

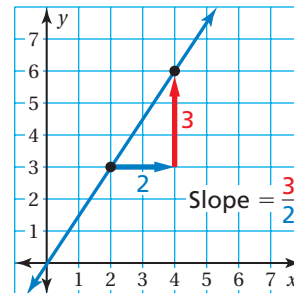
2.2 Slope of a Line

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

Slope is the rate of change between any two points on a line. It is the measure of the *steepness* of the 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).

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



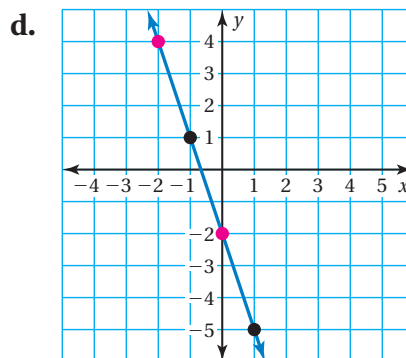
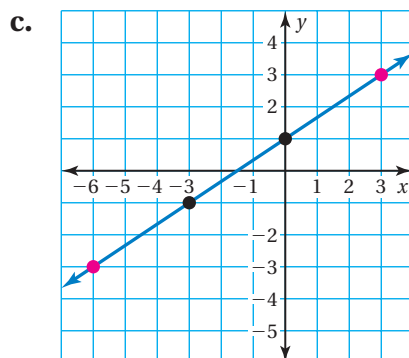
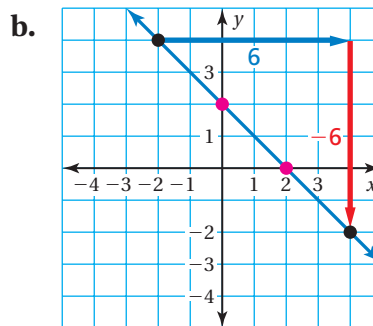
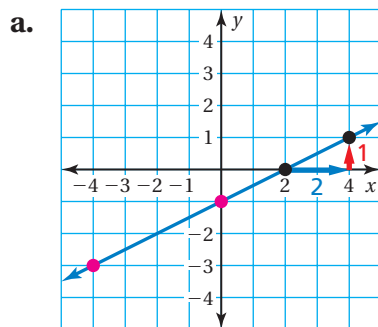
1 ACTIVITY: Finding the Slope of a Line

Work with a partner. Find the slope of each line using two methods.

Method 1: Use the two black points. ●

Method 2: Use the two pink points. ●

Do you get the same slope using each method?

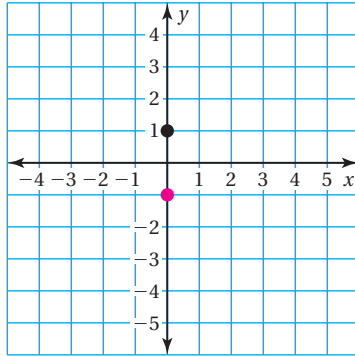


2 ACTIVITY: Drawing Lines with Given Slopes

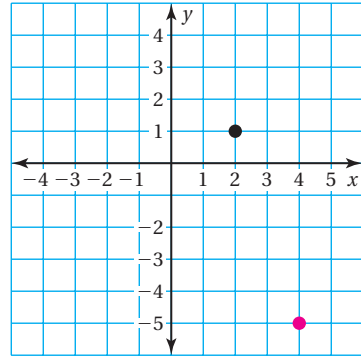
Work with a partner.

- Draw a line through the black point using the given slope.
- Draw a line through the pink point using the given slope.
- What do you notice about the two lines?

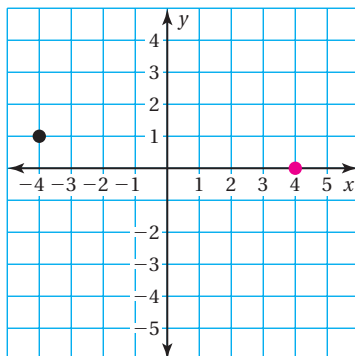
a. Slope = 2



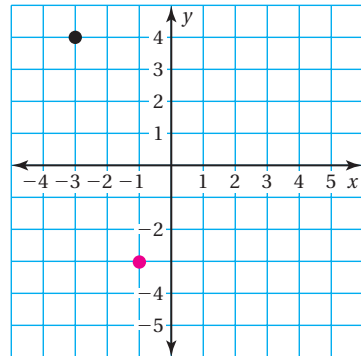
b. Slope = $-\frac{1}{2}$



c. Slope = $\frac{3}{4}$



d. Slope = -2



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.
- Line A has a slope of 1. Line B has a slope of 2. Compare the slopes of the lines. Illustrate your comparison.
- Line C has a slope of -1. Line D has a slope of -2. Compare the slopes of the lines. Illustrate your comparison.

