Section 4.3 Features of a Line

Objectives
In this section, you will learn to:

- Identify the x- and y-intercepts of a line.
- Calculate the slope of a line by counting rise and run.
- Using the slope ratio to find points on a line.
- Identify the slope and y-intercept of a line from an equation of the form $y = mx + b$.
- Graph a line of the form $y = mx + b$.

To successfully complete this section, you need to understand:

- Plotting points in the x-y-plane (4.1)
- Drawing a line in the x-y-plane (4.1)
- Choosing values of x and y to find points on a line (4.2)

INTRODUCTION

In Section 4.2 we learned the technique for graphing a line from an equation. This is done by selecting either an x-value and solving for the corresponding y-value, or by first selecting a y-value and solving for x.

In this section, we learn some of the features of a line and use them to graph lines using a non-algebraic method.

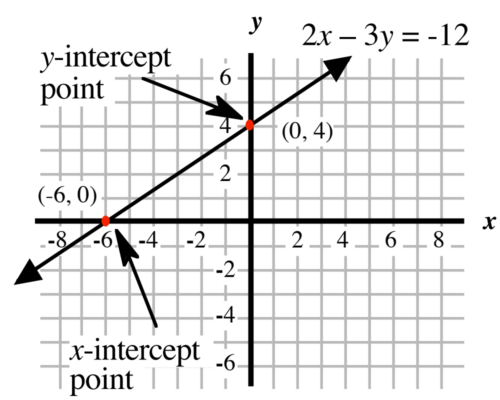
x- AND *y*-INTERCEPTS

Every line that is neither horizontal nor vertical has two axial points called *intercepts*. The value at which a line crosses the x-axis is called the ***x*-intercept.** Likewise, the value at which a line crosses the y-axis is called the ***y*-intercept**.

For example, in the graph of $2x – 3y = -12$, the x-intercept is -6 and the y-intercept is 4.

When labeled as an ordered pair, the x-intercept point is (-6, 0) and the y-intercept point is (0, 4).

Because the x-intercept point and the y-intercept point are axial points, it is required that at least one of the coordinates is 0.



When graphing lines in Section 4.2, we often found the x- or y-intercept point. Example 2 of Section 4.2 has an equation in the form $ax + by = c$. In the equation $3x + y = -2$, we found both x- and y-intercept points:

- when we chose $x = 0$, we found the y-intercept, -2, and the y-intercept point, (0, -2);
- when we chose $y = 0$, we found the x-intercept, $-\frac{2}{3}$, and the x-intercept point, $\left(-\frac{2}{3}, 0\right)$.

Example 3 of Section 4.2 has an equation in the form $y = mx + b$. In the equation $y = 2x + 1$, we chose $x = 0$ and found the y-intercept, 1, and the y-intercept point, (0, 1).

Notice that the y-intercept, 1, is the same as the value of b (the constant) in the equation. Will this always be the case? Yes. To see why this is so, we can replace x with 0 in the general equation and find the corresponding y-value:

x	$y = mx + b$	(x, y)
0	$y = mx + b$ $y = m(0) + b$ $y = 0 + b$ $y = b$	$(0, b)$

> For every linear equation written in the form $\boldsymbol{y = mx + b}$,
>
> $\boldsymbol{b}$ is the y-intercept and $(0, \boldsymbol{b})$ is the y-intercept point.
>
> This is true regardless of the value of m.

~Instructor Insight~

This section focuses on the y-intercept. The x-intercept will be discussed in more detail in Section 4.6.

Example 1: For each linear equation, identify the y-intercept point.

a) $y = 4x + 5$ b) $y = \frac{3}{5}x - 4$ c) $y = -3x + \frac{1}{2}$ d) $y = 2x$

Procedure: The y-intercept is the constant term in the equation, and the x-coordinate is 0. For part d), there is no visible constant term, so the constant is 0, as in $y = 2x + 0$.

Answer: a) (0, 5) b) (0, -4) c) $(0, \frac{1}{2})$ d) (0, 0)

YTI 1 For each linear equation, identify the y-intercept point. Use Example 1 as a guide.

a) $y = 4x + 3$

b) $y = -2x + 1$

c) $y = \frac{4}{5}x - 9$

d) $y = -3x$

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

f) $y = -x + 1.5$

Think about it 1 Does a vertical line have an x-intercept. a y-intercept, or neither. Explain your answer.

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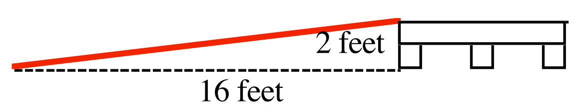
THE SLOPE RATIO

Just like a wheelchair ramp, a mountain, or a staircase, every non-vertical line has a slope to it. This slope can also be described as a *slant* or *steepness*.

A wheelchair ramp generally has a very shallow slant so that the wheelchair driver can easily navigate the ramp. Many wheelchair ramps are like a line in that they are straight and the steepness does not change.

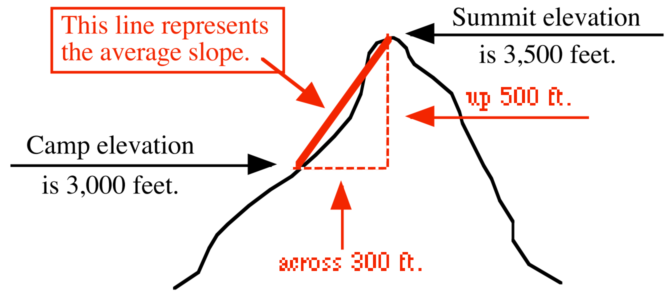
For example, Mark built a wheelchair ramp for his grandfather. Mark made the ramp so that it had a slope ratio of 1 to 8, or $\frac{\text{1 vertical foot}}{\text{8 horizontal feet}} = \frac{1}{8}$. This means that the slant of the ramp should have a vertical rise of 1 foot for every 8 horizontal feet of length.

