$$y = k \cdot x \quad (0, 0)$$

Algebra 1   3.4

Write and graph direct variation equations

Solve direct variation problems
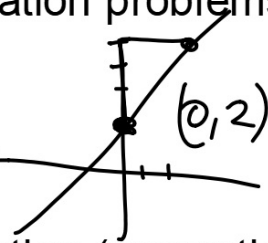
$$y = 2x + 1$$

$\dfrac{3}{2}$

y-intercept

slope $m = \dfrac{vert}{horz}$

direct variation

constant of variation (proportionality) k

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$$\boxed{y = k \cdot x}$$
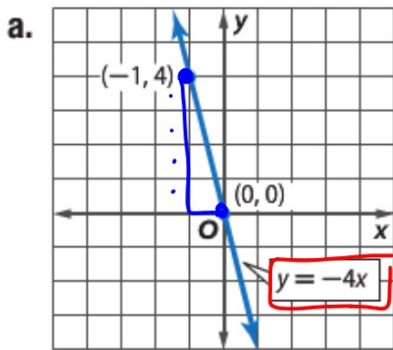
(0, 2)

$$y = 3x \qquad y = \tfrac{1}{2}x \qquad y = 3x - 6$$

COV comes
from equation
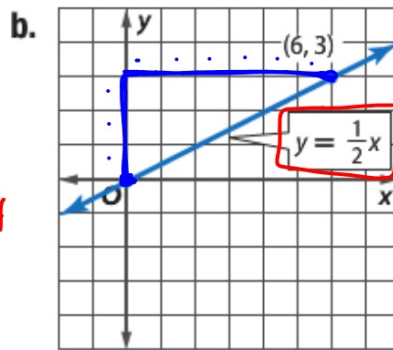Slope from
ordered pairs

Example 1 Slope and Constant of Variation

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

a.
$(-1, 4)$
$(0, 0)$
$y = -4x$

$C.O.V. = -4$

$m = \dfrac{-4}{1}$

b.
$(6, 3)$
$y = \dfrac{1}{2}x$

$C.O.V. = \dfrac{1}{2}$

$m = \dfrac{3}{6} = \dfrac{1}{2}$

Guided Practice $C.O.V. = \frac{1}{4}$ $m = \frac{1}{4}$
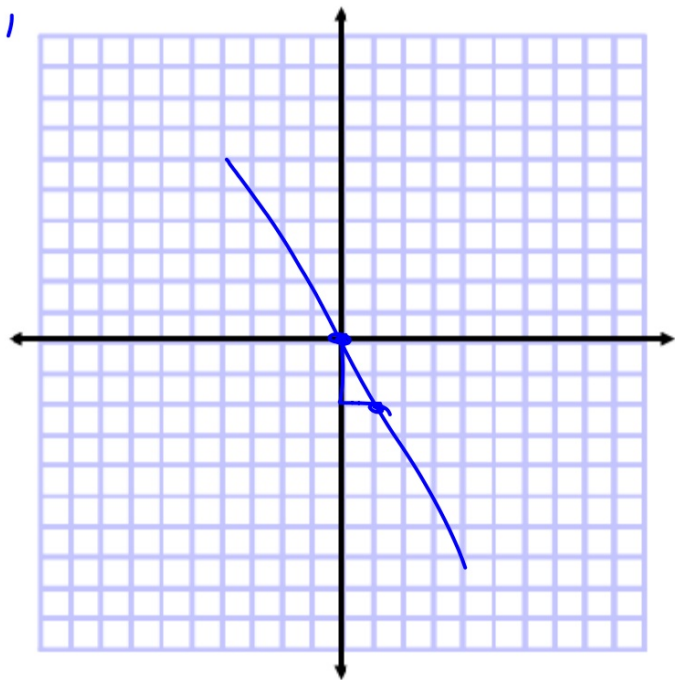
1A. Name the constant of variation for $y = \frac{1}{4}x$. Then find the slope of the line that passes through (0, 0) and (4, 1), two points on the line.

