

4.6 Model Direct Variation

Goal • Write and graph direct variation equations.

Your Notes

VOCABULARY	IS A SPECIAL LINE
Direct variation	The relationship of two variables, x and y , provided $y = ax$ and $a \neq 0$
DVEQ: $Y = Ax$	AKA $\rightarrow Y = mx + 0$
Constant of variation	In $y = ax$, a is called the constant of variation.
	\swarrow a is also the slope (m)

EVERY DIRECT VARIATION LINE
GOES THROUGH THE ORIGIN $(0,0)$
 $B=0$

Example 1 Identify direct variation equations

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

a. $4x + 2y = 0$

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.

$$\frac{2y}{2} = \frac{-4x}{2}$$

Subtract $4x$ from each side.

POTENTIAL
 $y = mx + b$
||

$y = -2x$

Simplify.

$y = ax$

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

Constant of variation is -2.

Example 1 Identify direct variation equations

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

b. $-2x + y = 3$

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Write original equation. $y = ax$

$y = 2x + 3$

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.

1. $3x + 4y = 0$

~~$y = -3x$~~

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

$a = -\frac{3}{4}$

2. $5x + y = 1$

$y = -5x + 1$

↑
NOT A
DIRECT VAR
EQ.

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.

Example 2 Graph direct variation equations

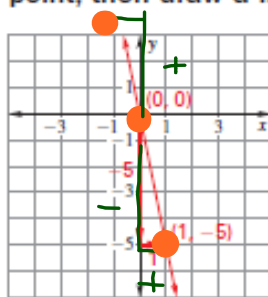
Graph the direct variation equation.

a. $y = -5x$

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

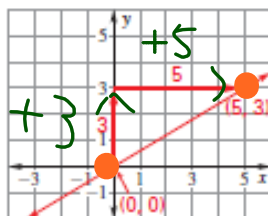
Solution

- 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.



$y = -5x$
 $m = -5/1$
 $b = 0$

- 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.

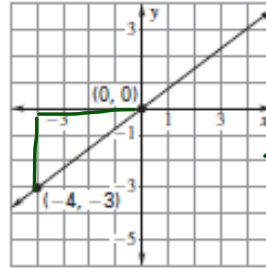


$m = 3/5$ $b = 0$

Your Notes

Example 3 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 $x = 80$.

Solution

- a. 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.

$$y = ax$$

$$\underline{-3} = a(\underline{-4})$$

$$\underline{\frac{3}{4}} = a$$

A direct variation equation that relates x and y is

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

- b. When $x = 80$,

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

$$y = \frac{3}{4}(80)$$

$$y = 60$$

LOOK AT GRAPH TO WRITE D.V. EQ

GIVEN GRAPH

METHOD I

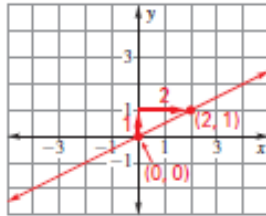
$$a \rightarrow m$$

$$a = \frac{\text{RISE}}{\text{RUN}}$$

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

✔ **Checkpoint** Complete the following exercises.

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



4. 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 $x = 15$.

① D.V. EQ $(3, -4)$ $y = ax$
 $-4 = a \cdot (3)$
 $\frac{-4}{3} = \frac{a \cdot 3}{3}$
 $a = -4/3$

$y = -4/3x$

② $x = 15$
 $y = -4/3(15)$

$y = -20$