The ramp Mark made has a horizontal length of16 feet, and the vertical rise is 2 feet: $\frac{\text{2 feet}}{\text{16 feet}} = \frac{1}{8}$, the same slope ratio.



A mountain has steepness to it, as well, but it is unlike a line because the mountain will be steeper in some parts than in others. Often, a geographer will consider the average steepness, or slope, of a mountain, possibly from a point somewhere on the mountain to the top of the mountain (the summit).

In the example at right, Joann wants to know the average slope of the mountain from her camp at the 3,000 foot elevation level.



Using her watch with GPS (global positioning system), she is able to calculate that the summit (the top most point on the mountain) is at 3,500 feet and the horizontal distance from her camp is 300 feet.

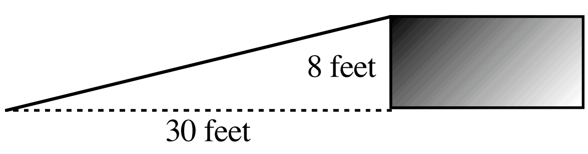
Note: The elevations mentioned in the example above indicate elevations *above sea level*. So, the camp is at 3,000 feet above sea level and the summit is at 3,500 feet above sea level.

Joann determines the slope ratio is $\frac{\text{500 vertical feet}}{\text{300 horizontal feet}}$. Because $\frac{500}{300}$ can simplify by a factor of 100 to just $\frac{5}{3}$, we can say that the slope ratio for that part of the mountain is $\frac{5}{3}$.

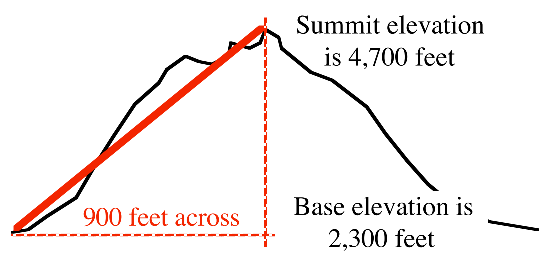
For the sake of consistency, the slope ratio of physical objects is always defined as $\frac{\text{vertical distance}}{\text{horizontal distance}}$. This is true in the examples of the wheelchair ramp and of the mountain.

YTI 2 Identify the slope ratio of the diagram. Simplify the ratio to lowest terms. Use the discussion above as a guide.

a) A ramp at a warehouse loading dock ends 8 feet above the driveway. The start of the ramp is 30 feet from the loading dock, as shown. What is the slope ratio of the ramp?

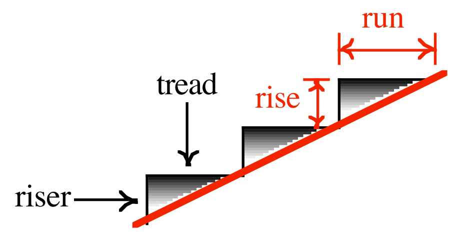


b) The elevation at the base of a mountain is 2,300 feet, and the summit is at 4,700 feet. The horizontal distance from the base to the summit is 900 feet. What is the (average) slope ratio of the mountain?

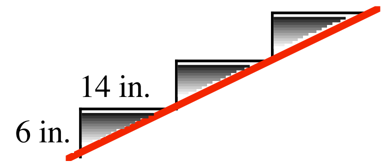


A staircase has a consistent slant to it as well. By itself it isn't a line, but we might imagine a line that supports the steps from underneath.

A staircase step has a vertical riser and a horizontal tread. In the world of stair making, the height of the riser is called the *rise* and the length of the tread is called the *run*. *Source: www.Staircraft.com*



For example, in the staircase at right, the riser (rise) is 6 inches and the tread (run) is 14 inches. The slope ratio of the line underneath is $\frac{\text{rise}}{\text{run}} = \frac{6}{14} = \frac{3}{7}$.



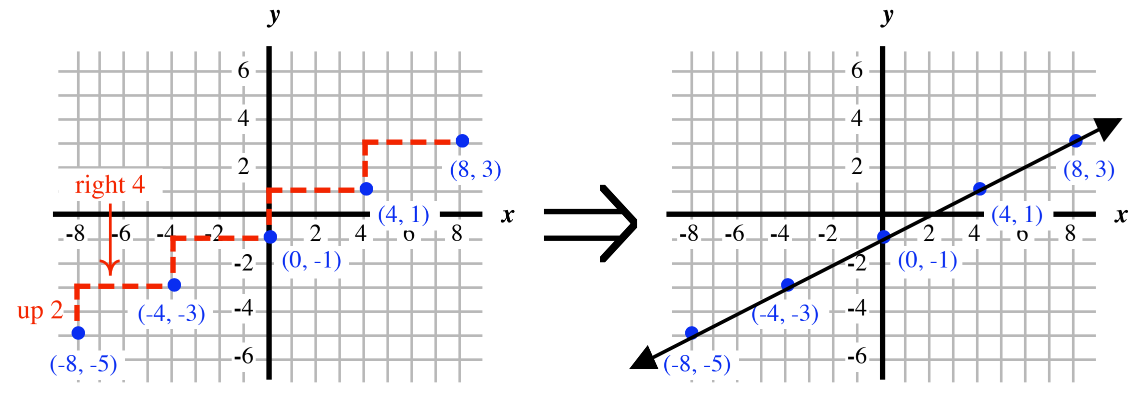
We can use the analogy of the staircase to help us understand the slope of a line. The notion of rise and run is similar to the exercise of locating a new point, as we did in Section 4.1. In that exercise, we used directions of

1. up or down, and then
2. left or right

to locate a new point in the *x*-*y*-plane. Doing this exercise repeatedly is like creating stair steps from point to point, and the points that are created are collinear.

Example 2:	From the point (-8, -5), locate and label four new points in the *x*-*y*-plane according to the directions. Then draw the unique line that passes through these five points.
Directions:	1. Count up 2 spaces, and 2. Count to the right 4 spaces. 3. Plot and label the new point. 4. Repeat.
Procedure:	Starting at (-8, -5), use the directions to locate a second point (the first new point). From this point, repeat the directions to locate a third point, and so on.