Practice →

Use what you learned about the slope of a line to complete Exercises 4–6 on page 59.

Key Vocabulary

slope, p. 56
rise, p. 56
run, p. 56

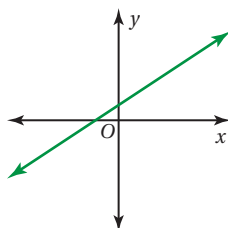
Key Idea

Slope

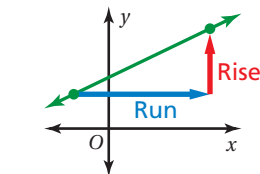
The **slope** of a line is a ratio of the change in y (the **rise**) to the change in x (the **run**) between any two points on the line.

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

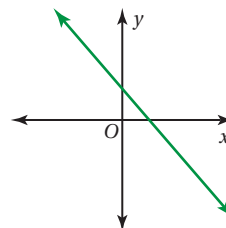
Positive slope



The line rises from left to right.



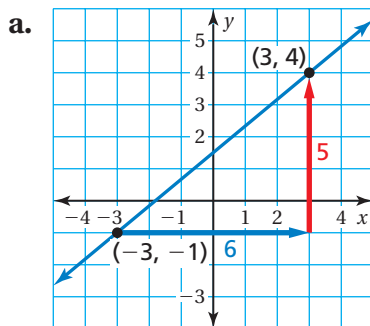
Negative slope



The line falls from left to right.

EXAMPLE 1 Finding the Slope of a Line

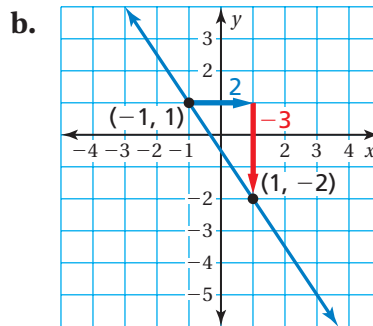
Tell whether the slope of the line is *positive* or *negative*. Then find the slope.



The line rises from left to right. So, the slope is positive.

$$\begin{aligned} \text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{5}{6} \end{aligned}$$

∴ The slope is $\frac{5}{6}$.



The line falls from left to right. So, the slope is negative.

$$\begin{aligned} \text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{-3}{2}, \text{ or } -\frac{3}{2} \end{aligned}$$

∴ The slope is $-\frac{3}{2}$.

EXAMPLE 2 Finding the Slope of a Horizontal Line

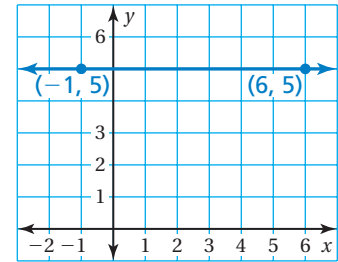
Study Tip

The slope of a horizontal line is always 0.

Find the slope of the line.

The line is not rising or falling.
So, the rise is 0.

$$\begin{aligned} \text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{0}{7} \end{aligned}$$

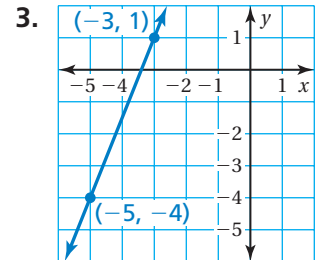
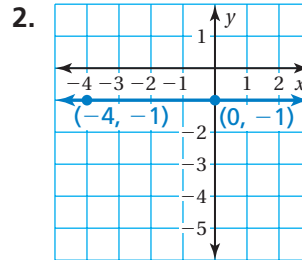
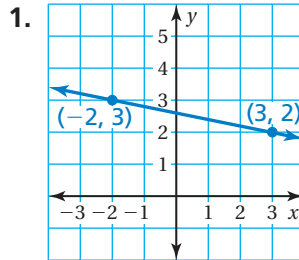


∴ The slope is 0.

On Your Own

Find the slope of the line.

Now You're Ready
Exercises 7–12



EXAMPLE 3 Finding Slope from a Table

The points in the table lie on a line. Find the slope of the line.
Then draw its graph.

