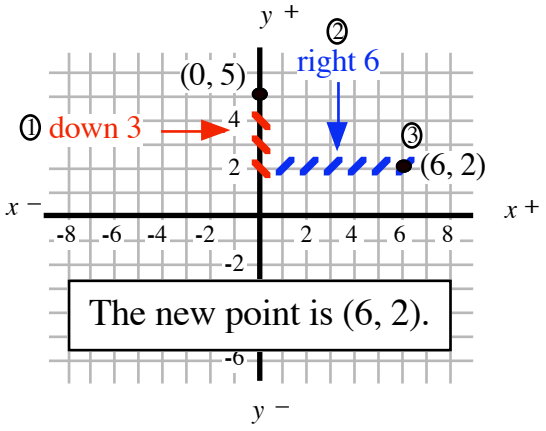
1. Count up 5 spaces, and
2. Count to the left 4 spaces.
3. Plot and label the new point.



b) The given point is (0, 5).

Directions:

1. Count down 3 spaces, and
2. Count to the right 6 spaces.
3. Plot and label the new point.



YTI 12 From a given point, locate and label a new point in the *x*-*y*-plane according to the directions. Use example 8 as a guide.

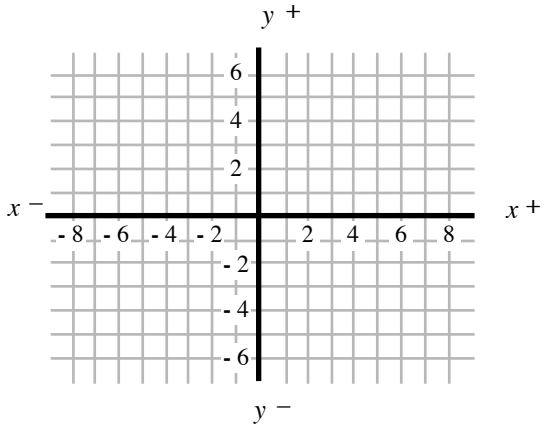
a) The given point is (6, 4).
1. Count down 2 spaces, and
2. Count to the left 5 spaces.
3. Plot and label the new point.

New point: (,)

b) The given point is (-5, -1).
1. Count down 4 spaces, and
2. Count to the right 8 spaces.
3. Plot and label the new point.

New point: (,)

Use this graph for a) and b):



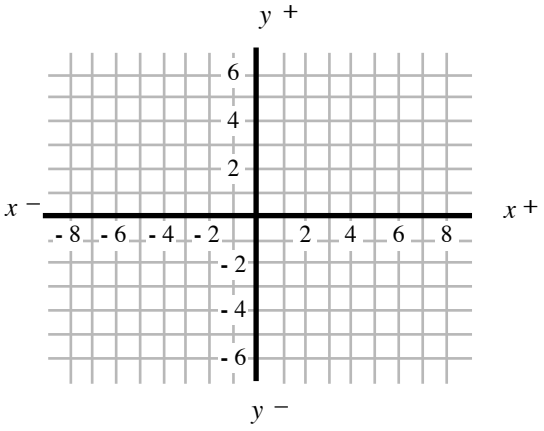
c) The given point is (3, 2).
1. Count up 3 spaces, and
2. Count to the left 7 spaces.
3. Plot and label the new point.

New point: (,)

d) The given point is (0, -3).
1. Count up 3 spaces, and
2. Count to the right 4 spaces.
3. Plot and label the new point.

New point: (,)

Use this graph for c) and d):



