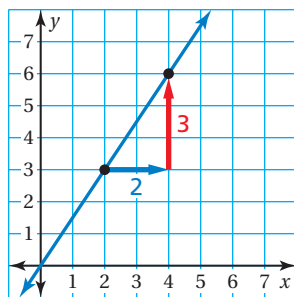


B.4 Slope of a Line

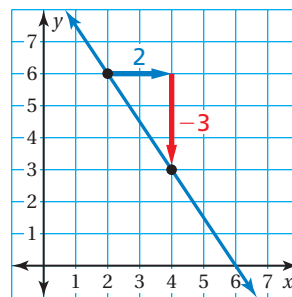
Essential Question How can the slope of a line be used to describe the line?

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).



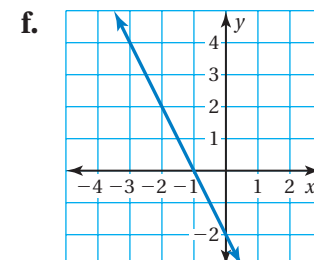
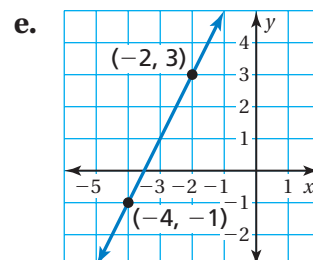
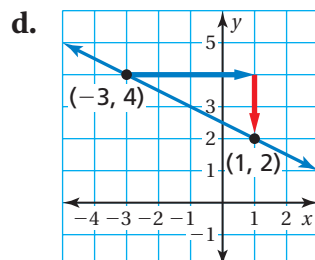
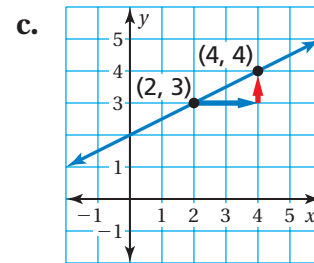
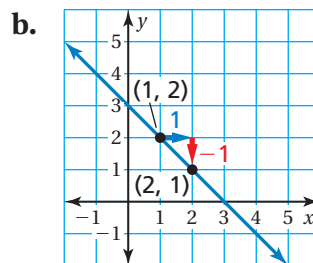
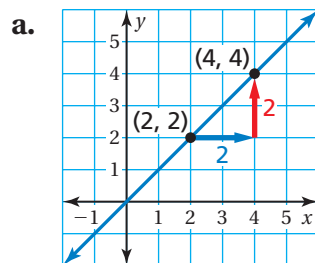
$$\begin{aligned} \text{slope} &= \frac{\text{change in } y}{\text{change in } x} \\ &= \frac{3}{2} \end{aligned}$$



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

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?

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

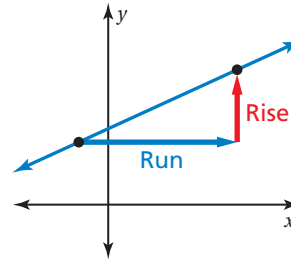
slope, p. A32
rise, p. A32
run, p. A32

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.

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

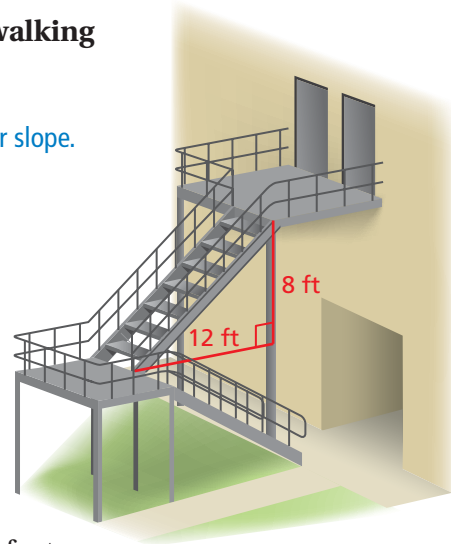


EXAMPLE 1 Real-Life Application

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

$$\begin{aligned} \text{slope} &= \frac{\text{rise}}{\text{run}} && \text{Write formula for slope.} \\ &= \frac{8 \text{ ft}}{12 \text{ ft}} && \text{Substitute.} \\ &= \frac{2}{3} && \text{Simplify.} \end{aligned}$$

∴ 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

Study Tip

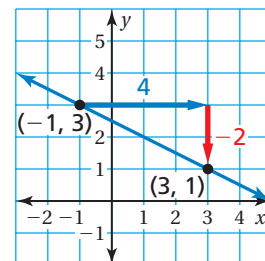
A line that rises from left to right has a *positive* slope.

