

LESSON 3.6

Notes

GOAL

Write and graph direct variation equations.

Vocabulary

Two variables x and y show **direct variation**, provided $y = ax$ and $a \neq 0$.

The nonzero number a is called the **constant of variation**, and y is said to *vary directly* with x .

EXAMPLE 1

Identify direct variation equations

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

- a. $6x - 3y = 12$
b. $-5x + 2y = 0$

Solution

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

- | | | |
|----|------------------|-------------------------------|
| a. | $6x - 3y = 12$ | Write original equation. |
| | $-3y = -6x + 12$ | Subtract $6x$ from each side. |
| | $y = 2x - 4$ | Divide each side by -3 . |

Because the equation $6x - 3y = 12$ cannot be rewritten in the form $y = ax$, it does not represent direct variation.

a

- | | | |
|----|--------------------|--------------------------|
| b. | $-5x + 2y = 0$ | Write original equation. |
| | $2y = 5x$ | Add $5x$ to each side. |
| | $y = \frac{5}{2}x$ | Simplify. |

Because the equation $-5x + 2y = 0$ can be rewritten in the form $y = ax$, it represents direct variation. The constant of variation is $\frac{5}{2}$.

Exercises for Example 1

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

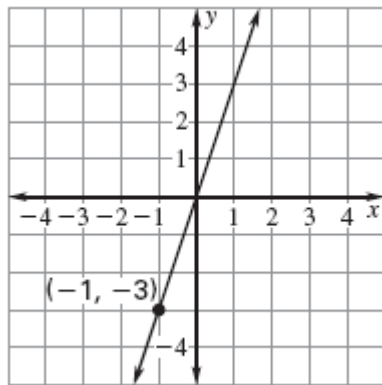
1. $3x + 5y = 0$
2. $x + 2y = 1$
3. $7x - 9y = 0$

EXAMPLE 2

Write and use a direct variation equation

The graph of a direct variation equation is shown.

- a Write the direct variation equation.
- b Find the value of y when $x = 12$.



Solution

- a Because y varies directly with x , the equation has the form $y = ax$. Use the fact that $y = -3$ when $x = -1$ to find a .

| | |
|--------------|----------------------------------|
| $y = ax$ | Write direct variation equation. |
| $-3 = a(-1)$ | Substitute. |
| $3 = a$ | Solve for a . |

A direct variation equation that relates x and y is $y = 3x$.

- b When $x = 12$, $y = 3(12) = 36$. The value of y when $x = 12$ is 36.

EXAMPLE 3

Use a direct variation model

The table shows the cost C of purchasing tickets for a rock concert.

- a Explain why C varies directly with t
- b Write a direct variation equation that relates t and C .

| Number of tickets, t | Cost, C |
|------------------------|-----------|
| 2 | \$36 |
| 3 | \$54 |
| 5 | \$90 |

Solution

- a To explain why C varies directly with t , compare the ratios $\frac{C}{t}$ for all data pairs (t, C) : $\frac{36}{2} = \frac{54}{3} = \frac{90}{5} = 18$. Because the ratios all equal 18, C varies directly with t .
- b A direct variation equation is $C = 18t$.

Exercises for Examples 2 and 3

- 4 The graph of a direct variation equation passes through the point $(5, -2)$. Write a direct variation equation and find the value of y when $x = 20$.
- 5 **What if?** In Example 3, suppose the ticket distributor charges \$5.50 for each transaction, no matter how many tickets are purchased, and \$18 per ticket. Is it reasonable to use a direct variation model for this situation? *Explain*

Answer Key

Lesson 3.6

Study Guide

1. yes; $\frac{3}{5}$
2. no
3. yes; $\frac{7}{9}$
4. $y = -\frac{2}{5}x - 8$
5. No, the equation cannot be written in $y = ax$ form.