

# 4.6

## Model Direct Variation

**Goal** • Write and graph direct variation equations.

### Your Notes

#### VOCABULARY

**Direct variation** The relationship of two variables,  $x$  and  $y$ , provided  $y = ax$  and  $a \neq 0$

**Constant of variation** In  $y = ax$ ,  $a$  is called the constant of variation.

#### Example 1 Identify direct variation equations

Tell whether the equation represents direct variation. If so, identify the constant of variation.

a.  $4x + 2y = 0$

b.  $-2x + y = 3$

#### Solution

To tell whether an equation represents direct variation, try to rewrite the equation in the form  $y = ax$ .

a.  $4x + 2y = 0$

Write original equation.

$$2y = -4x$$

Subtract  $4x$  from each side.

$$y = -2x$$

Simplify.

Because the equation  $4x + 2y = 0$  can be rewritten in the form  $y = ax$ , it represents direct variation. The constant of variation is  $-2$ .

b.  $-2x + y = 3$

Write original equation.

$$y = 2x + 3$$

Add  $2x$  to each side.

Because the equation  $-2x + y = 3$  cannot be rewritten in the form  $y = ax$ , it does not represent direct variation.

**Your Notes**

✔ **Checkpoint** Tell whether the equation represents direct variation. If so, identify the constant of variation.

<p>1. <math>3x + 4y = 0</math></p> <p>yes; <math>-\frac{3}{4}</math></p>	<p>2. <math>5x + y = 1</math></p> <p>no</p>
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**Example 2** Graph direct variation equations

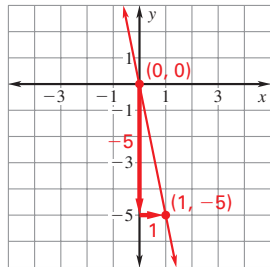
Graph the direct variation equation.

a.  $y = -5x$

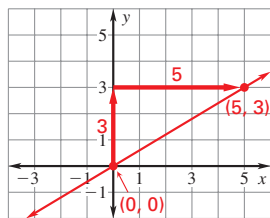
b.  $y = \frac{3}{5}x$

**Solution**

a. Plot a point at the origin. The slope is equal to the constant of variation, or  $-5$ . Find and plot a second point, then draw a line through the points.



b. Plot a point at the origin. The slope is equal to the constant of variation, or  $\frac{3}{5}$ . Find and plot a second point, then draw a line through the points.

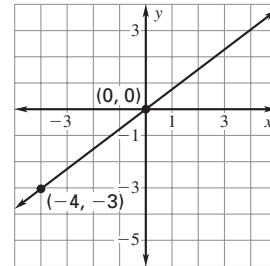


The graph of a direct variation equation is a line with a slope of  $a$  and a  $y$ -intercept of  $0$ . This line passes through the origin.

**Your Notes**

**Example 3** Write and use a direct variation equation

The graph of a direct variation equation is shown.



- Write the direct variation equation.
- Find the value of  $y$  when  $x = 80$ .

**Solution**

- Because  $y$  varies directly with  $x$ , the equation has the form  $y = ax$ . Use the fact that  $y = -3$  when  $x = -4$  to find  $a$ .

$y = ax$  Write direct variation equation.

$-3 = a(-4)$  Substitute.

$\frac{3}{4} = a$  Solve for  $a$ .

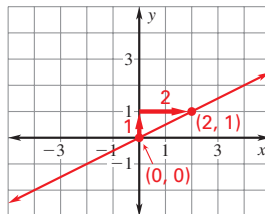
A direct variation equation that relates  $x$  and  $y$  is

$y = \frac{3}{4}x$ .

- When  $x = 80$ ,  $y = \frac{3}{4}(80) = 60$ .

**Checkpoint** Complete the following exercises.

- Graph the direct variation equation  $y = \frac{1}{2}x$ .



- The graph of a direct variation equation passes through the point  $(3, -4)$ . Write the direct variation equation and find the value of  $y$  when  $x = 15$ .

$y = -\frac{4}{3}x$ ;  $y = -20$

**Homework**