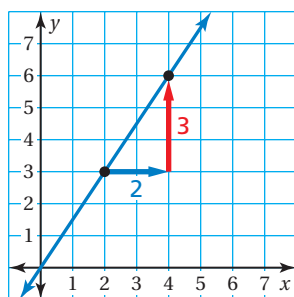


B.4 Slope of a Line

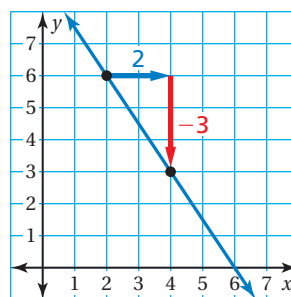
Essential Question How can the slope of a line be used to describe the line?

You studied the following definition of the slope of a line.

Slope is the rate of change between any two points on a line. It is a measure of the *steepness* of a line. To find the slope of a line, find the ratio of the **change in y** (vertical change) to the **change in x** (horizontal change).



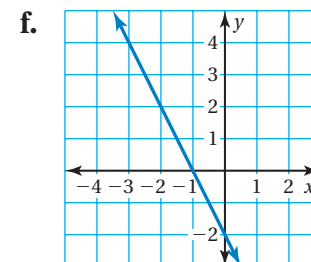
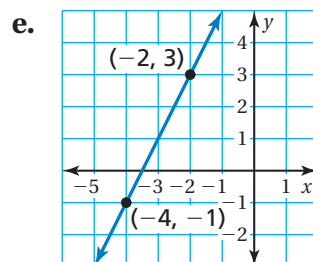
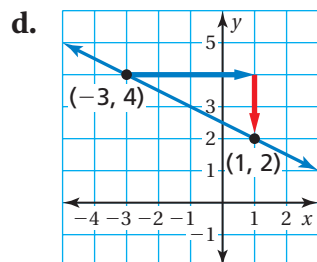
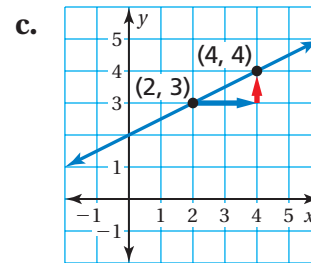
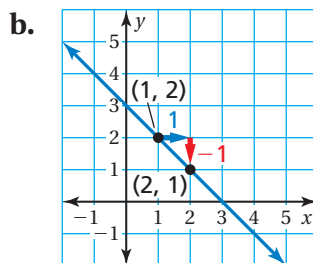
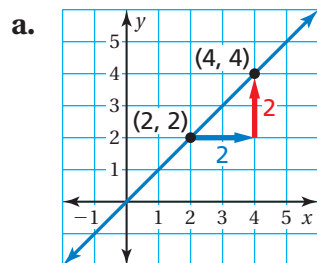
$$\begin{aligned}\text{slope} &= \frac{\text{change in } y}{\text{change in } x} \\ &= \frac{3}{2}\end{aligned}$$



$$\begin{aligned}\text{slope} &= \frac{\text{change in } y}{\text{change in } x} \\ &= \frac{-3}{2} = -\frac{3}{2}\end{aligned}$$

1 ACTIVITY: Extending the Concept of a Slope

Work with a partner. Find the slope of each line.



Inductive Reasoning

Work with a partner. Copy and complete the table.

	Two Points	Change in y	Change in x	Slope of Line
1a	2. $(2, 2), (4, 4)$	2	2	
1b	3. $(1, 2), (2, 1)$	-1	1	
1c	4. $(2, 3), (4, 4)$			
1d	5. $(-3, 4), (1, 2)$			
1e	6. $(-4, -1), (-2, 3)$			
1f	7.			
	8. $(-4, 0), (0, 1)$			
	9. $(-3, 4), (6, -2)$			
	10. $(-4, 2), (8, -1)$			
	11. $(-6, -1), (3, 5)$			
	12. $(-5, 7), (10, -5)$			
	13. $(0, 1), (4, 1)$			
	14. $(-4, -2), (-3, -6)$			

What Is Your Answer?

15. **IN YOUR OWN WORDS** How can the slope of a line be used to describe the line?
 - a. Draw three lines that have positive slopes.
 - b. Draw three lines that have negative slopes.
16. Compare a slope of 1 with a slope of 2. Show your comparison on a graph.
17. Compare a slope of -1 with a slope of -2. Show your comparison on a graph.

Practice

Use what you learned about the slope of a line to complete Exercises 4–7 on page A34.

Key Vocabulary

slope, p. A32

rise, p. A32

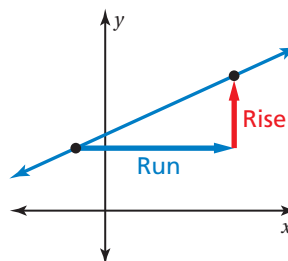
run, p. A32

Key Idea

Slope

The **slope** of a line is a ratio of the change in y (the **rise**) to the change in x (the **run**) between any two points on the line.

$$\text{slope} = \frac{\text{change in } y}{\text{change in } x} = \frac{\text{rise}}{\text{run}}$$



EXAMPLE 1 Real-Life Application

What is the slope of the stairs when walking up to the apartment?

