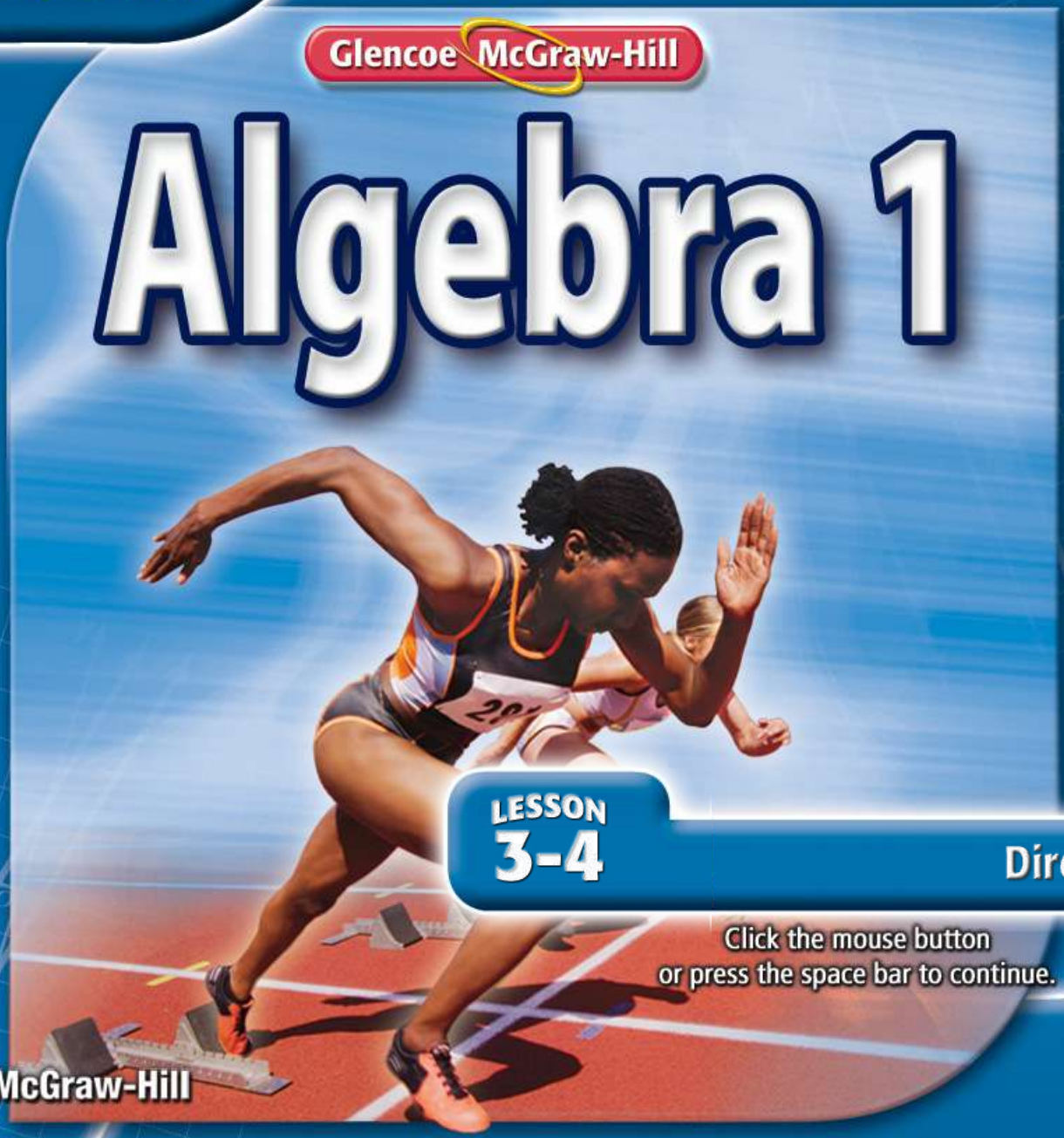
Interactive Classroom

Glencoe McGraw-Hill

Algebra 1



LESSON 3-4

Direct Variation

Click the mouse button or press the space bar to continue.

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Class Opener and Learning Target

- I CAN write, graph, and solve problems involving direct variation equations.
- Note Card 3-4ADefine Direct Variation and Constant of Variation (Constant of Proportionality).
- Note Card 3-4BCopy the Concept Summary (Direct Variation Graphs).

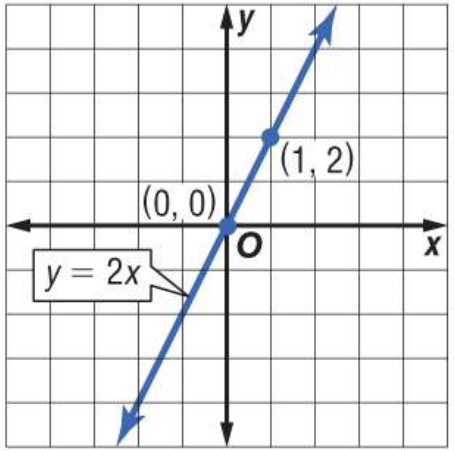
Direct Variation – Described by an equation of the form $y = kx$, where $k \neq 0$.