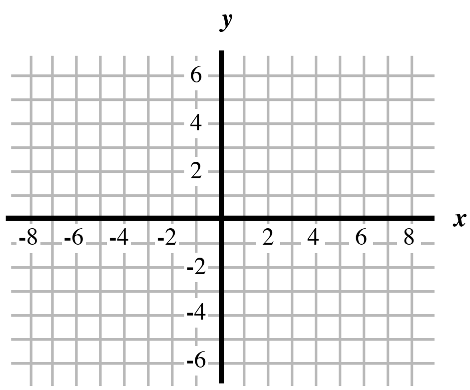
Answer:

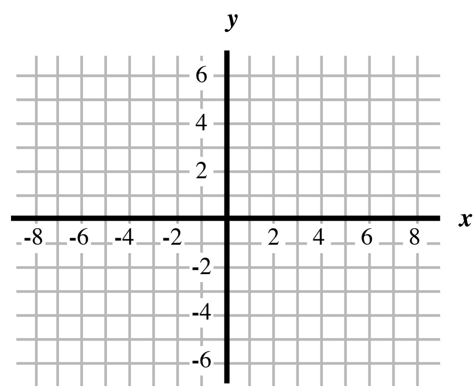


YTI 3 From the given point, locate and label three new points in the *x*-*y*-plane according to the directions. Then draw the unique line that passes through these four points. Use Example 2 as a guide.

a) The given point is (4, -4).
1. Count up 3 spaces, and
2. Count to the left 2 spaces.
3. Plot and label the new point.
4. Repeat.

b) The given point is (7, 5).
1. Count down 1 spaces, and
2. Count to the left 4 spaces.
3. Plot and label the new point.
4. Repeat.





~Instructor Insight~
A somewhat rare instance of a physical object with a negative slope is a backward cliff face. The slope is still calculated using distances, but it is assigned a negative value.

THE SLOPE OF A LINE

In the discussion on the slope ratio, it is mentioned that the slope ratio of physical objects is defined as $\frac{\text{vertical distance}}{\text{horizontal distance}}$. Because distance is always a positive measure, the slope ratio for physical objects is always positive. This is due to the fact that a physical object, such as a ramp, a staircase, or a mountain, can be looked at from different points of view, different orientations.

For a line, the slope ratio is $\frac{\text{vertical } \textit{change} \text{ (rise)}}{\text{horizontal } \textit{change} \text{ (run)}}$, or simply $\frac{\text{rise}}{\text{run}}$, and either change can be positive or negative. This is because in the *x-y*-plane, there is only one point of view, one orientation. The *x-y*-plane is centered at the origin and the direction of *up* is positive and *down* is negative. Similarly, the direction *right* is positive and *left* is negative.

In general, we call the slope ratio of a line just the *slope*, and we give it the value *m*:

The **slope** of line is defined as $\boldsymbol{m} = \frac{\textbf{rise}}{\textbf{run}}$.

We can use the rise and run directions of the slope to locate points on the line. That is, given one point on the line, the slope indicates what up/down and left/right directions we are to count to locate other points.

In the numerator of the slope, a positive rise indicates counting upward and a negative rise indicates counting downward. In the denominator a positive run indicates counting to the right and a negative run indicates counting to the left.

To prepare for graphing lines using the slope, let's first explore how to interpret a given $\frac{\text{rise}}{\text{run}}$.

Example 3: Given the slope, *m*, describe the directions of the slope.

a) $m = \frac{2}{7}$ b) $m = \frac{5}{-4}$ c) $m = -3$ d) $m = \frac{-1}{-6}$

Procedure: The numerator is the rise (up/down direction) and the denominator is the run (left/right direction). In part c), we can write it as a fraction, $m = \frac{-3}{1}$.

Slope interpretation: **Answer:**

a) $m = \frac{2}{7} = \frac{\text{up 2}}{\text{right 7}}$ *Up 2 and right 7*

b) $m = \frac{5}{-4} = \frac{\text{up 5}}{\text{left 4}}$ *Up 5 and left 4*

c) $m = -3 = \frac{-3}{1} = \frac{\text{down 3}}{\text{right 1}}$ *Down 3 and right 1*

d) $m = \frac{-1}{-6} = \frac{\text{down 1}}{\text{left 6}}$ *Down 1 and left 6*

YTI 4 Given the slope, *m*, describe the directions of the slope. Use Example 3 as a guide.

a) $m = \frac{-9}{2}$

b) $m = \frac{8}{3}$

c) $m = 4$

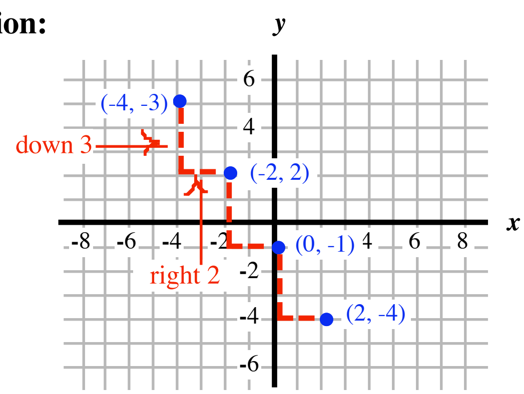
d) $m = \frac{-2}{-5}$

Let's put this understanding to use in drawing the graph of a line based on knowing one point on the line and the slope of the line.

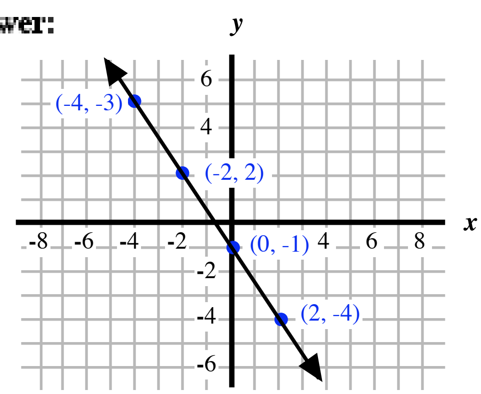
Example 4: Draw the line that passes through the point (-4, 5) and has slope $m = \frac{-3}{2}$.