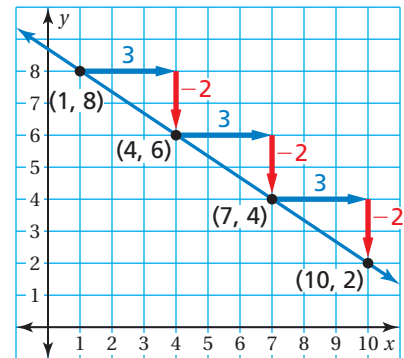
x	1	4	7	10
y	8	6	4	2

Choose any two points from the table. Then find the change in y and the change in x .

Use the points (1, 8) and (4, 6).

$$\begin{aligned} \text{slope} &= \frac{\text{change in } y}{\text{change in } x} \\ &= \frac{6 - 8}{4 - 1} \\ &= \frac{-2}{3} \end{aligned}$$

∴ The slope is $-\frac{2}{3}$.



On Your Own

The points in the table lie on a line. Find the slope of the line. Then draw its graph.

4.

x	1	3	5	7
y	2	5	8	11

5.

x	-3	-2	-1	0
y	6	4	2	0

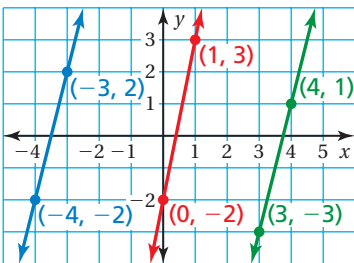
Key Idea

Parallel Lines and Slopes

Two lines in the same plane that do not intersect are parallel lines. Two lines with the same slope are parallel.

EXAMPLE 4 Finding Parallel Lines

Which two lines are parallel? Explain.



Find the slope of each line.

Blue Line

$$\begin{aligned} \text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{4}{1} \\ &= 4 \end{aligned}$$

Red Line

$$\begin{aligned} \text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{5}{1} \\ &= 5 \end{aligned}$$

Green Line

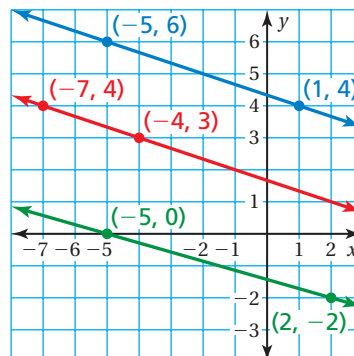
$$\begin{aligned} \text{slope} &= \frac{\text{rise}}{\text{run}} \\ &= \frac{4}{1} \\ &= 4 \end{aligned}$$

The slope of the blue and green lines is 4. The slope of the red line is 5.

∴ The blue and green lines have the same slope, so they are parallel.

On Your Own

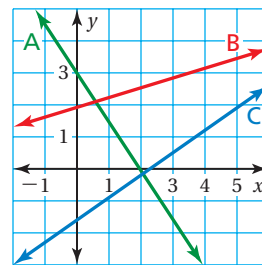
6. Which two lines are parallel? Explain.



2.2 Exercises

Vocabulary and Concept Check

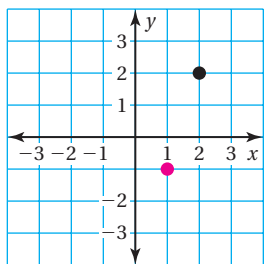
- CRITICAL THINKING** Refer to the graph.
 - Which lines have positive slopes?
 - Which line has the steepest slope?
 - Are any two of the lines parallel? Explain.
- OPEN-ENDED** Describe a real-life situation that involves slope.
- REASONING** The slope of a line is 0. What do you know about the line?



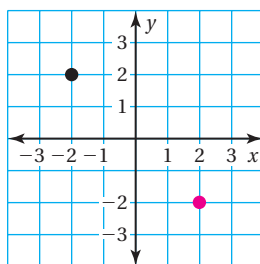
Practice and Problem Solving

Draw a line through each point using the given slope. What do you notice about the two lines?

