LESSON 4.4

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Practice with Examples

For use with pages 226–233

GOAL **Find the slope of a line using two of its points and how to interpret slope as a rate of change in real-life situations**

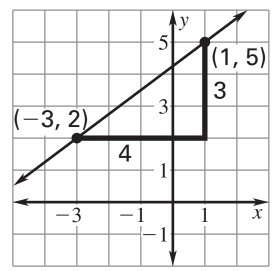
VOCABULARY

The **slope** m of a nonvertical line is the number of units the line rises or falls for each unit of horizontal change from left to right.

A **rate of change** compares two different quantities that are changing.

EXAMPLE 1 *Finding the Slope of a Line*

Find the slope of the line passing through $(-3, 2)$ and $(1, 5)$.



SOLUTION

Let $(x_1, y_1) = (-3, 2)$ and $(x_2, y_2) = (1, 5)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1} \begin{array}{l} \leftarrow \text{ Rise: Difference of } y\text{-values} \\ \leftarrow \text{ Run: Difference of } x\text{-values} \end{array}$$

$$= \frac{5 - 2}{1 - (-3)} \qquad \text{Substitute values.}$$

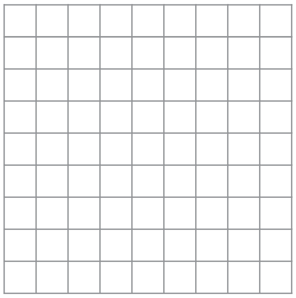
$$= \frac{3}{1 + 3} = \frac{3}{4} \qquad \text{Simplify. Slope is positive.}$$

Because the slope in Example 1 is positive, the line rises from left to right. If a line has negative slope, then the line falls from left to right.

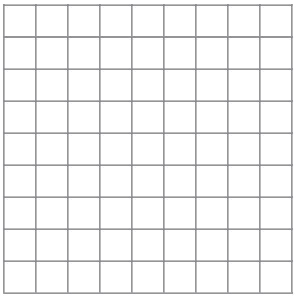
Exercises for Example 1

Plot the points and find the slope of the line passing through them.

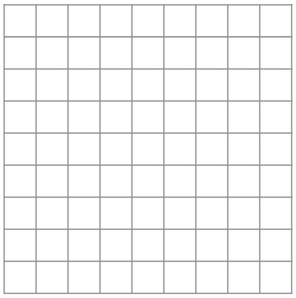
1. $(-4, 0), (3, 3)$



2. $(-1, -2), (2, -6)$



3. $(-3, -1), (1, 3)$



Chapter 4

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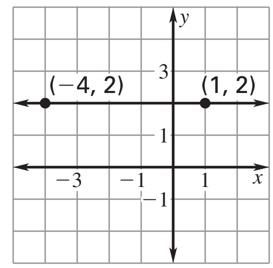
EXAMPLE 2 *Finding the Slope of a Line*

Find the slope of the line passing through $(-4, 2)$ and $(1, 2)$.

SOLUTION



Let $(x_1, y_1) = (-4, 2)$ and $(x_2, y_2) = (1, 2)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$ ← Rise: Difference of y-values; ← Run: Difference of x-values

$$= \frac{2 - 2}{1 - (-4)}$$ Substitute values.

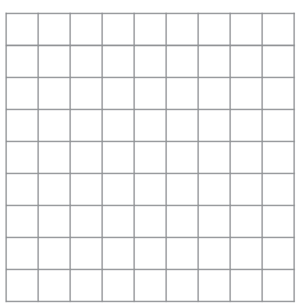
$$= \frac{0}{5} = 0$$ Simplify. Slope is zero.

Because the slope in Example 2 is zero, the line is horizontal. If the slope of a line is undefined, the line is vertical.

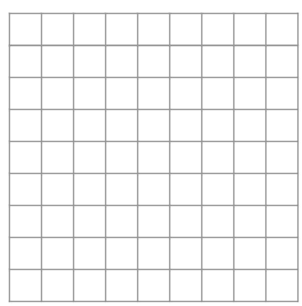
Exercises for Example 2

Plot the points and find the slope of the line passing through the points.

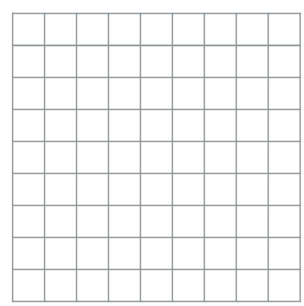
4. $(-4, 0), (-4, 3)$



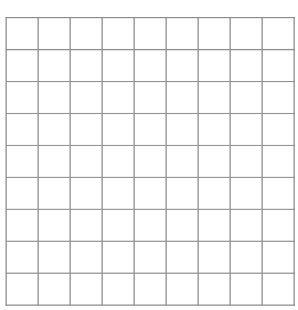
5. $(1, -1), (1, 3)$



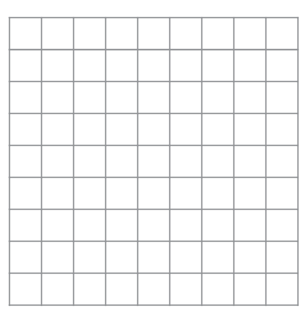
6. $(-3, 0), (1, 0)$



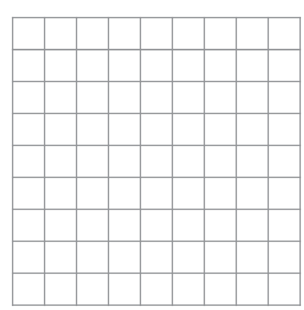
7. $(-4, 3), (1, 3)$



8. $(2, -2), (2, -6)$



9. $(-1, -6), (2, -6)$



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Practice with Examples

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EXAMPLE 3 Interpreting Slope as a Rate of Change

In 1994, a video store had 23,500 rentals. In 2000, the store had 28,540 rentals. Find the average rate of change of the store's rentals in rentals per year.

SOLUTION

Use the formula for slope to find the average rate of change. The change in rentals is $28{,}540 - 23{,}500 = 5040$ rentals. Subtract in the same order. The change in time is $2000 - 1994 = 6$ years.

VERBAL MODEL

$$\boxed{\text{Average rate of change}} = \frac{\boxed{\text{Change in rentals}}}{\boxed{\text{Change in time}}}$$

LABELS

Average rate of change $= m$ (rentals per year)
Change in rentals $= 5040$ (rentals)
Change in time $= 6$ (years)

ALGEBRAIC MODEL

$$m = \frac{5040}{6}$$

The average rate of change is 840 rentals per year.

Exercises for Example 3

10. In 1992, the population of Seoul, South Korea was 17,334,000. In 1995, the population of Seoul was 19,065,000. Find the average rate of change of the population in people per year.

11. In 1990, the number of motorcycles registered in the United States was 4.3 million. In 1996, the number of registered motorcycles was 3.8 million. Find the average rate of change of the number of registered motorcycles in motorcycles per year.