Procedure: $m = \frac{-3}{2} = \frac{\text{down } 3}{\text{right } 2}$ and has directions *down 3 and right 2*, starting from the point (-4, 5). We should be able to locate three other points on the line within the *x*-*y*-grid.

Preparation:



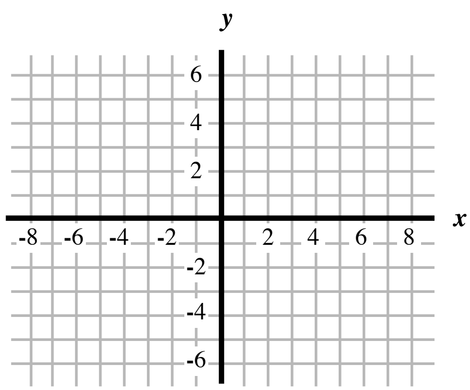
Answer:



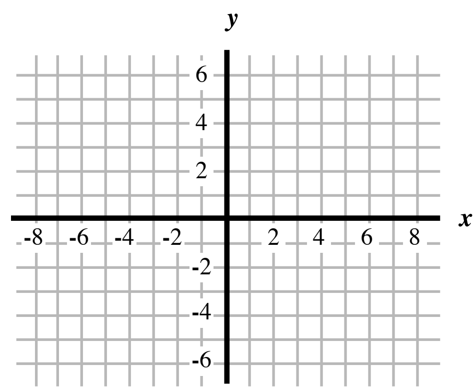
Note: Because it is difficult to show the step-by-step drawing of a graph on a page, the preparation graph is shown in Example 4. However, only the answer graph is expected to be shown in You Try It 5.

YTI 5 Draw the line that passes through the given point and has given slope. Use Example 4 as a guide.

a) Given point: (-6, 1); given slope $m = \frac{2}{5}$.



b) Given point: (-2, 6); given slope m = -4.



MORE ABOUT THE SLOPE OF A LINE

Every positive and negative slope can be interpreted in two ways. To illustrate this, let's consider the slopes $m = \frac{3}{5}$ and $m = -\frac{1}{4}$. In a positive fraction, such as $m = \frac{3}{5}$, the numerator and denominator have the same sign, either both positive or both negative. So,

$m = \frac{3}{5}$ can be thought of as either

1. $m = \frac{+3}{+5}$, *up 3 and right 5*; or
2. $m = \frac{-3}{-5}$, *down 3 and left 5.*

In a negative fraction, such as $m = -\frac{1}{4}$, the numerator and denominator have different signs, one is positive and the other is negative. So,

$m = -\frac{1}{4}$ can be thought of as either

1. $m = \frac{-1}{+4}$, *down 1 and right 4*, or
2. $m = \frac{+1}{-4}$., *up 1 and left 4.*

Example 5: Given the slope, *m*, describe two possible directions of the slope.

a) $m = -\frac{1}{3}$ b) $m = 2$

Procedure: Consider the different ways the numerator and denominator can be positive or negative without changing the value of the *m*.

Slope interpretations: **Answer:**

a) $m = -\frac{1}{3}$ can be written as either $m = \frac{-1}{3} = \frac{\text{down } 1}{\text{right } 3}$ *Down 1 and right 3*

or as $m = \frac{1}{-3} = \frac{\text{up } 1}{\text{left } 3}$ *Up 1 and left 3*

b) $m = 2$ can be written as either $m = \frac{2}{1} = \frac{\text{up } 2}{\text{right } 1}$ *Up 2 and right 1*

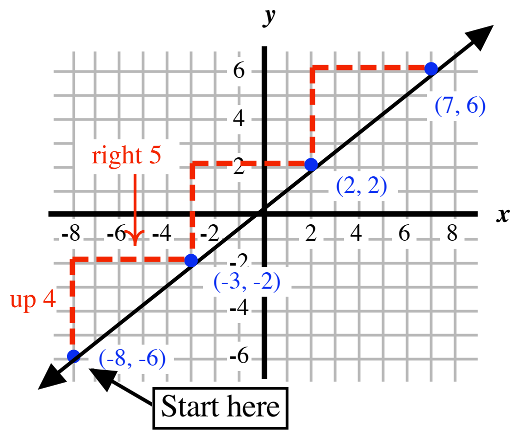
or as $m = \frac{-2}{-1} = \frac{\text{down } 2}{\text{left } 1}$ *Down 2 and left 1*

YTI 6 Given the slope, *m*, describe two possible directions of the slope. Use Example 5 as a guide.

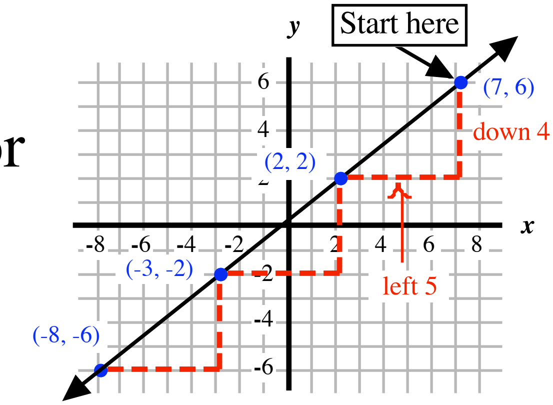
a) $m = 5$ b) $m = -\frac{7}{4}$

Consider a line that has slope $m = \frac{4}{5}$ and passes through the points (-8, -6), (-3, -2), (2, 2), and (7, 6). We can verify that these points are on the line by starting at (-8, -6) and using the slope directions *up 4 and right 5* to locate the other points on the line.