1B. Name the constant of variation for $y = -2x$. Then find the slope of the line that passes through (0, 0) and (1, −2), two points on the line.
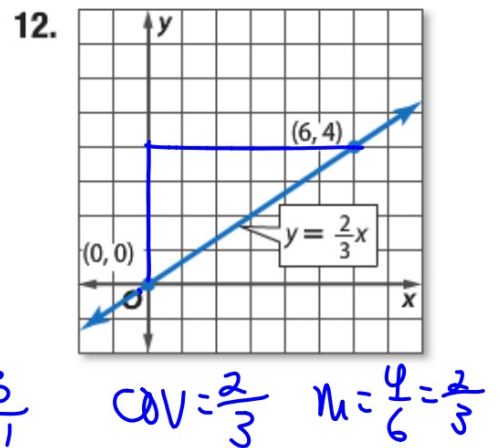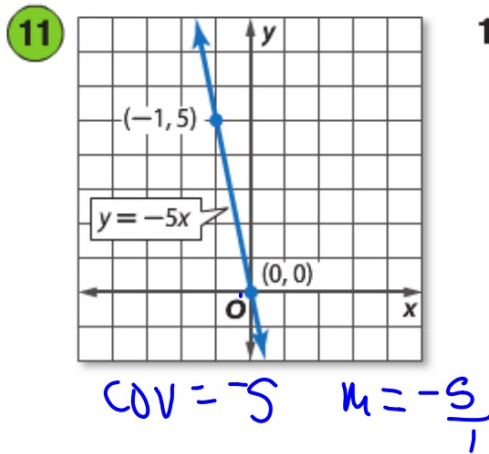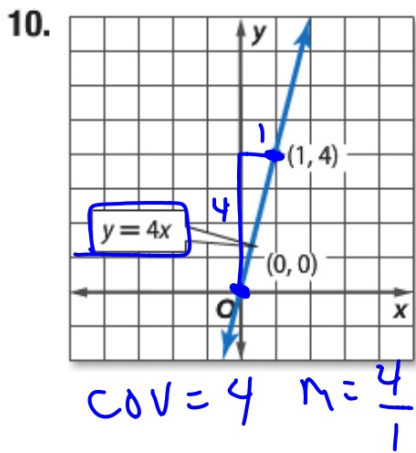
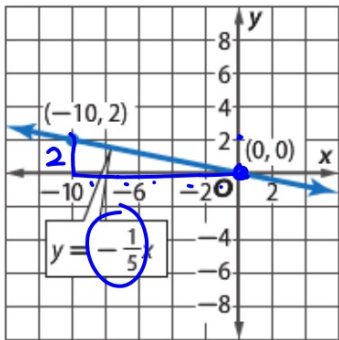$C.O.V. = -2$ $m = \frac{-2}{1}$

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

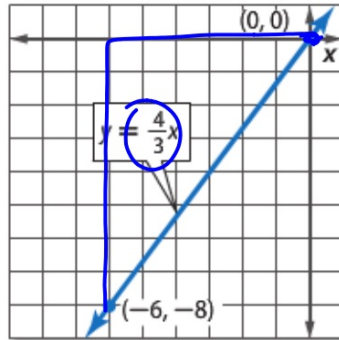**10.**

$y = 4x$

(1, 4)

(0, 0)

$COV = 4$ $m = \dfrac{4}{1}$

11

(−1, 5)

$y = -5x$

(0, 0)

$COV = -5$ $m = \dfrac{-5}{1}$

12.

(6, 4)

$y = \dfrac{2}{3}x$

(0, 0)

$COV = \dfrac{2}{3}$ $m = \dfrac{4}{6} = \dfrac{2}{3}$

13.

Graph showing points $(-10, 2)$ and $(0, 0)$, line $y = -\frac{1}{5}x$

$COV = -\frac{1}{5}$

$M = \frac{-2}{10} = -\frac{1}{5}$

14.

Graph showing points $(0, 0)$ and $(-6, -8)$, line $y = \frac{4}{3}x$

$COV = \frac{4}{3}$

$m = \frac{8}{6} = \frac{4}{3}$

15.

Graph showing points $(0, 0)$ and $(1, -12)$, line $y = -12x$
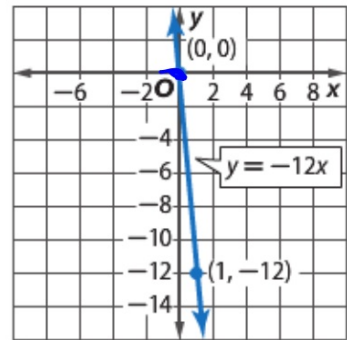
$$m = -\frac{6}{1}$$

Example 2 Graph a Direct Variation

Graph $y = -6x$.

