

## A Practice by Example

### Example 1 (page 311)

Find the slope of a line parallel to the graph of each equation.

1.  $y = \frac{1}{2}x + 2.3$

2.  $y = -\frac{2}{3}x - 1$

3.  $y = x$

4.  $y = 6$

5.  $3x + 4y = 12$

6.  $7x - y = 5$

Are the graphs of the lines in each pair parallel? Explain.

7.  $y = 4x + 12$

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

9.  $y = \frac{1}{3}x + 3$

$-4x + 3y = 21$

$3x + 2y = 8$

$x - 3y = 6$

10.  $y = -\frac{1}{2}x + \frac{3}{2}$

11.  $y = -3x$

12.  $y = \frac{3}{4}x - 2$

$5x - 10y = 15$

$21x + 7y = 14$

$-3x + 4y = 8$

### Example 2 (page 312)

Write an equation for the line that is parallel to the given line and that passes through the given point.

13.  $y = 6x - 2; (0, 0)$

14.  $y = -3x; (3, 0)$

15.  $y = -2x + 3; (-1, 0)$

16.  $y = -\frac{7}{2}x + 6; (-4, -6)$

17.  $y = 0.5x - 8; (8, -5)$

18.  $y = -\frac{2}{3}x + 12; (5, 10)$

### Example 3 (page 313)

Find the slope of a line perpendicular to the graph of each equation.

19.  $y = 2x$

20.  $y = -3x$

21.  $y = \frac{7}{5}x - 2$

22.  $y = -\frac{x}{5} - 7$

23.  $2x + 3y = 5$

24.  $y = -8$

Write an equation for the line that is perpendicular to the given line and that passes through the given point.

25.  $y = 2x + 7; (0, 0)$

26.  $y = x - 3; (4, 6)$

27.  $y = -\frac{1}{3}x + 2; (4, 2)$

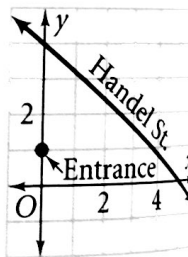
28.  $3x + 5y = 7; (-1, 2)$

29.  $-10x + 8y = 3; (15, 12)$

30.  $4x - 2y = 9; (8, -2)$

### Example 4 (page 313)

**31. Maps** A city's civil engineer is planning a new parking garage and a new street. The new street will go from the entrance of the parking garage to Handel St. It will be perpendicular to Handel St. What is the equation of the line representing the new street?



## B Apply Your Skills

Tell whether the lines for each pair of equations are *parallel*, *perpendicular*, or *neither*.