Or, we can verify that these points are on the line by starting at (7, 6) and using the slope directions *down 4 and left 5* to locate the other points on the line.



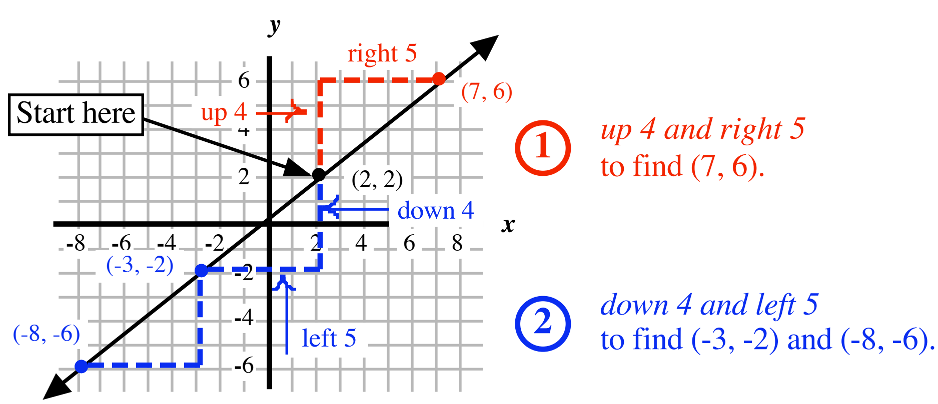
or



What this illustration shows is that we can actually use both sets of directions together:

Because $m = \frac{4}{5} = \frac{\text{up } 4}{\text{right } 5}$, we get the directions *up 4 and right 5*. In addition, this slope can be written as $m = \frac{-4}{-5} = \frac{\text{down } 4}{\text{left } 5}$, giving us the directions *down 4 and left 5*.

This idea is especially useful if the only point we are given is in the middle region of the *x*-*y*-grid, near to the origin. For example, we can start at (2, 2) and use the two sets of directions, *up 4 and right 5* and *down 4 and left 5,* to find more points on the line:

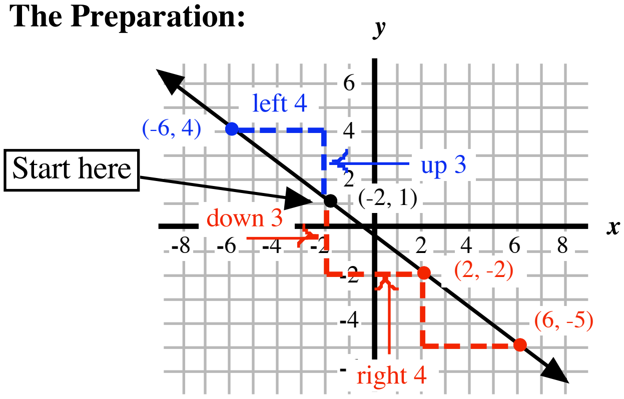


Example 6: Draw the graph of the line that has slope $m = -\frac{3}{4}$ and passes through the point (-2, 1).

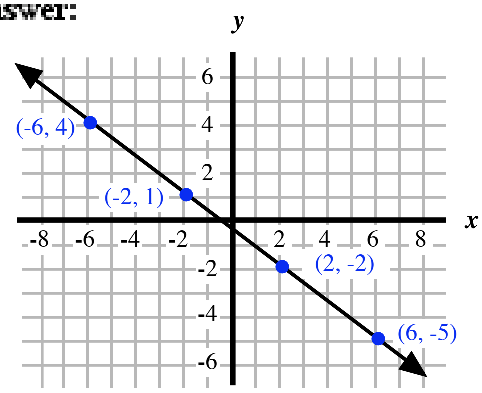
Procedure: We can think of the slope in two ways: as $m = \frac{-3}{4} = \frac{\text{down } 3}{\text{right } 4}$ and as $m = \frac{3}{-4} = \frac{\text{up } 3}{\text{left } 4}$.

Using $m = \frac{\text{down } 3}{\text{right } 4}$ we get both (2, -2) and (6, -5); using $m = \frac{\text{up } 3}{\text{left } 4}$ we get (-6, 4).

The Preparation:



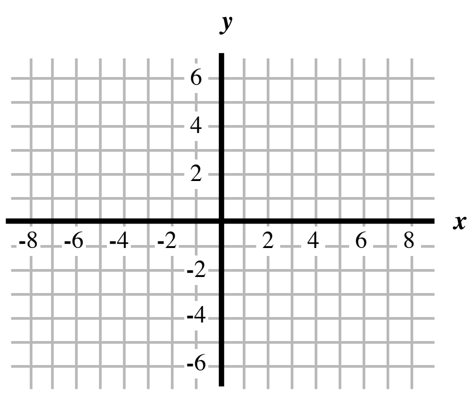
Answer:

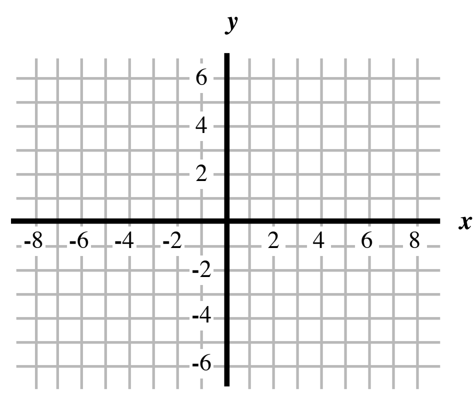


YTI 7 Draw the graph of the line that has the given slope and passes through the given point. Use Example 6 as a guide.

a) Given slope $m = \frac{1}{4}$; given point: (-2, -3).

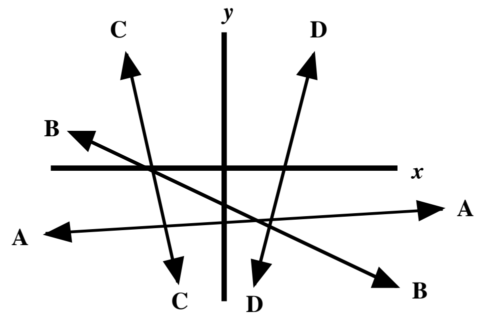
b) Given slope $m = -3$; given point: (1, 2).





