

Section Overview

Linear Functions

Lesson 5-1

Why? Linear functions describe numerous real-world situations that involve constant rates of change, such as cost, distance, and speed.

In a linear function, a constant change in x corresponds to a constant change in y .

| $y = -3x - 4$ | |
|---------------|-----|
| x | y |
| -2 | 2 |
| -1 | -1 |
| 0 | -4 |
| 1 | -7 |
| 2 | -10 |

Arrows on the left indicate a change of +1 in x between rows. Arrows on the right indicate a change of -3 in y between rows.

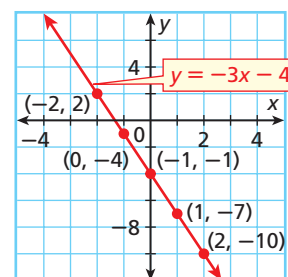
For $y = -3x - 4$, a constant change of +1 in x corresponds to a constant change of -3 in y .

An equation that can be written in the form $Ax + By = C$, where A , B , and C are real numbers and A and B are not both 0, is a linear equation.

$y = -3x - 4$ can be written as $3x + 1y = -4$, where $A = 3$, $B = 1$, and $C = -4$.

Note that if $B = 0$ and A and C are nonzero real numbers, the linear equation does *not* describe a function. It describes a vertical line.

The graph of a linear function is a line.



Slope and Intercepts

Lessons 5-2, 5-3, 5-4

Why? Students who understand slope and x - and y -intercepts will be able to graph linear functions with ease.

Slope is the constant rate of change shown by a line. For two different points (x_1, y_1) and (x_2, y_2) on a line,

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{y_2 - y_1}{x_2 - x_1}$$

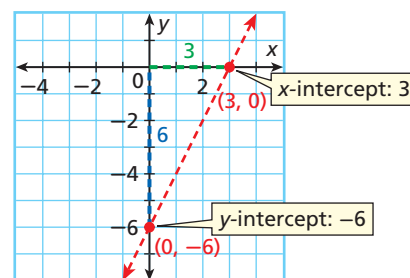
$$\text{slope} = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0 - (-6)}{3 - 0} = \frac{6}{3} = 2$$

The **x -intercept** is the x -coordinate of the point where the graph crosses the x -axis (where $y = 0$).

$$\begin{aligned} y &= 2x - 6 \\ 0 &= 2x - 6 \\ 6 &= 2x \\ 3 &= x \end{aligned}$$

The **y -intercept** is the y -coordinate of the point where the graph crosses the y -axis (where $x = 0$).

$$\begin{aligned} y &= 2x - 6 \\ y &= 2(0) - 6 \\ y &= 0 - 6 \\ y &= -6 \end{aligned}$$



Direct Variation

Lesson 5-5

Why? Many real-world relationships involve direct variations, including relationships in science, cooking, and medicine.

When the dependent variable y depends solely on the value of the independent variable x , the linear relationship is a direct variation and can be written in the form $y = kx$, where k is a constant nonzero value.

$$\begin{aligned} 3y &= 12x \\ \frac{3y}{3} &= \frac{12x}{3} \\ y &= 4x \end{aligned}$$

$3y = 12x$ is a direct variation because it can be written as $y = 4x$; the constant of variation is 4.