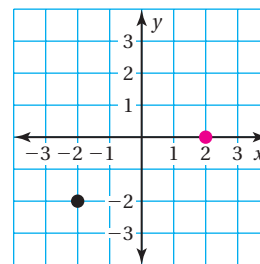
4. Slope = 1



5. Slope = -3

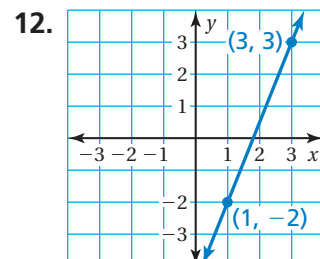
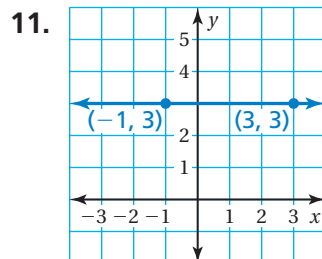
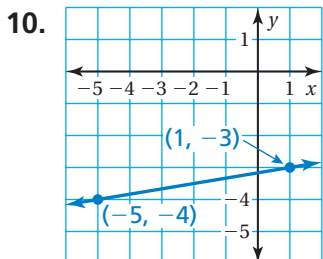
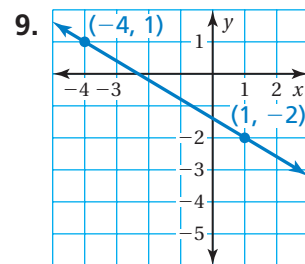
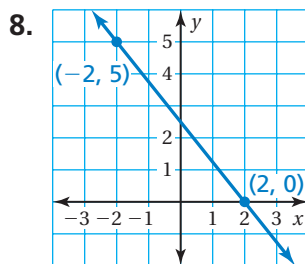
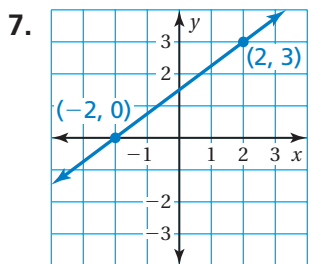


6. Slope = $\frac{1}{4}$



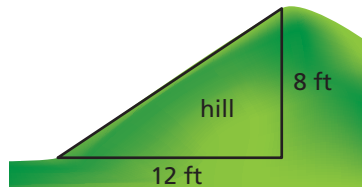
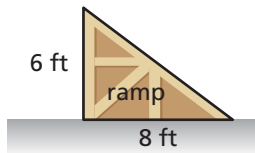
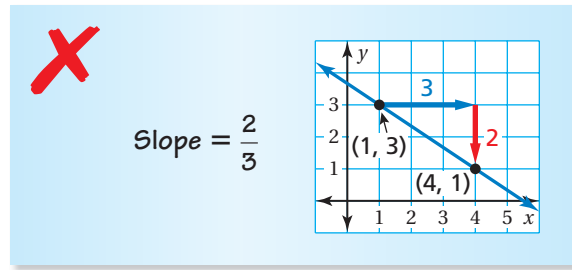
Find the slope of the line.

1 2



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

14. **CRITICAL THINKING** Is it more difficult to walk up the ramp or the hill? Explain.



The points in the table lie on a line. Find the slope of the line. Then draw its graph.

15.

x	1	3	5	7
y	2	10	18	26

16.

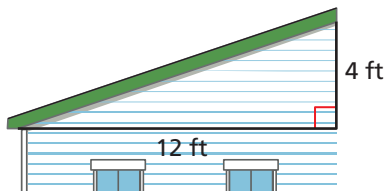
x	-3	2	7	12
y	0	2	4	6

17.

x	-6	-2	2	6
y	8	5	2	-1

18.

x	-8	-2	4	10
y	8	1	-6	-13



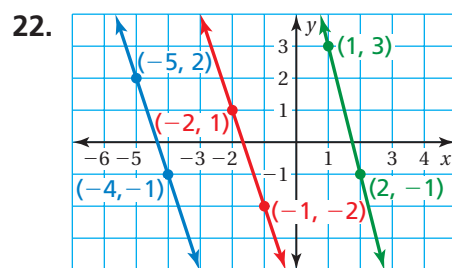
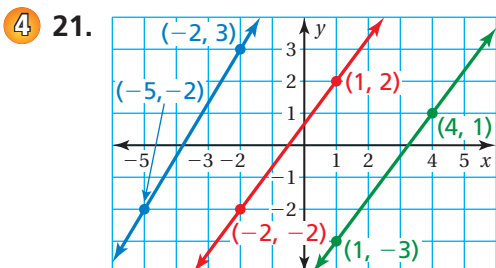
19. **PITCH** Carpenters refer to the slope of a roof as the *pitch* of the roof. Find the pitch of the roof.

20. **PROJECT** The guidelines for a wheelchair ramp suggest that the ratio of the rise to the run be no greater than 1 : 12.