Think about it 2 Match up the line (A, B, C, or D) with each given slope.

1. $m = 4$
2. $m = -\frac{1}{2}$
3. $m = \frac{1}{6}$
4. $m = -\frac{7}{2}$



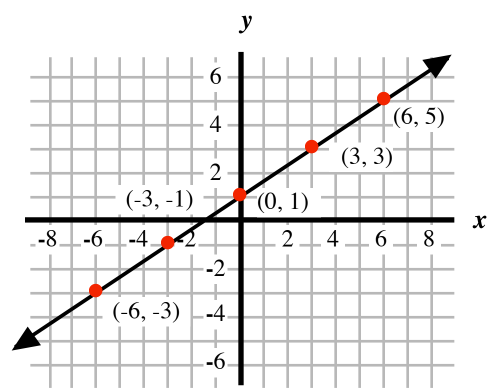
THE SLOPE-INTERCEPT FORM OF A LINE

In the beginning of this section we were introduced to the y-intercept and how it is easily identified in the equation $y = mx + b$: the y-intercept is b, and the y-intercept point is $(0, b)$.

The other constant value in the equation $y = mx + b$ is m, the slope of the line.

Why is the coefficient of x the slope of the line? Recall, from Section 4.2, that to find points on the line of, say, $y = \frac{2}{3}x + 1$, we are encouraged to choose values of x that are multiples of the denominator, 3, such as -6, -3, 0, 3, and 6:

x	$y = \frac{2}{3}x + 1$	(x, y)
-6	$y = \frac{2}{3}(-6) + 1$ $y = -3$	(-6, -3)
-3	$y = \frac{2}{3}(-3) + 1$ $y = -1$	(-3, -1)
0	$y = \frac{2}{3}(0) + 1$ $y = 1$	(0, 1)
3	$y = \frac{2}{3}(3) + 1$ $y = 3$	(3, 3)
6	$y = \frac{2}{3}(6) + 1$ $y = 5$	(6, 5)



Because we have chosen x-values that are multiples of 3, there is a horizontal change of 3 from point to point.

Notice also that there is a vertical change of 2 from point to point.

This suggests a slope is

$$m = \frac{\text{up } 2}{\text{right } 3} = \frac{2}{3}, \text{ the coefficent of } x.$$

This means that the equation $\boldsymbol{y = mx + b}$ contains both the slope, m, and the y-intercept, b. For this reason, $y = mx + b$ is called the *slope-intercept* form of a line.

The Slope-Intercept Form of a Line

In any linear equation in the form $\boldsymbol{y = mx + b}$,

the slope of the line is m

and the y-intercept point is $(0, b)$.

Example 7: Given the equation of the line, identify its slope and y-intercept point.

a) $y = \frac{1}{4}x - 3$ b) $y = \frac{-3}{5}x + 6$ c) $y = -4x - 1$ d) $y = x + 5$

Procedure: The slope, m, is the coefficient of x. The y-intercept point is $(0, b)$.

a) $m = \frac{1}{4}$; y-intercept point is (0, -3) b) $m = -\frac{3}{5}$; y-intercept point is (0, 6)

c) $m = -4$ or $-\frac{4}{1}$; y-intercept point is (0, -1) d) $m = 1$ or $\frac{1}{1}$; y-intercept point is (0, 5)

YTI 8 Given the equation of the line, identify its slope and y-intercept point. Use Example 7 as a guide.

a) $y = -\frac{4}{3}x + 6$ b) $y = 3x$ c) $y = \frac{5}{2}x - 1$ d) $y = -x - 3$

GRAPHING FROM THE SLOPE-INTERCEPT FORM

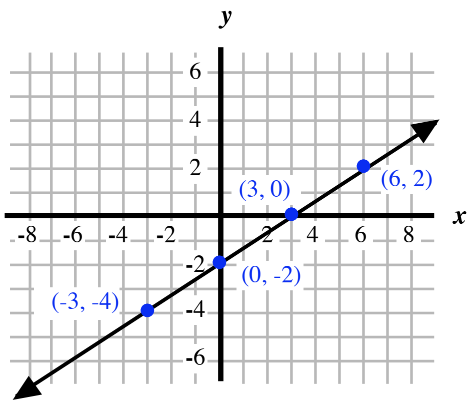
If a linear equation is in slope-intercept form, then we can graph the line by first identifying the y-intercept point and the slope. We can then plot the y-intercept point and use the slope to find two or three more points on the line, as demonstrated in this next example.

Example 8: Identify the slope and the y-intercept point of the line. Then use them to graph the line.

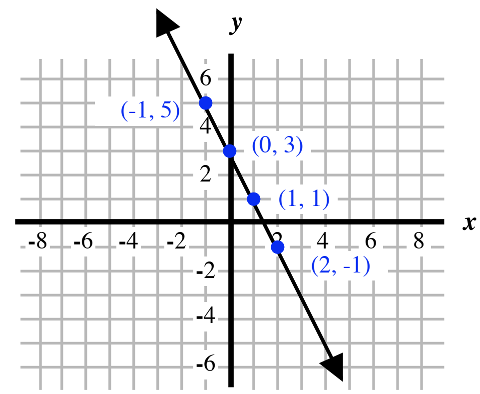
a) $y = \frac{2}{3}x - 2$ b) $y = -2x + 3$

Procedure: The slope, m, is the coefficient of x, and the y-intercept is the point $(0, b)$. Plot the point $(0, b)$ and use the slope to locate two more points on the line.

a) The y-intercept point is (0, -2), and the slope is $\frac{2}{3}$. We can use both $\frac{2}{3} = \frac{\text{up } 2}{\text{right } 3}$ and $\frac{-2}{-3} = \frac{\text{down } 2}{\text{left } 3}$ to locate other points on the line.

