4.5 Direct Variation

What you should learn

GOAL 1 Write linear equations that represent direct variation.

GOAL 2 Use a ratio to write an equation for direct variation, such as the ratio of tail length to body length in alligators in **Example 4**.

Why you should learn it

▼ To solve **real-life** problems such as lengths of several stringed instruments in **Exs. 36 and 37**.

GOAL 1 Recognizing and Using Direct Variation

Two variables x and y *vary directly* if there is a nonzero number k such that the following is true.

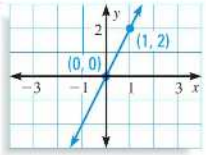
$$y = kx \quad \longleftarrow \text{Model for direct variation}$$

The number k is the **constant of variation**. Two quantities that vary directly are said to have **direct variation**.

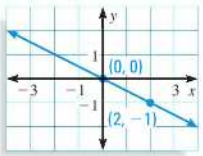
EXAMPLE 1 Graphs of Direct Variation Models

Find the constant of variation and the slope of each direct variation model.

a. $y = 2x$



b. $y = -\frac{1}{2}x$



SOLUTION

a. For the equation $y = 2x$, the constant of variation is $k = 2$.

To find the slope of the line, use the slope formula.

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

$$m = \frac{2 - 0}{1 - 0} = 2$$

b. For the equation $y = -\frac{1}{2}x$, the constant of variation is $k = -\frac{1}{2}$.

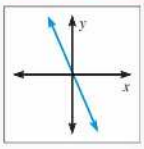
To find the slope of the line, use the slope formula.

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

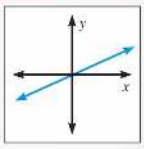
$$m = \frac{-1 - 0}{2 - 0} = -\frac{1}{2}$$

PROPERTIES OF GRAPHS OF DIRECT VARIATION MODELS

- The graph of $y = kx$ is a line through the origin.
- The slope of the graph of $y = kx$ is k.



$k < 0$



$k > 0$