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

Write formula for slope.

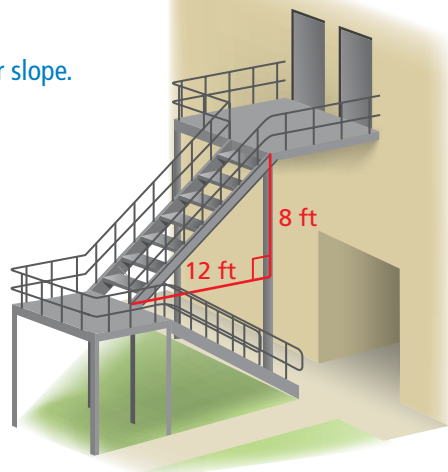
$$= \frac{8 \text{ ft}}{12 \text{ ft}}$$

Substitute.

$$= \frac{2}{3}$$

Simplify.

∴ The slope of the stairs is $\frac{2}{3}$.



On Your Own

- WHAT IF?** The rise of the stairs is 9 feet. What is the slope of the stairs?

EXAMPLE 2 Finding the Slope of a Line

Find the slope of the line.

$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

Write formula for slope.

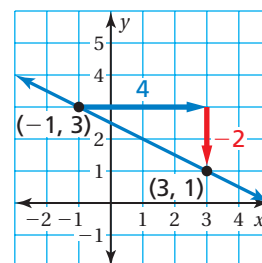
$$= \frac{-2}{4}$$

Substitute.

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

Simplify.

∴ The slope is $-\frac{1}{2}$.



Study Tip

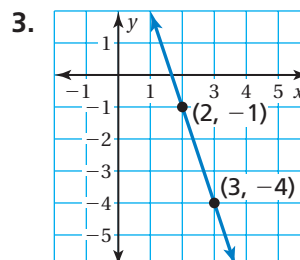
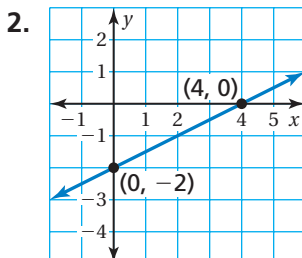
A line that rises from left to right has a **positive** slope.

A line that falls from left to right has a **negative** slope.

Now You're Ready
Exercises 8–10

On Your Own

Find the slope of the line.



EXAMPLE 3 Graphing Lines Using a Point and a Slope

- a. Graph the line with a slope of 3 that passes through $(-3, -4)$.

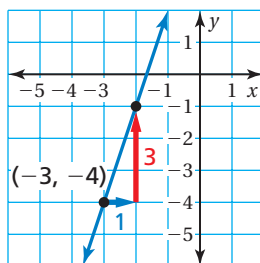
Step 1: Plot $(-3, -4)$.

Step 2: Find the rise and the run.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{3}{1}$$

Step 3: Plot the point that is 1 unit right and 3 units up from $(-3, -4)$.

Step 4: Draw a line through the two points.



••• The graph is shown at the left.

- b. Graph the line with a slope of $-\frac{4}{3}$ that passes through $(2, 3)$.

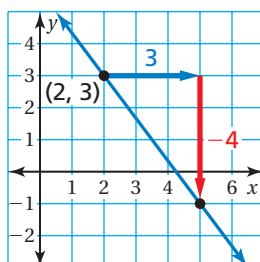
Step 1: Plot $(2, 3)$.

Step 2: Find the rise and the run.

$$\text{slope} = \frac{\text{rise}}{\text{run}} = \frac{-4}{3}$$

Step 3: Plot the point that is 3 units right and 4 units down from $(2, 3)$.

Step 4: Draw a line through the two points.



••• The graph is shown at the left.

On Your Own

Graph the line with the given slope that passes through the given point.

Now You're Ready
Exercises 11–14

4. slope = 1; $(1, 3)$

5. slope = $\frac{2}{5}$; $(2, -1)$

6. slope = -2 ; $(0, -2)$

7. slope = $-\frac{3}{2}$; $(-4, -4)$

B.4 Exercises



Vocabulary and Concept Check

- OPEN-ENDED** How could you measure the slope of the roof of a house?
- REASONING** The slope of a line is $\frac{1}{2}$. What do you know about the graph of the line?
- OPEN-ENDED** A line with slope $-\frac{2}{3}$ passes through the point $(2, -6)$. Find two additional points on the line.