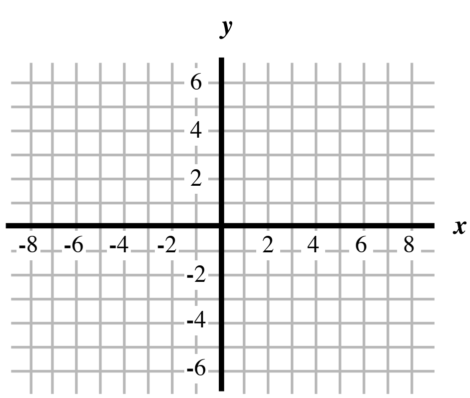


b) The y-intercept point is (0, -3), and the slope is $-2 = \frac{-2}{1}$. We can use both $\frac{-2}{1} = \frac{\text{down } 2}{\text{right } 1}$ and $\frac{2}{-1} = \frac{\text{up } 2}{\text{left } 1}$ to locate other points on the line.

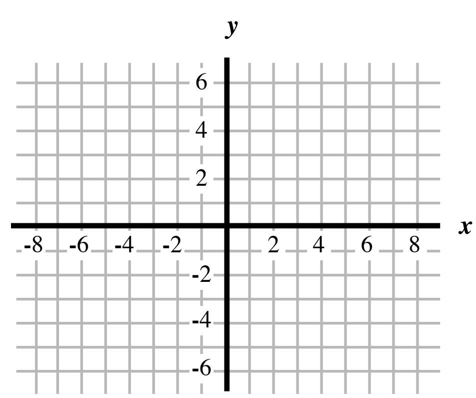


YTI 9 Identify the slope and the y-intercept of the line. Then use them to graph the line. Use Example 8 as a guide.

a) $y = -\frac{1}{3}x + 4$



b) $y = 4x - 1$



Answers: You Try It and Think About It

YTI 1:

a)	(0, 3)	b)	(0, 1)	c)	(0, -9)
d)	(0, 0)	e)	$\left(0, -\frac{2}{3}\right)$	f)	(0, 1.5)

YTI 2:

a) The slope ratio of the ramp is $\frac{4}{15}$.

b) The (average) slope ratio of the mountain is $\frac{8}{3}$.

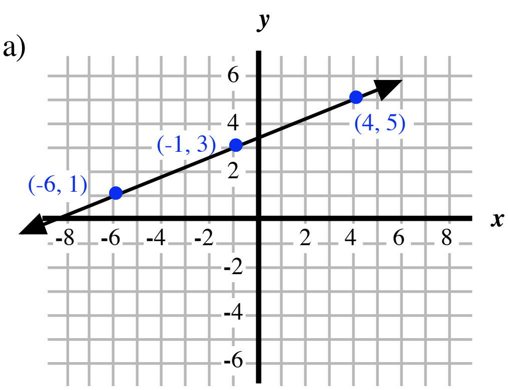
YTI 3: a) (2, -1) b) (3, 4)

YTI 4:

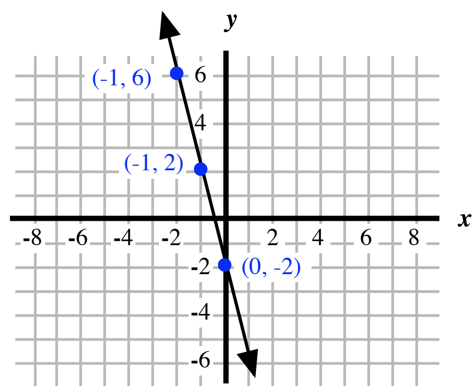
a)	down 9 and right 2	b)	up 8 and right 3
c)	up 4 and right 1	d)	down 2 and left 5

YTI 5: Some points shown may be different from yours.

a)



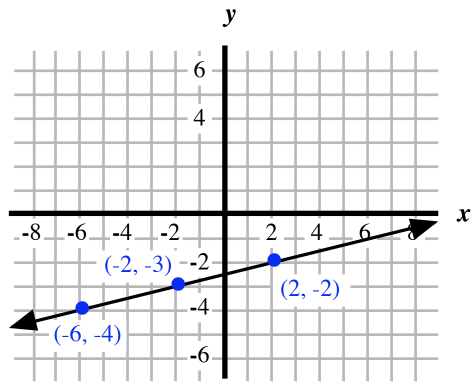
b)



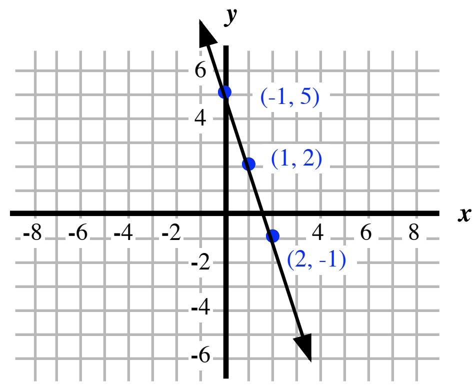
YTI 6: a) $m = \frac{5}{1} = \frac{-5}{-1}$ b) $m = \frac{-7}{4} = \frac{7}{-4}$

YTI 7: Some points shown may be different from yours.

a)



b)



YTI 8:

a) $m = -\frac{4}{3}$; y-intercept point is (0, 6)

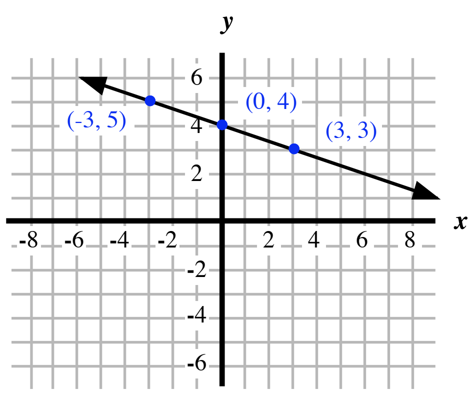
b) $m = 3$; y-intercept point is (0, 0)

c) $m = \frac{5}{2}$; y-intercept point is (0, -1)