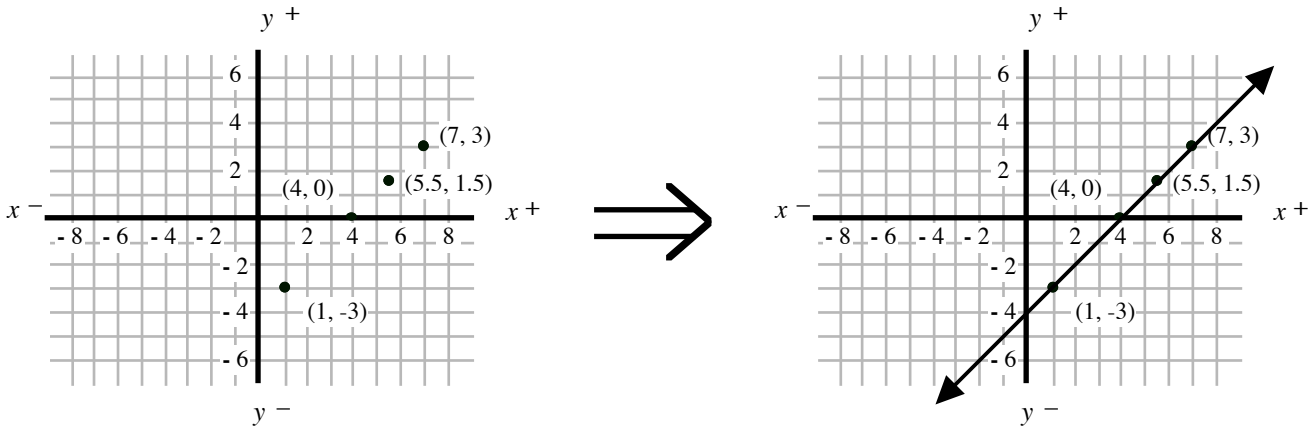
POINTS ON A LINE

Sometimes the points plotted in the *x*-*y*-plane lie on a line. In a plane, a line is straight and goes on forever. We indicate this by placing arrows on each end of the line.

If we know that some points are on a line, then we can plot the points and draw the line that passes through them. For example, throughout this section we have seen a number of solutions to the equation $x - y = 4$, such as (7, 3), (5.5, 1.5), (4, 0), and (1, -3).

Because these ordered pairs are all solutions of the same equation, they can be represented as points in the *x*-*y*-plane, and connected to form a straight line. We place arrowheads at each end of the line to indicate that the line continues indefinitely beyond the confines of the *x*-*y*-plane shown. (Use something with a straight edge, such as a ruler, as a guide while drawing the line.)

The reason we draw the line is to show all of the possible solutions to an equation or a situation, such as the comparison of temperatures between Sunny Meadows and Green Valley.



These points represent some of the temperature comparisons between Sunny Meadows and Green Valley.

This line represents *all* of the possible temperatures of Sunny Meadows and Green Valley.

The fewest number of points we need to draw a line is two. In other words,

> Any two points determine a unique line.

Note: In mathematics, *unique* means *one and only one*. Through any two points we can draw one and only one line.

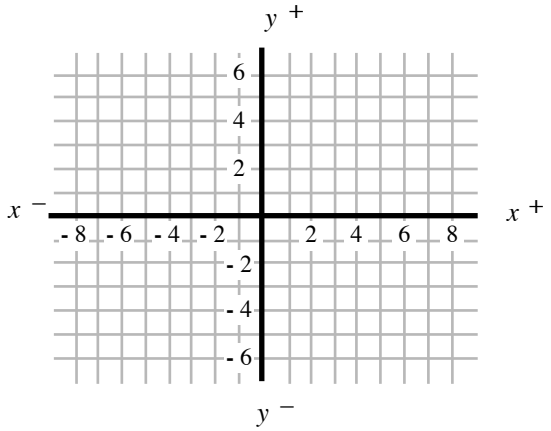
However, to help us draw the line more accurately, we usually plot at least three points.

In Section 4.2 we will learn a technique for finding points on a line. For now, we are given three points known to be on a line, asked to plot the points, and then to draw a line through the three points.

YTI 13

Three solutions to the line equation $y = \frac{1}{2}x + 3$ are (-4, 1), (0, 3), and (2, 4).

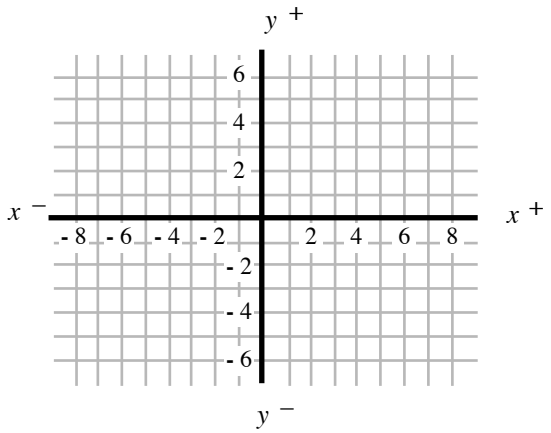
Plot these points in the *x*-*y*-plane, and draw the line that passes through them.



YTI 14

Three solutions to the line equation $3x + y = -2$ are (-2, 4), (0, -2), and (1, -5).

Plot these points in the *x*-*y*-plane, and draw the line that passes through them.