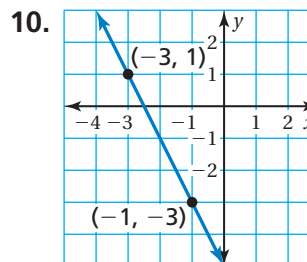
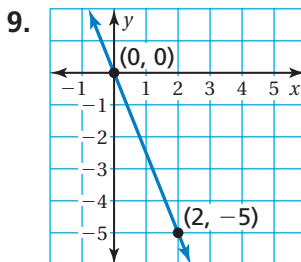
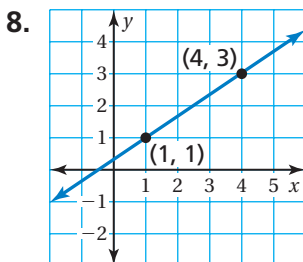
Practice and Problem Solving

Copy and complete the table.

	Two Points	Change in y	Change in x	Slope of Line
4.	$(0, 5), (2, 7)$			
5.	$(-10, 4), (5, -20)$			
6.	$(-8, -4), (-6, 5)$			
7.	$(1, 9), (7, 6)$			

Find the slope of the line.

1 2



Graph the line with the given slope that passes through the given point.

3

11. slope = 3; $(1, 1)$

12. slope = $\frac{1}{5}$; $(-2, 2)$

13. slope = -2; $(4, 7)$

14. slope = $-\frac{3}{7}$; $(-6, 1)$

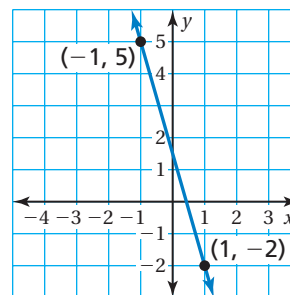
15. **POINTS** What point is 3 units right and 5 units down from $(-6, -2)$?

16. **ERROR ANALYSIS** Describe and correct the error made in finding the slope of the line.

X

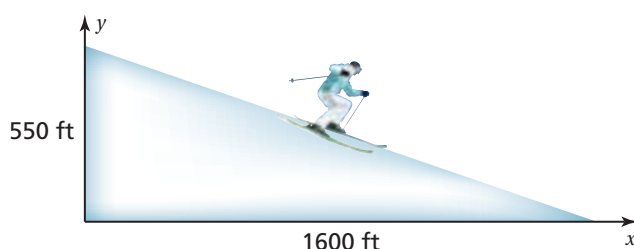
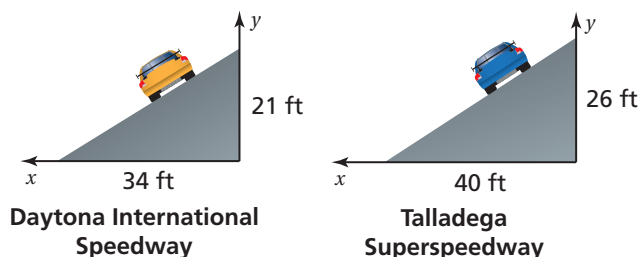
$$\text{slope} = \frac{\text{rise}}{\text{run}}$$

$$\text{slope} = -\frac{2}{7}$$



17. **RACING** The bankings of two race tracks are shown.

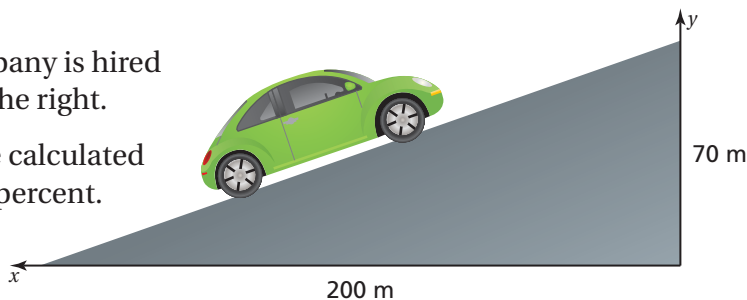
- What is the slope of each track?
- Which track has the steeper slope?
- Why are the tracks sloped and not flat?



18. **SKIING** What is the slope of the ski hill?

19. **ROADWAY** A construction company is hired to build the roadway shown at the right.

- The gradient of a hill can be calculated by converting its slope to a percent. What is the gradient of the roadway?
- The gradient of the new roadway cannot exceed 18%. What changes could you make to accommodate this restriction?



20. **Reasoning** A line has a slope of 0.5 and passes through the point $(-4, 5)$. Does the line also pass through the point $(2, 7)$? Explain.



Fair Game Review

What you learned in previous grades & lessons

Solve.

21. $4x - 8 = -24$

22. $2x - 19 = 5$

23. $15 - 3x = -6$

24. **MULTIPLE CHOICE** What is the solution of the equation?

$$6[4(3 + x) - 14] + 2^2 = 0$$

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) $\frac{4}{3}$

(D) $\frac{5}{3}$