Constant of Variation or Constant of Proportionality – the ratio k.

Direct Variation **3-4A**

EXAMPLE 1 Slope and Constant of Variation

A. Name the constant of variation for the equation. Then find the slope of the line that passes through the pair of points.



$$m = \frac{y_2 - y_1}{x_2 - x_1}$$ Slope formula

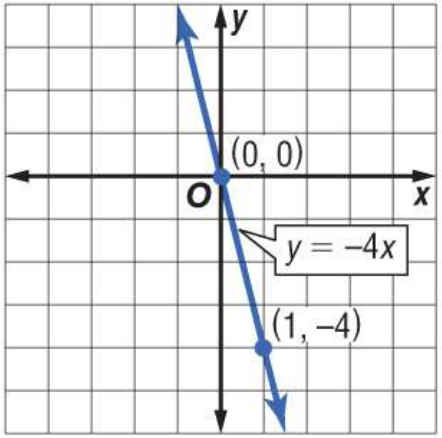
$$m = \frac{2 - 0}{1 - 0}$$ $(x_1, y_1) = (0, 0)$, $(x_2, y_2) = (1, 2)$

$$m = 2$$ Simplify.

Answer:
The constant of variation is 2.
The slope is 2.

EXAMPLE 1 Slope and Constant of Variation

B. Name the constant of variation for the equation. Then find the slope of the line that passes through the pair of points.



$$m = \frac{y_2 - y_1}{x_2 - x_1}$$ Slope formula

$$m = \frac{-4 - 0}{1 - 0}$$ $(x_1, y_1) = (0, 0)$

$(x_2, y_2) = (1, -4)$

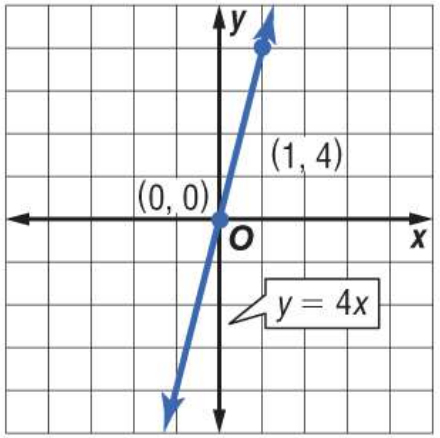
$m = -4$ Simplify.

Answer:
The constant of variation is –4.
The slope is –4.

EXAMPLE 1 Check Your Progress

CheckPoint

A. Name the constant of variation for the equation. Then find the slope of the line that passes through the pair of points.



A. constant of variation: 4; slope: –4

B. constant of variation: 4; slope: 4

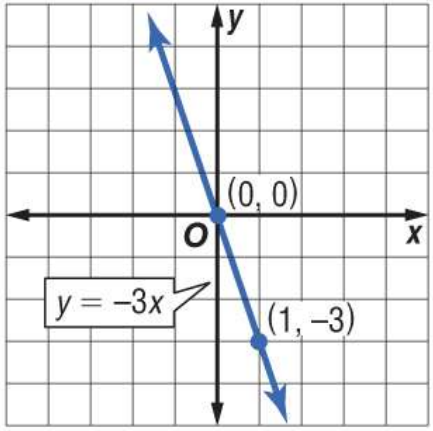
C. constant of variation: –4; slope: –4

D. constant of variation: $\frac{1}{4}$; lope: $\frac{1}{4}$

EXAMPLE 1 Check Your Progress

CheckPoint

B. Name the constant of variation for the equation. Then find the slope of the line that passes through the pair of points.



A. constant of variation: 3; slope: 3

B. constant of variation: $\frac{1}{3}$; ope: $\frac{1}{3}$

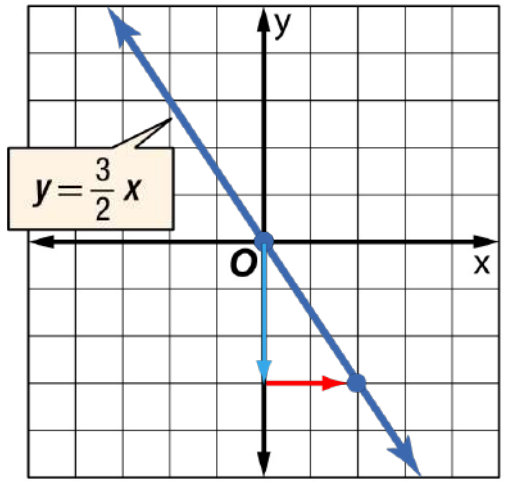
C. constant of variation: 0; slope: 0

D. constant of variation: –3; slope: –3

EXAMPLE 2 Graph a Direct Variation

Graph $y = -\frac{3}{2}x$.