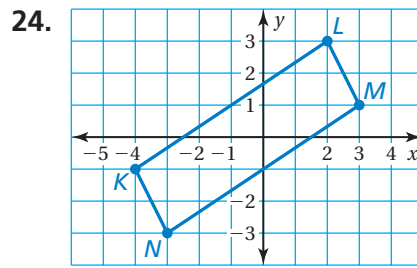
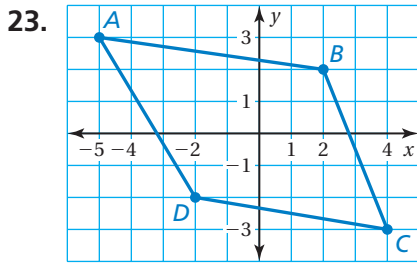
- Find a wheelchair ramp in your school or neighborhood. Measure its slope. Does the ramp follow the guidelines?
- Design a wheelchair ramp that provides access to a building with a front door that is 2.5 feet higher than the sidewalk. Illustrate your design.



Which two lines are parallel? Explain.

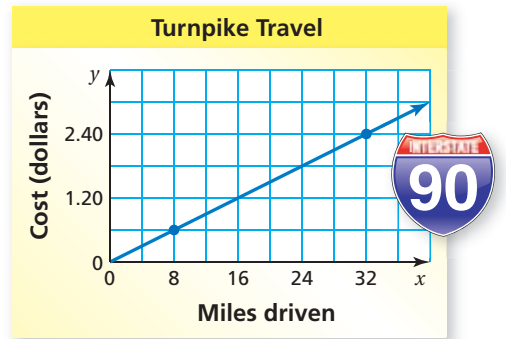


Tell whether the quadrilateral is a parallelogram. Explain.

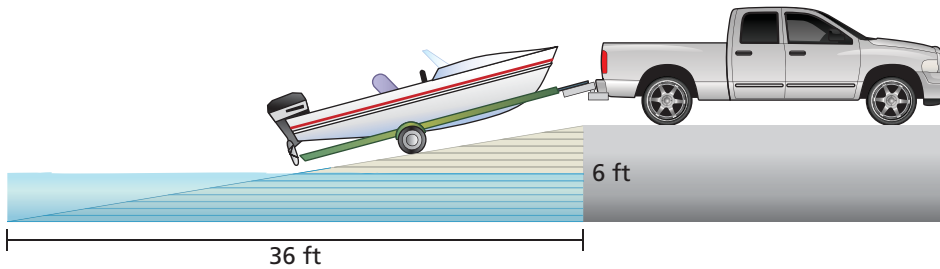


25. **TURNPIKE TRAVEL** The graph shows the cost of traveling by car on a turnpike.

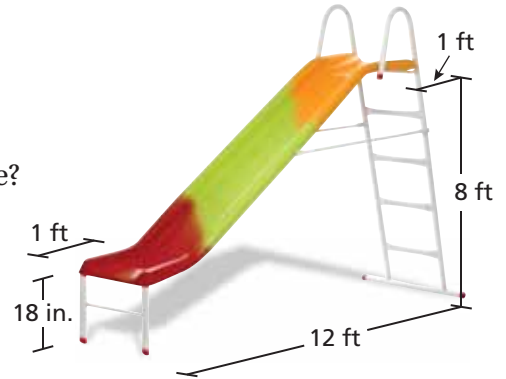
- Find the slope of the line.
- Explain the meaning of the slope as a rate of change.



26. **BOAT RAMP** Which is steeper: the boat ramp or a road with a 12% grade? Explain. (*Note:* Road grade is the vertical increase divided by the horizontal distance.)



27. **Critical Thinking** The top and bottom of the slide are parallel to the ground.
- What is the slope of the main portion of the slide?
 - How does the slope change if the bottom of the slide is only 12 inches above the ground? Is the slide steeper? Explain.



Fair Game Review What you learned in previous grades & lessons

Graph the linear equation. (*Section 2.1*)

28. $y = -\frac{1}{2}x$

29. $y = 3x - \frac{3}{4}$

30. $y = -\frac{x}{3} - \frac{3}{2}$

31. **MULTIPLE CHOICE** What is the prime factorization of 84?
(*Skills Review Handbook*)

(A) $2 \times 3 \times 7$

(B) $2^2 \times 3 \times 7$

(C) $2 \times 3^2 \times 7$

(D) $2^2 \times 21$