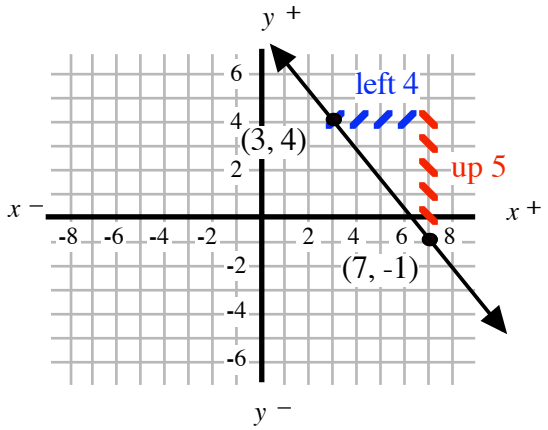
Example 9: From a given point, locate and label a new point in the x-y-plane according to the directions. Then draw the unique line that passes through these two points.

Procedure: Plot the given point and then follow the directions to find one other point, and label it. Draw a line through these two points.

a) The given point is (7, -1).

Directions:

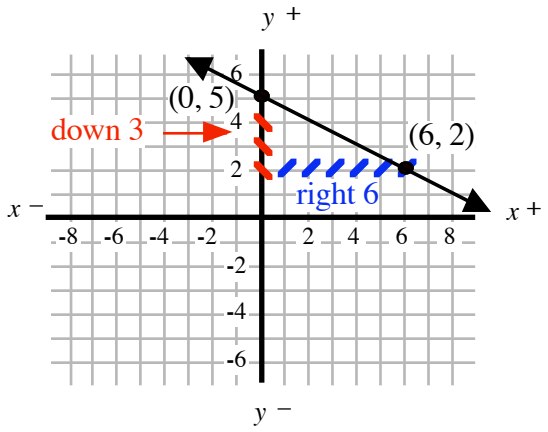
1. Count up 5 spaces, and
2. Count to the left 4 spaces.
3. Plot and label the new point.
4. Draw the line through these two points.



b) The given point is (0, 5).

Directions:

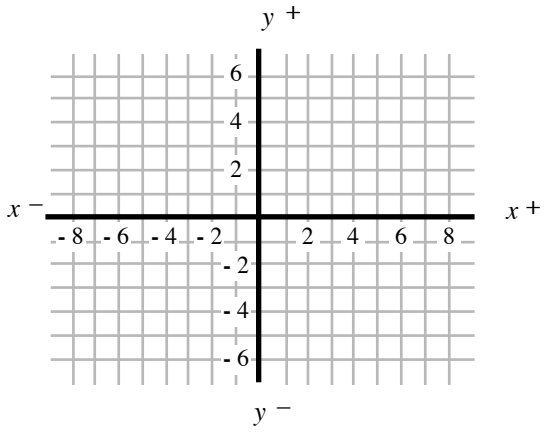
1. Count down 3 spaces, and
2. Count to the right 6 spaces.
3. Plot and label the new point.
4. Draw the line through these two points.

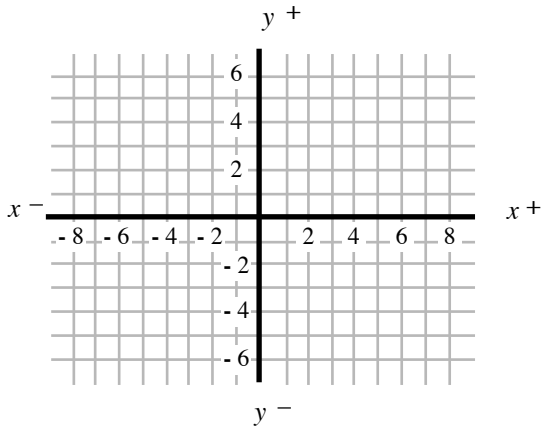


YTI 15 From a given point, locate and label a new point in the *x*-*y*-plane according to the directions. Use Example 9 as a guide.

a) The given point is (-5, 1).
   1. Count down 4 spaces, and
   2. Count to the right 3 spaces.
   3. Plot and label the new point.
   4. Draw the line through these two points.

b) The given point is (2, 3).
   1. Count down 3 spaces, and
   2. Count to the left 5 spaces.
   3. Plot and label the new point.
   4. Draw the line through these two points.