$\frac{y}{}$

$(0, \underset{=}{\quad})$
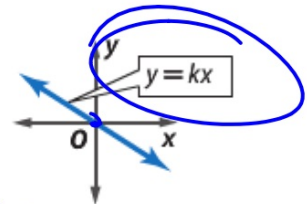
$(\quad, 0)$

$y = -6x$
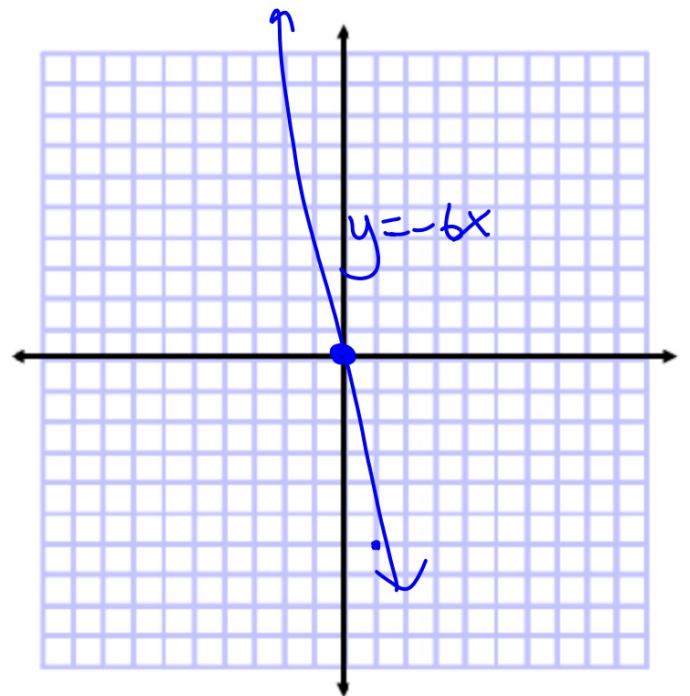
ConceptSummary Direct Variation Graphs

- 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 $k > 0$.
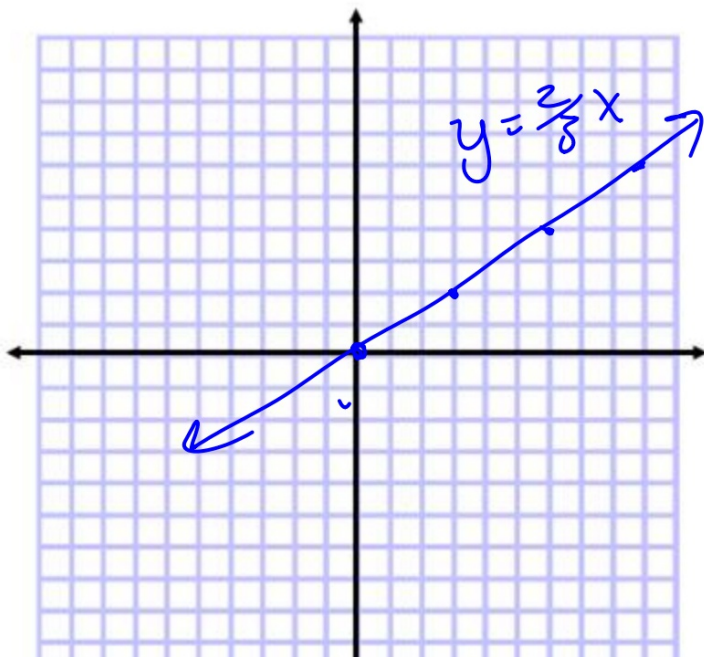
  $y = kx$
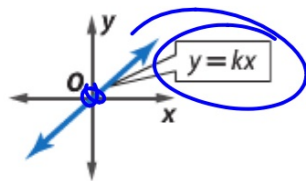
  pos.

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

  $y = kx$

  neg.

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2A. $y = 6x$

$\dfrac{6}{1}$

2B. $y = \dfrac{2}{3}x$

$y = \dfrac{2}{3}x$

Graph

2C. $y = -5x$ **2D.** $y = -\dfrac{3}{4}x$

$y = k \cdot x$ $(8, 72)$

Example 3 Write and Solve a Direct Variation Equation

Suppose y varies directly as x, and $y = 72$ when $x = 8$.

a. Write a direct variation equation that relates x and y.

$$y = k \cdot x$$
$$\frac{72}{8} = \frac{k \cdot 8}{8}$$

$K = 9$

$y = 9x$

b. Use the direct variation equation to find x when $y = 63$.

$x = 7$

$$\frac{63}{9} = \frac{9x}{9}$$

1. find the constant
2. write the equation
3. answer the question

$y = k \cdot x$

3. Suppose y varies directly as x, and $y = 98$ when $x = 14$. Write a direct variation equation that relates x and y. Then find y when $x = -4$.

$(14, 98)$

$$\frac{98}{14} = \frac{k \cdot 14}{14}$$

$6 = k$

$y = 6x$

$y = 6 \cdot -4$

$y = -24$

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Suppose y varies directly as x. Write a direct variation equation that relates x and y. Then solve.

30. If $y = 3.2$ when $x = 1.6$, find y when $x = 19$.

$$y = K \cdot x$$

$$\frac{3.2}{1.6} = \frac{K \cdot 1.6}{1.6}$$

$$2 = K$$

$$y = 2x$$

$$y = 2 \cdot 19$$

31. If $y = 15$ when $x = \frac{3}{4}$, find x when $y = 25$.

32. If $y = 4.5$ when $x = 2.5$, find y when $x = 12$.

There are other kinds of variation:
    inverse
    combined