Answer:



Step 1 Find the slope.

$$m = \frac{-3}{2} \qquad \frac{\text{rise}}{\text{run}}$$

Step 2 Graph (0, 0).

Step 3 From the point (0, 0), move down 3 units and right 2 units. Draw a dot.

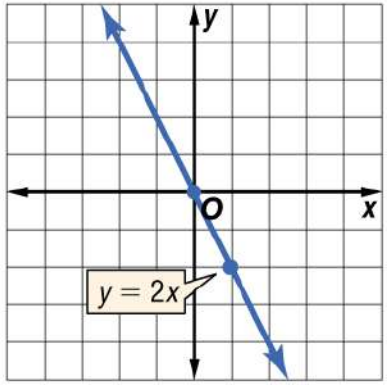
Step 4 Draw a line connecting the points.

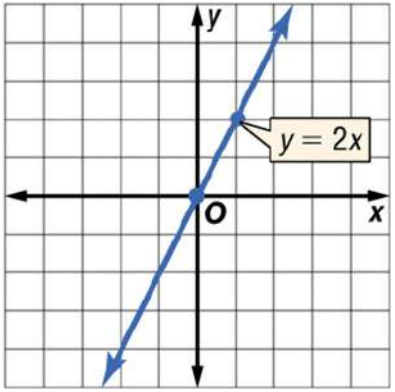
EXAMPLE 2 Check Your Progress

CheckPoint

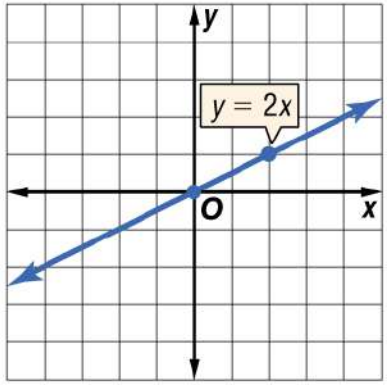
Graph $y = 2x$.

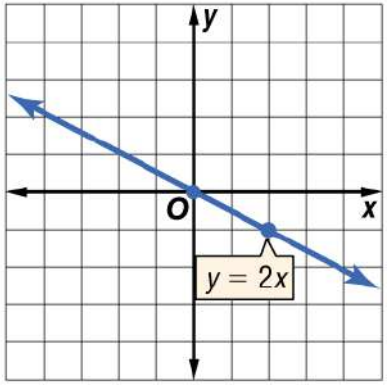
A.I





C.I



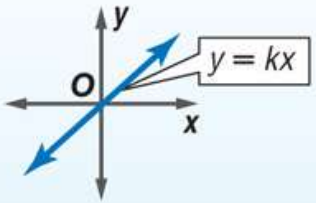


Concept Summary

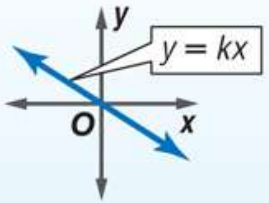
Direct Variation Graphs

For Your FOLDABLE

- Direct variation equations are of the form $y = kx$, where $k \neq 0$.
- The graph of $y = kx$ always passes through the origin.
- The slope is positive if $k > 0$.



- The slope is negative if $k < 0$.



Direct Variation Graphs **3-4B**

EXAMPLE 3 Write and Solve a Direct Variation Equation

A. Suppose y varies directly as x, and $y = 9$ when $x = -3$. Write a direct variation equation that relates x and y.

Find the value of k.

$y = kx$ Direct variation formula

$9 = k(-3)$ Replace y with 9 and x with –3.

$\frac{9}{-3} = \frac{k(-3)}{-3}$ Divide each side by –3.

$-3 = k$ Simplify.

EXAMPLE 3 Write and Solve a Direct Variation Equation

Answer: Therefore, the direct variation equation is $y = -3x$.

EXAMPLE 3 Write and Solve a Direct Variation Equation

B. Use the direct variation equation to find x when $y = 15$.

$$y = -3x$$ Direct variation equation

$$15 = -3x$$ Replace y with 15.

$$\frac{15}{3} = \frac{-3x}{-3}$$ Divide each side by –3.

$$-5 = x$$ Simplify.

Answer: Therefore, $x = -5$ when $y = 15$.

EXAMPLE 3 Check Your Progress

CheckPoint

A. Suppose y varies directly as x, and $y = 15$ when $x = 5$. Write a direct variation equation that relates x and y.

A. $y = 3x$

B. $y = 15x$

C. $y = 5x$

D. $y = 45x$

EXAMPLE 3 Check Your Progress

CheckPoint

B. Suppose y varies directly as x, and $y = 15$ when $x = 5$. Use the direct variation equation to find x when $y = -45$.