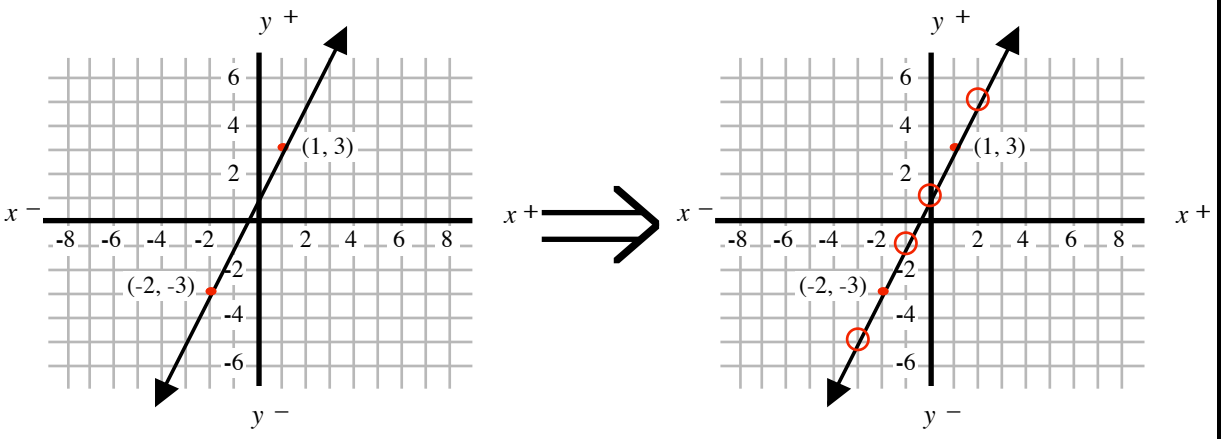


IDENTIFYING POINTS ON A LINE

If we have the graph of a line that passes through two points, then it is sometimes possible to identify other points on the line within our *x*-*y*-grid. Some of these points might be between the two given points; others might be beyond one of them.

Example 10: The graph of the equation $y = 2x + 1$ passes through the points (1, 3) and (-2, -3), as shown in the x-y-plane. Identify four other points that appear to be on the line.

Procedure: Look closely at the graph and identify where the line crosses at integer coordinates in the grid. Do not use fractional coordinates.

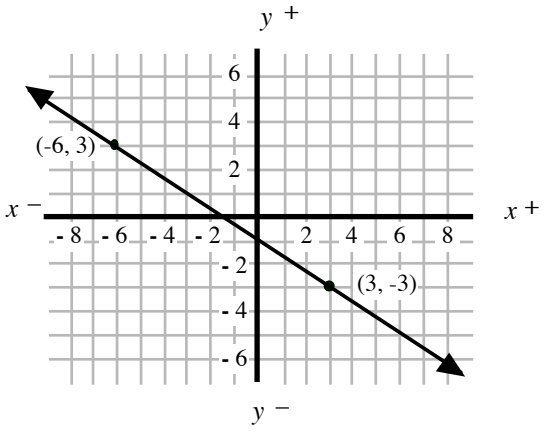


Answer: The four circled points are (-3, -5), (-1, -1), (0, 1), and (2, 5).

YTI 16

The graph of the equation $y = -\frac{2}{3}x - 1$ passes through the points (-6, 3) and (3, -3), as shown.

Identify *three* other points that appear to be on the line. Use Example 9 as a guide. (Do not use fractional coordinates.)



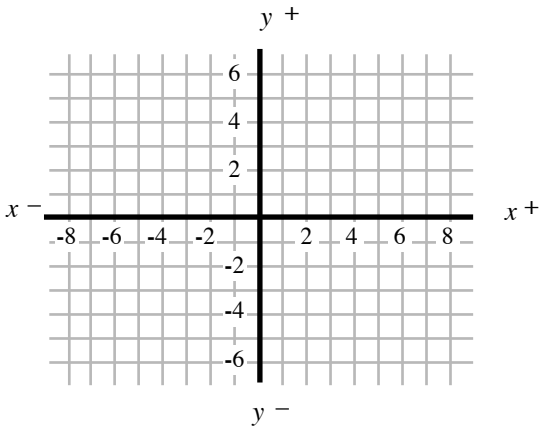
HORIZONTAL AND VERTICAL LINES

A *horizontal* line is one that goes straight across from left to right. A *vertical* line is one that goes straight up and down. We will discuss horizontal and vertical lines in greater detail in Section 4.6. For now, we graph them using two points.

YTI 17 For each, plot the given points and draw the line that passes through them. Also, identify three other points on each line.

a) Two points on a horizontal line:

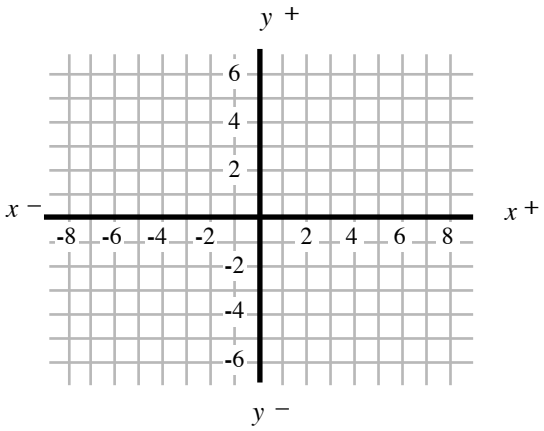
(-3, 4) and (2, 4)