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

Find the slope of the line.

$$\begin{aligned} \text{slope} &= \frac{\text{rise}}{\text{run}} && \text{Write formula for slope.} \\ &= \frac{-2}{4} && \text{Substitute.} \\ &= -\frac{1}{2} && \text{Simplify.} \end{aligned}$$

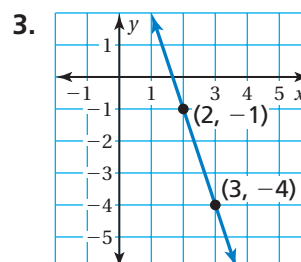
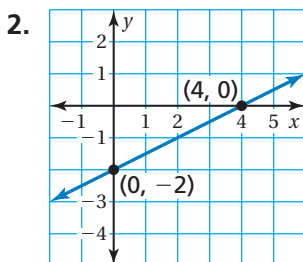
∴ The slope is $-\frac{1}{2}$.



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 $(-3, -4)$.

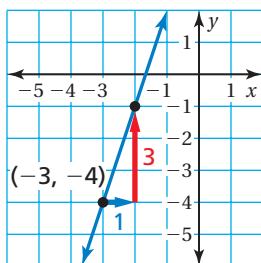
Step 1: Plot $(-3, -4)$.

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 $(2, 3)$.

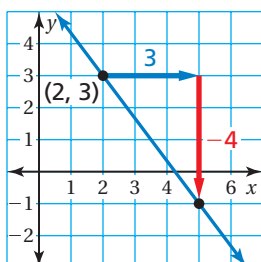
Step 1: Plot $(2, 3)$.

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

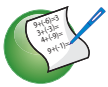
6. slope = -2 ; $(0, -2)$

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



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.



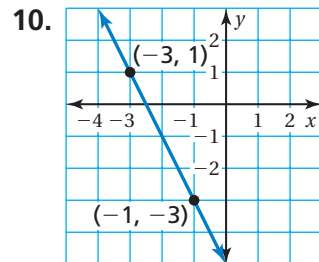
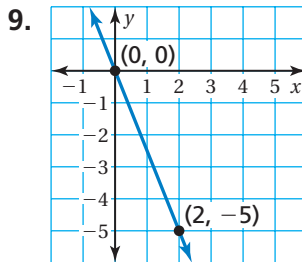
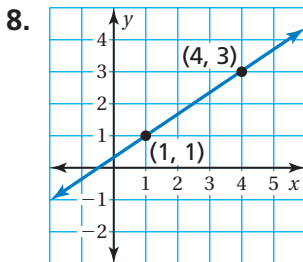
Practice and Problem Solving

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

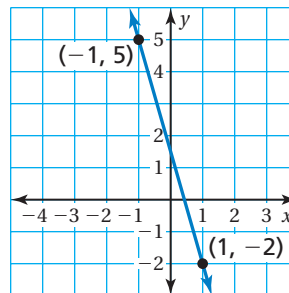


Graph the line with the given slope that passes through the given point.

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 $(-6, -2)$?

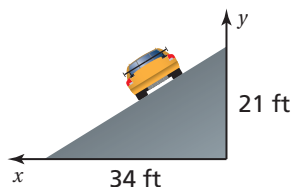
16. **ERROR ANALYSIS** Describe and correct the error made in finding the slope of the line.

X $\text{slope} = \frac{\text{rise}}{\text{run}}$
 $\text{slope} = -\frac{2}{7}$

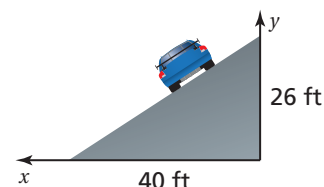


17. **RACING** The bankings of two race tracks are shown.

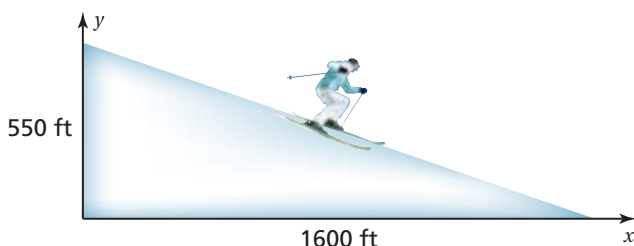
- What is the slope of each track?
- Which track has the steeper slope?
- Why are the tracks sloped and not flat?



Daytona International Speedway



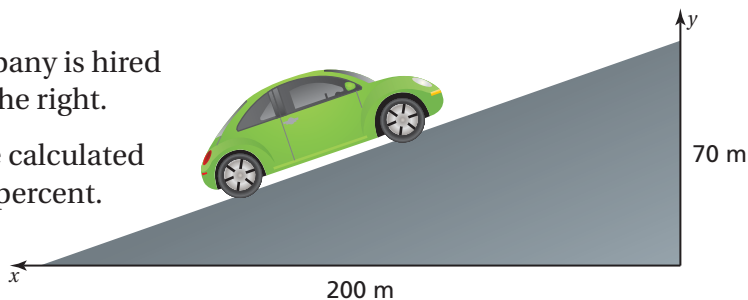
Talladega Superspeedway



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) $\frac{5}{3}$