

## 4.2 Use linear equations in slope intercept form

### Key Concept

If you know two points on a line, you can calculate the slope  $m$  using the slope formula, and you can substitute the slope and one ordered pair into the slope-intercept form  $y = mx + b$  to find the  $y$ -intercept  $b$ . Then you can complete the slope-intercept form of the equation of the line.

### Common Student Errors

- Confusing a given point and the  $y$ -intercept

**Tip** Stress that the point is only the  $y$ -intercept if the  $x$ -value is 0:  $(0, y)$

- Getting stuck trying to find the  $y$ -intercept or substituting the  $x$ - and  $y$ -values incorrectly

**Tip** Reinforce that the given points are solutions of the equation. Use one color for the  $x$  and the  $x$ -value and another color for the  $y$  and the  $y$ -value. Visually connect the substitution with arrows.

Example:  $m = 3$  through  $(2, -5)$

Student equation:  $y = 3x - 5$  ✗

A visual like this may help:

$$y = 3x + b$$

$(2, -1)$

**GOAL** Write an equation of a line using points on the line.

### EXAMPLE 1 Write an equation given the slope and a point

**Write an equation of the line that passes through the point  $(2, 5)$  and has a slope of 3.**

#### Solution

**STEP 1** Identify the slope. The slope is 3.

**STEP 2** Find the  $y$ -intercept. Substitute the slope and the coordinates of the given point into  $y = mx + b$ . Solve for  $b$ .

$$y = mx + b \quad \text{Write slope-intercept form.}$$

$$5 = 3(2) + b \quad \text{Substitute 3 for } m, 2 \text{ for } x, \text{ and 5 for } y.$$

$$-1 = b \quad \text{Solve for } b.$$

**STEP 3** Write an equation of the line.

$$y = mx + b \quad \text{Write slope-intercept form.}$$

$$y = 3x - 1 \quad \text{Substitute 3 for } m, \text{ and } -1 \text{ for } b.$$

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### **EXAMPLE 2** Write an equation given two points

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**Write an equation of the line that passes through (3, 9) and (-2, -1).**

**Solution**

**STEP 1** Calculate the slope.

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{-1 - 9}{-2 - 3} = \frac{-10}{-5} = 2$$

**STEP 2** Find the  $y$ -intercept. Use the slope and the point (3, 9).

$$y = mx + b \quad \text{Write slope-intercept form.}$$

$$9 = 2(3) + b \quad \text{Substitute 2 for } m, 3 \text{ for } x, \text{ and 9 for } y.$$

$$3 = b \quad \text{Solve for } b.$$

**STEP 3** Write an equation of the line.

$$y = mx + b \quad \text{Write slope-intercept form.}$$

$$y = 2x + 3 \quad \text{Substitute 2 for } m \text{ and 3 for } b.$$

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### Exercises for Examples 1 and 2

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Write an equation of the line that passes through the given point and has the given slope.

1.  $(7, 2); m = 4$
2.  $(9, 15); m = -\frac{1}{3}$

Write an equation of the line that passes through the two given points.

3.  $(5, 8), (13, 12)$
4.  $(-6, -7), (-3, 5)$

### EXAMPLE 3 Write a linear function

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Write an equation of the linear function with the values  $f(2) = 3$  and  $f(-3) = 8$ .

**Solution**

**STEP 1** Calculate the slope. Write  $f(2) = 3$  as  $(2, 3)$  and  $f(-3) = 8$  as  $(-3, 8)$ .

$$m = \frac{y_2 - y_1}{x_2 - x_1} = \frac{8 - 3}{-3 - 2} = \frac{5}{-5} = -1$$

**STEP 2** Find the  $y$ -intercept. Use the slope and the point  $(2, 3)$ .

$$y = mx + b \quad \text{Write slope-intercept form.}$$

$$3 = -1(2) + b \quad \text{Substitute } -1 \text{ for } m, 2 \text{ for } x, \text{ and } 3 \text{ for } y.$$

$$5 = b \quad \text{Solve for } b.$$

**STEP 3** Write an equation for the function. Use  $f(x) = mx + b$ .

$$f(x) = -x + 5 \quad \text{Substitute } -1 \text{ for } m \text{ and } 5 \text{ for } b.$$

### Exercises for Example 3

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Write an equation for a linear function  $f$  that has the given values.

5.  $f(2) = -4$  and  $f(-4) = -7$
6.  $f(-5) = 17$  and  $f(3) = 9$