Three other points:

b) Two points on a vertical line:

(3, -5) and (3, 1)



Three other points:

Answers: You Try It and Think About It

YTI 1:

Temperature in Sunny Meadows	Temperature in Green Valley
20	16
1.5	- 2.5
0	**- 4**
- 5.5	**- 9.5**

YTI 2: a) $5.4 - 1.4 \stackrel{?}{=} 4$

$4 = 4$ True!

b) $-1 - (-5) \stackrel{?}{=} 4$

$-1 + 5 = 4$

$4 = 4$ True!

YTI 3: a) (1, -4) b) (5.2, 0) c) $\left(-2\frac{5}{8}, 1\frac{3}{8}\right)$ d) (-8, -10)

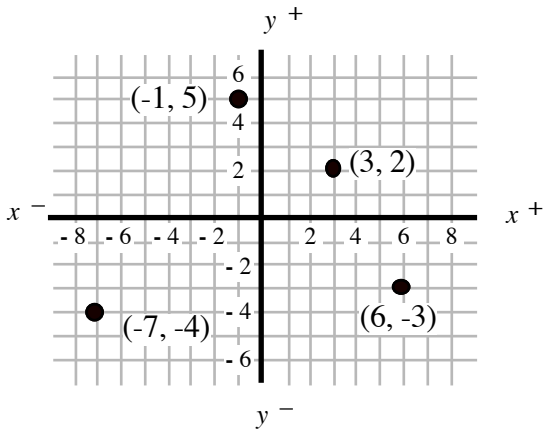
YTI 4: a) $x = -5.1, y = -3$ b) $x = 0, y = 4$ c) $x = -6, y = -\frac{7}{10}$

YTI 5: a) $6 = 6$ True!
Yes, (4, -3) is a solution.

b) $-6 = 6$ False!
No, (2, -6) is not a solution.

c) $6 = 6$ True!
Yes, $\left(\frac{2}{3}, 2\right)$ is a solution.

YTI 6:



YTI 7: a) (-3, 5) b) (-7, 2) c) (-5, -3) d) (-3, -6)

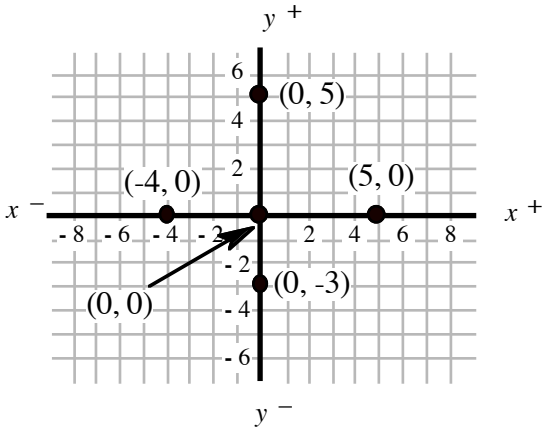
e) (3, -4) f) (8, -6) g) (1, 1) h) (8, 5)

YTI 8: a) Quadrant II b) Quadrant IV c) Quadrant III d) Quadrant I

YTI 9: a) (-5, 0) is on the negative *x*-axis b) (0, 9) is on the positive *y*-axis

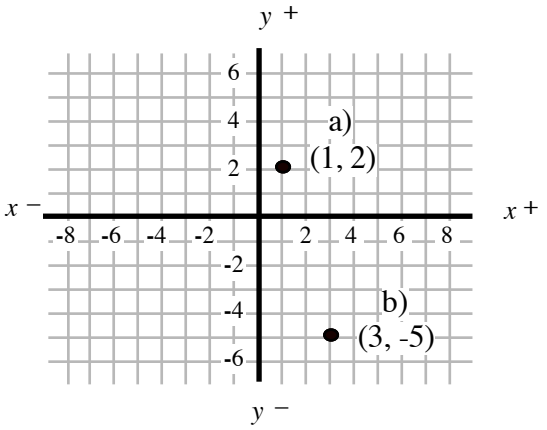
c) (0, -4) is on the negative *y*-axis d) (10, 0) is on the positive *x*-axis