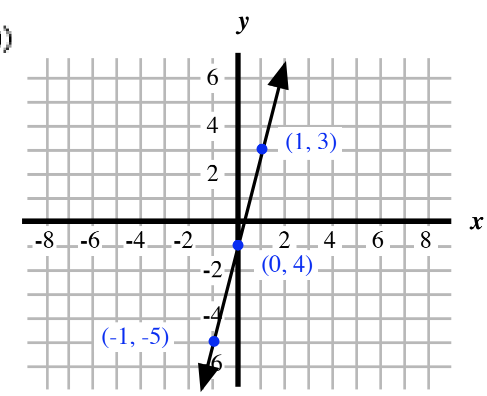
d) $m = -1$; y-intercept point is (0, -3)

YTI 9: You may have other points than what are shown here.

a)



b)



Think About It: **1.** Answers may vary. One possibility is, A vertical line crosses only the x-axis, so it has an x-intercept only. (Also, a vertical line is parallel to the y-axis, so it cannot have a y-intercept.)

Section 4.3 Exercises

Think Again.

1. Does a vertical line have an *x*-intercept. a *y*-intercept, or neither. Explain your answer. *(Refer to Think About It 1)*

2. For an *x*-intercept point, which coordinate must be 0? Explain your answer.

3. Is it possible for a slope to be 0? Explain your answer.

4. If a line crosses through the origin, what are the *x*-intercept point and the *y*-intercept point?

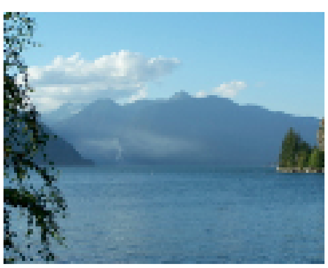
Focus Exercises.

Identify the slope ratio of the diagram. Simplify the ratio to lowest terms.

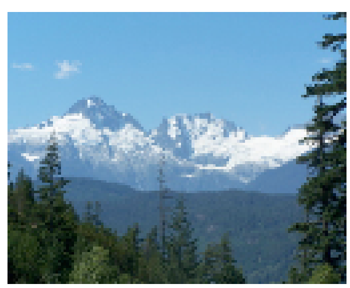
5. A ramp at a courthouse has a vertical rise of 4 feet and a horizontal run of 42 feet before it makes a turn. What is the slope ratio of this ramp?

6. To get from the third level to the fourth level at a baseball stadium, a ramp has a vertical rise of 15 feet and a horizontal run of 120 feet. What is the slope ratio of the ramp?

7. A mountain has its base at sea level (0 feet), and the summit is at 1,800 feet. The horizontal distance from the base to the summit is 800 feet. What is the (average) slope ratio of the mountain?



8. The elevation at a camp on a mountain is 4,600 feet, and the summit is at 5,400 feet. The horizontal distance from the base to the summit is 600 feet. What is the (average) slope ratio of the mountain?



From the given point, locate and label three new points in the x-y-plane according to the directions. Then draw the unique line that passes through these four points.

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

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

11. The given point is (-4, -5).
1. Count up 3 spaces, and
2. Count to the right 2 spaces.
3. Plot and label the new point.
4. Repeat.

12. The given point is (3, -6).
1. Count up 4 spaces, and
2. Count to the left 3 spaces.
3. Plot and label the new point.
4. Repeat.

Draw the line that passes through the given point and has given slope. Find and label two other points on the line.

13. (0, -4) and slope $m = \frac{1}{4}$

14. (0, 5) and slope $m = -\frac{5}{3}$

15. (2, 0) and slope $m = -\frac{3}{2}$

16. (-3, 0) and slope $m = \frac{1}{3}$

17. (3, -5) and slope $m = -2$

18. (-2, -4) and slope $m = 3$

19. (-6, -1) and slope $m = \frac{1}{3}$

20. (-5, 6) and slope $m = -\frac{3}{4}$

21. (0, 1) and slope $m = \frac{5}{2}$

22. (0, 4) and slope $m = \frac{3}{7}$

23. (0, -2) and slope $m = \frac{4}{5}$

24. (0, -1) and slope $m = -\frac{3}{8}$

25. (-1, 4) and slope $m = -\frac{1}{6}$

26. (2, -3) and slope $m = -\frac{4}{5}$

27. (1, 2) and slope $m = \frac{4}{7}$

28. (2, -1) and slope $m = -\frac{5}{2}$

Identify the slope and the y-intercept of the line, and use them to graph the line.

29. $y = \frac{1}{2}x + 2$ **30.** $y = \frac{2}{3}x + 5$ **31.** $y = \frac{3}{4}x - 6$ **32.** $y = \frac{2}{5}x - 1$

33. $y = -\frac{4}{3}x - 5$ **34.** $y = -\frac{3}{2}x - 2$ **35.** $y = -\frac{5}{2}x$ **36.** $y = -\frac{6}{5}x$

37. $y = 3x - 6$ **38.** $y = 2x - 3$ **39.** $y = 4x + 1$ **40.** $y = 5x + 6$

41. $y = -2x + 4$ **42.** $y = -4x + 1$ **43.** $y = -5x - 1$ **44.** $y = -3x - 4$

45. $y = x - 3$ **46.** $y = x + 2$ **47.** $y = -x + 5$ **48.** $y = -x - 4$

THINK OUTSIDE THE BOX:

For each: *a) Plot the given point in the x-y-plane.*
b) Use the given slope to locate the y-intercept.
c) Graph the line that passes through these points
d) Write the equation of the line.

49. $(6, 2)$; $m = -\frac{1}{3}$ **50.** $(8, 5)$; $m = \frac{3}{4}$

51. $(-4, -5)$; $m = 2$ **52.** $(-3, 5)$; $m = -3$

