LESSON 3.4
Notes

GOAL
Find the slope of a line and interpret slope as a rate of change.

Vocabulary
The **slope** of a non vertical line is the ratio of the vertical change (the *rise*) to the horizontal change (the *run*) between any two points on a line.

A **rate of change**. Compares a change in one quantity to a change in another quantity

Key Concept
The slope *m* of a non-vertical line is the ratio of the vertical change in *y* (the rise) to the horizontal
change in *x* (the run) between any two points on the line. The slope is positive if the line rises to the
right and negative if it falls to the right. In real-world data, slope is seen as a rate of change.

Common Student Errors
• Not keeping the order of the *x*- and *y*-coordinates consistent

Tip Label the points before using them.

Example: Find the slope of the line that passes through the points (–4, 1) and (2, 4).

↑ Point 1 ↑ Point 2

So, $\frac{4-1}{2-(-4)} = \frac{3}{6} = \frac{1}{2}$, not $\frac{4-1}{-4-2} = \frac{3}{-6} = -\frac{1}{2}$.

EXAMPLE 1

Find a positive slope

Find the slope of the line shown.

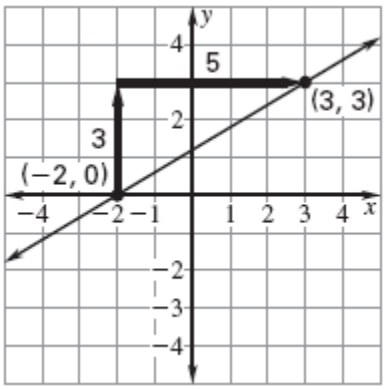
Solution

Let $(x_1, y_1) = (-2, 0)$ and $(x_2, y_2) = (3, 3)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$ Write formula for slope

$$= \frac{3-0}{3-(-2)}$$ Substitute

$$= \frac{3}{5}$$ Simplify



EXAMPLE 2

Find a negative slope

Find the slope of the line shown.

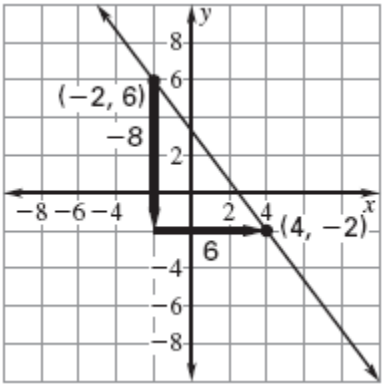
Solution

Let $(x_1, y_1) = (4, -2)$ and $(x_2, y_2) = (-2, 6)$.

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$ Write formula for slope

$$= \frac{6 - (-2)}{-2 - 4}$$ Substitute

$$= \frac{8}{-6} = -\frac{4}{3}$$ Simplify



The line falls from left to right. The slope is negative.

Exercises for Examples 1 and 2

Find the slope of the line that passes through the points.

1. $(-4, -1)$ and $(5, 9)$
2. $(-2, 5)$ and $(-7, 8)$

EXAMPLE 3

Find the slope of a horizontal line

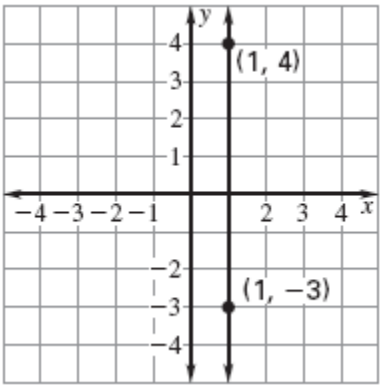
Find the slope of the line shown.

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

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$ Write formula for slope

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

$$= \frac{0}{6} = 0$$ Simplify



EXAMPLE 4

Find the slope of a vertical line

Find the slope of the line shown.

Let $(x_1, y_1) = (1, 4)$ and $(x_2, y_2) = (1, -3)$.

$m = \frac{y_2 - y_1}{x_2 - x_1}$ Write formula for slope

$= \frac{-3 - 4}{1 - 1}$ Substitute

$= \frac{-7}{0}$ Division by zero is undefined

EXAMPLE 5

Find a rate of change

Water loss The table shows the amount of water evaporating from a swimming pool on a hot day. Find the rate of change in gallons with respect to time. Time (hours)

Time (hours)	2	6	12
Gallons evaporated	4.5	13.5	27

Solution

$$\text{Rate of Change} = \frac{\text{change in gallons}}{\text{change in time}} = \frac{13.5 - 4.5}{6 - 2} = \frac{9}{4}$$

The rate of change in gallons is $\frac{9}{4}$ gallons, or 2.25 gallons per hour.

Exercises for Examples 3, 4, and 5

Find the slope of the line that passes through the points.

3. (–8, 0) and (3, 0)

4. (5, –8) and (5, 4)

5. Find the rate of change in calories burned with respect to time.

Time (minutes)	40	60	0
Calories burned	500	750	1000

Answer Key

Lesson 3.4

Study Guide

1. $\frac{10}{9}$
2. $-\frac{3}{5}$
3. 0
4. undefined
5. 12.5 calories per minute