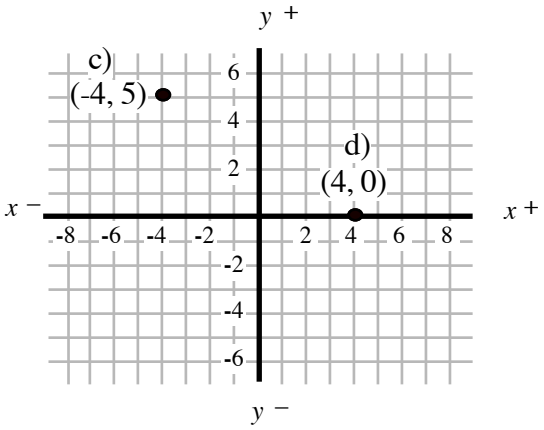
YTI 10:



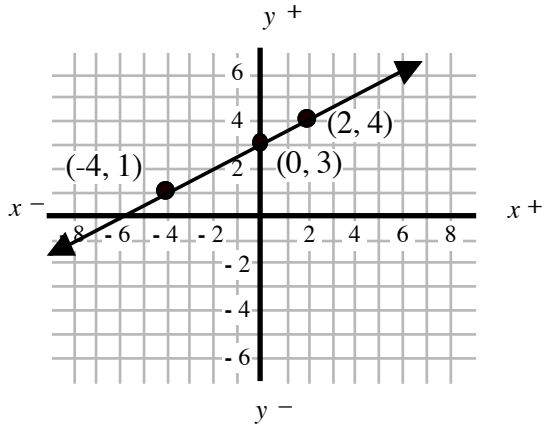
YTI 11: a) (-4, 4) b) (-7, 0) c) (-4, -4) d) (0, -5)
e) (1, 0) f) (8, 0) g) (3, 3) h) (0, 5)

YTI 12: a) (1, 2) b) (3, -5) c) (-4, 5) d) (4, 0)

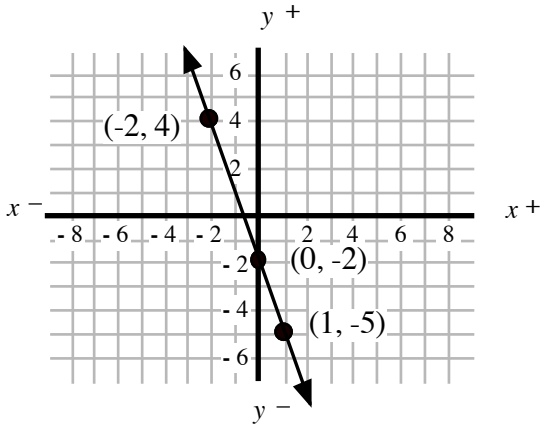




YTI 13:



YTI 14:



Think About It: **1.** Answers may vary. One possibility is, The coordinates are always in alphabetical order, x and then y.

Section 4.1 Exercises

Think Again.

1. What would you tell a classmate is the best way to remember which is the x-value, and which is the y-value in an ordered pair? *(Refer to Think About It 1)*

2. In which quadrant(s) in the x-y-plane would you find all points for which the x-coordinate is the same as the y-coordinate? Explain your answer or show an example that supports your answer.

3. In which quadrant(s) in the x-y-plane would you find all points for which the x-coordinate is the opposite of the y-coordinate? Explain your answer or show an example that supports your answer.

4. What type of lines pass through only two quadrants? Explain your answer or show an example that supports your answer.

Focus Exercises.

Determine whether the given ordered pair is a solution to the equation $2x - 5y = 10$.

5. (10, 2) **6.** (0, -2) **7.** (-5, 0) **8.** (5, 4)

Determine whether the given ordered pair is a solution to the equation $y = \frac{3}{2}x - 4$.

9. (6, 0) **10.** (-4, -2) **11.** (2, -1) **12.** (0, -4)

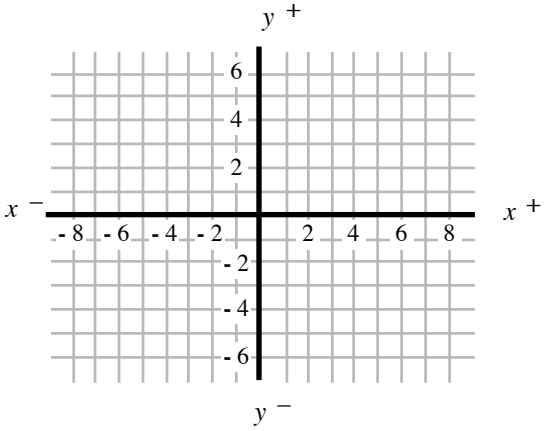
Plot each point in the x-y-plane. Be sure to label each one with its ordered pair.