A. –3

B. 9

C. –15

D. –5

Real-World Example 4

Estimate Using Direct Variation

A. TRAVEL The Ramirez family is driving cross-country on vacation. They drive 330 miles in 5.5 hours.

Write a direct variation equation to find the distance driven for any number of hours.

Words	Distance	equals	rate	times	time.
Variable	Let d = distance and t = time.				
Equation	d	$=$	60	$\times$	t

Real-World Example 4

Estimate Using Direct Variation

Solve for the rate.

$$330 = r(5.5)$$ Original equation

$$\frac{330}{5.5} = \frac{r(5.5)}{5.5}$$ Divide each side by 5.5.

$$60 = r$$ Simplify.

Answer: Therefore, the direct variation equation is $d = 60t$.

Real-World Example 4

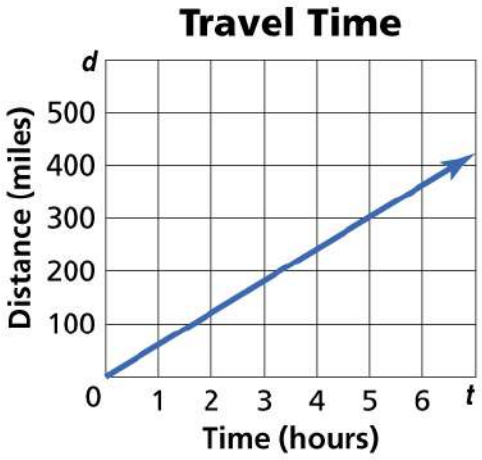
Estimate Using Direct Variation

B. Graph the equation.

The graph of $d = 60t$ passes through the origin with a slope of 60.

$$m = \frac{60}{1} \qquad \frac{\text{rise}}{\text{run}}$$

Answer:



Real-World Example 4

Estimate Using Direct Variation

C. Estimate how many hours it would take to drive 500 miles.

$d = 60t$ Original equation

$500 = 60t$ Replace d with 500.

$\frac{500}{60} = \frac{60t}{60}$ Divide each side by 60.

$8.33 \approx t$ Simplify.

Answer: At this rate, it will take about 8.3 hours to drive 500 miles.

Real-World Example 4 | Check Your Progress | CheckPoint

A. Dustin ran a 26-mile marathon in 3.25 hours. Write a direct variation equation to find the distance run for any number of hours.

A. $d = h$

B. $d = 8h$

C. $d = 8$

D. $d = \frac{1}{8}h$

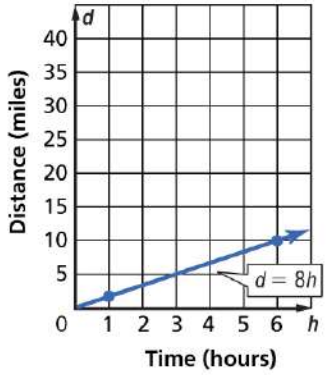
Real-World Example 4

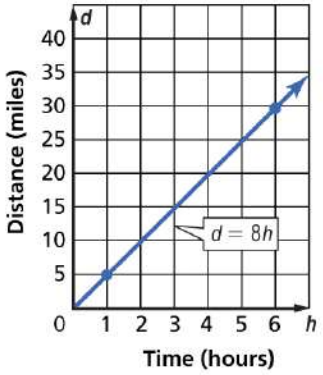
Check Your Progress

CheckPoint

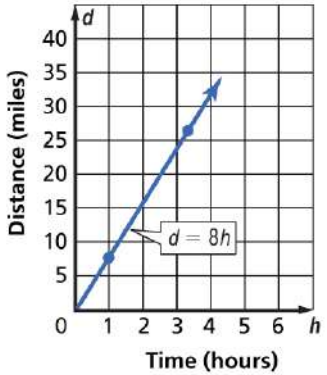
B. Dustin ran a 26-mile marathon in 3.25 hours. Graph the equation.

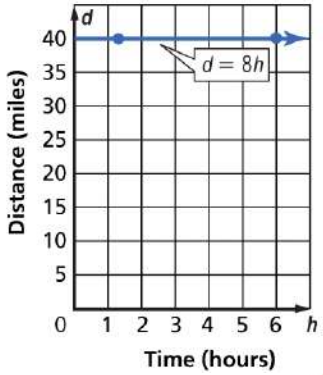
A.





C.





Real-World Example 4 | Check Your Progress | CheckPoint

C. Estimate how many hours it would take to jog 16 miles.

A. 1 hour

B. $\frac{1}{2}$ hour

C. 16 hours

D. 2 hours