13. (5, 4) **14.** (-3, 1)

15. (2, -5) **16.** (-1, -4)

17. (-7, 0) **18.** (5, 0)

19. (0, -2) **20.** (0, 6)



Given the graph at the right, identify the ordered pair of each point shown.

21. A

22. B

23. C

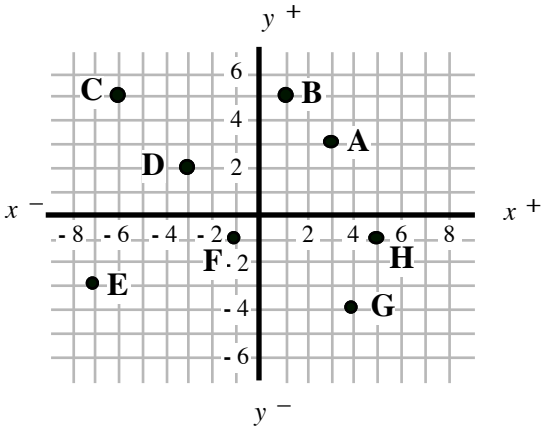
24. D

25. E

26. F

27. G

28. H



Determine in which quadrant each point lies.

29. (8, -2)

30. (-2, -2)

31. (-3, 5)

32. (1, 4)

33. (-10, -15)

34. (-8, 12)

35. (1, -20)

36. (26, 34)

37. (1, -7)

38. (-4, -9)

39. (2, 11)

40. (-5, 14)

Describe where each axial point is located in the x-y-plane.

41. (0, 6)

42. (-5, 0)

43. (3, 0)

44. (0, -1)

45. (0, -7)

46. (8, 0)

47. (0, 0)

48. (0, 3)

Given the graph at the right, identify the ordered pair of each point shown.

49. A

50. B

51. C

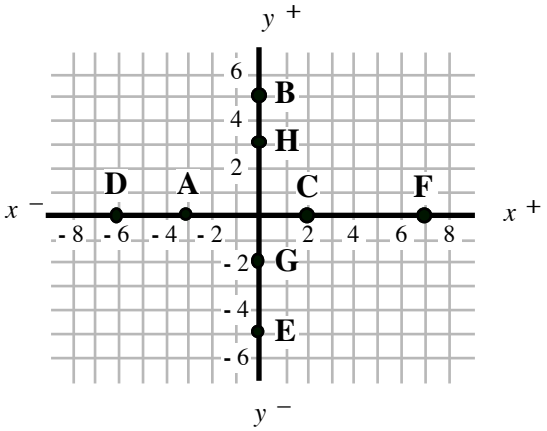
52. D

53. E

54. F

55. G

56. H



From a given point, locate and label a new point in the x-y-plane according to the directions.

57. The given point is (1, 6).
1. Count down 5 spaces, and
2. Count to the left 7 spaces.
3. Plot and label the new point.

58. The given point is (4, 0).
1. Count up 5 spaces, and
2. Count to the left 3 spaces.
3. Plot and label the new point.

59. The given point is (-2, -4).
1. Count down 2 spaces, and
2. Count to the right 6 spaces.
3. Plot and label the new point.

60. The given point is (-3, 1).
1. Count up 1 spaces, and
2. Count to the right 3 spaces.
3. Plot and label the new point.

61. The given point is (0, 3).
1. Count up 3 spaces, and
2. Count to the left 2 spaces.
3. Plot and label the new point.

62. The given point is (-6, -5).
1. Count down 2 spaces, and
2. Count to the right 6 spaces.
3. Plot and label the new point.

63. The given point is (5, -4).
1. Count up 3 spaces, and
2. Do not count left or right.
3. Plot and label the new point.

64. The given point is (-3, 1).
2. Do not count up or down.
2. Count to the right 4 spaces.
3. Plot and label the new point.

Plot the three points of the given equation, and draw the line that passes through them.

65. The line equation $y = 2x - 5$ passes through the points (2, -1), (0, -5) and (5, 5). (2, -1).

66. The line equation $y = -2x + 3$ passes through the points (-2, 7), (0, 3) and

67. The line equation $y = \frac{2}{3}x - 1$ passes passes
through the points (-3, -3), (0, -1) and (3, 1). (8, -4).

68. The line equation $y = -\frac{3}{4}x + 2$

through the points (-4, 5), (0, 2) and

From a given point, locate and label a new point in the x-y-plane according to the directions, then draw the line through these two points.

69. The given point is (6, 2).
1. Count down 4 spaces, and
2. Count to the left 3 spaces.
3. Plot and label the new point.
4. Draw the line through these two points.

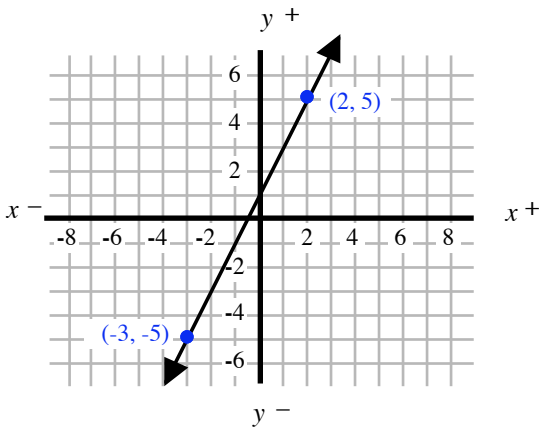
70. The given point is (-1, 5).
1. Count down 3 spaces, and
2. Count to the right 4 spaces.
3. Plot and label the new point.
4. Draw the line through these two points.

71. The given point is (4, -4).
1. Count up 4 spaces, and
2. Count to the left 5 spaces.
3. Plot and label the new point.
4. Draw the line through these two points.

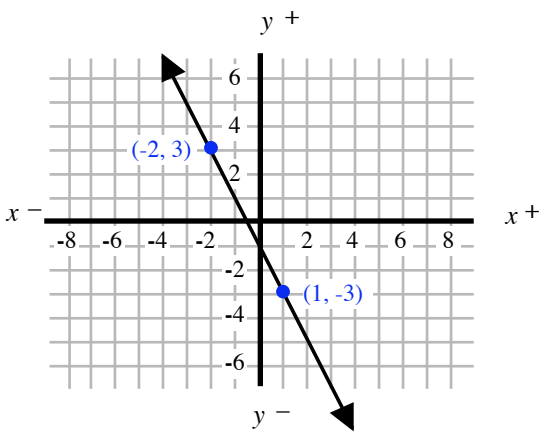
72. The given point is (-2, -3).
1. Count up 6 spaces, and
2. Count to the right 2 spaces.
3. Plot and label the new point.
4. Draw the line through these two points.

Identify three other points that appear to be on the given line. (Do not use fractional coordinates.)

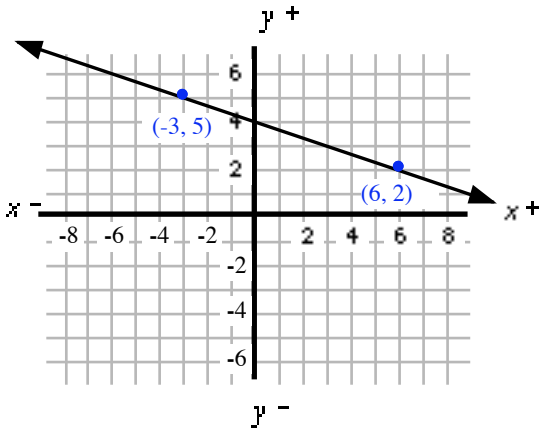
73. The graph of the equation $y = 2x + 1$ passes through the points (-3, -5) and (2, 5), as shown.



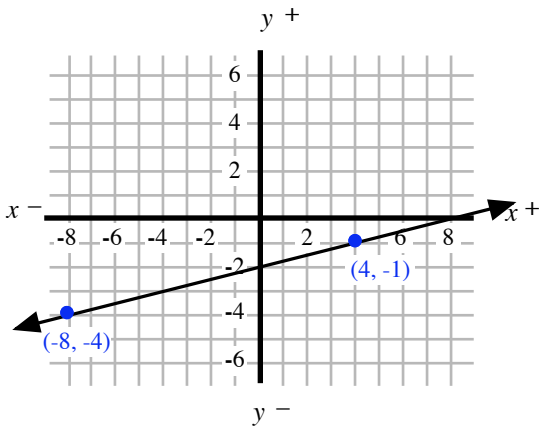
74. The graph of the equation $y = -2x - 1$ passes through the points (1, -3) and (-2, 3), as shown.



75. The graph of the equation $x + 3y = 12$ passes through the points (-3, 5) and (6, 2), as shown.



76. The graph of the equation $x - 4y = 8$ passes through the points (-8, -4) and (4, -1), as shown.



For each, plot the given points and draw the line that passes through them. Also, identify three other points on each line.

77. (2, -1) and (2, 6)

78. (5, 6) and (-1, 6)

79. (-6, -3) and (4, -3)

80. (-4, -5) and (-4, 1)

Think Outside the Box.

Determine if the given ordered pair is a solution to the equation $y = x^2 - 3x - 4$.

81. (3, 4)

82. (5, 6)

83. (-2, 6)

84. (-4, 0)