32.  $y = 4x + \frac{3}{4}, y = -\frac{1}{4}x + 4$

33.  $y = \frac{2}{3}x - 6, y = \frac{2}{3}x + 6$

34.  $y = -x + 5, y = x + 5$

35.  $y = 5x, y = -5x + 7$

36.  $y = \frac{x}{3} - 4, y = \frac{1}{3}x + 2$

37.  $x = 2, y = 9$

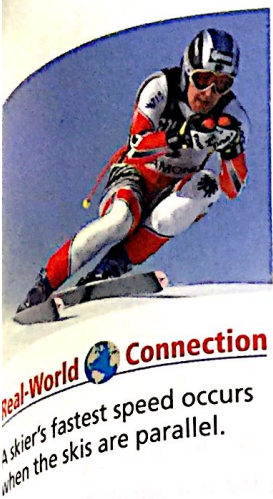
38.  $2x + y = 2, 2x + y = 5$

39.  $3x - 5y = 3, -5x + 3y = 8$

40.  $4x - 3y = 36, 3x + 4y = 20$

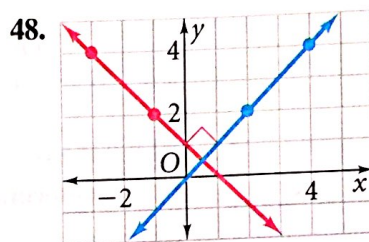
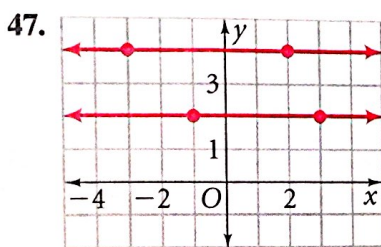
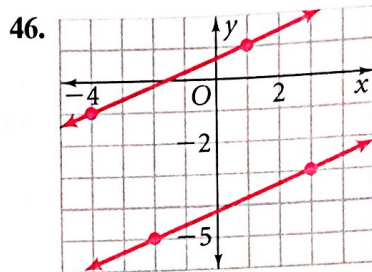
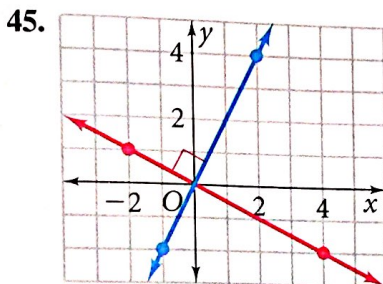
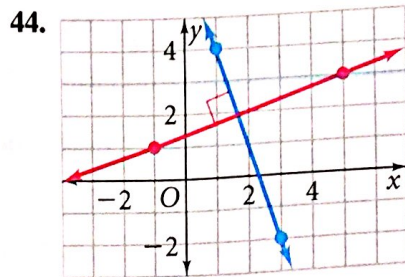
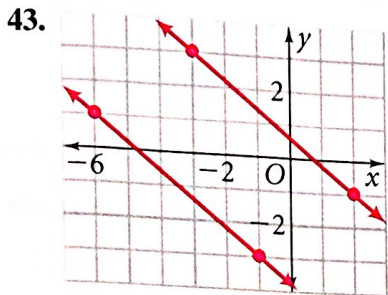
41.  $2x - 5y = 15, 2x + 5y = 10$

**42. Critical Thinking** Explain how you can tell that the graphs of  $7x - 3y = 5$  and  $7x - 3y = 8$  are parallel without finding their slopes.

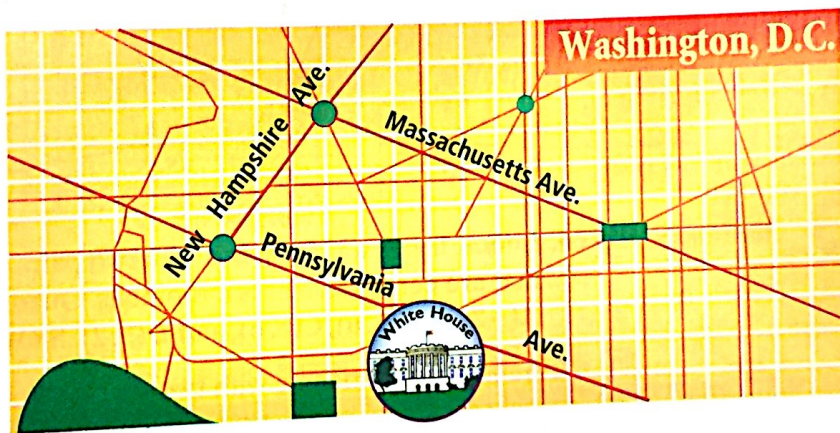


**Real-World Connection**  
A skier's fastest speed occurs when the skis are parallel.

Find the equation for each line.



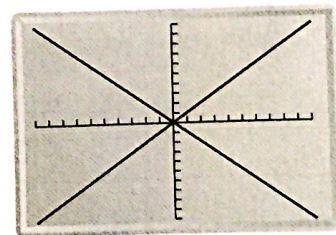
**Maps** Use the map below for Exercises 49–51.



49. What is the slope of New Hampshire Avenue?
50. Show that the parts of Pennsylvania Avenue and Massachusetts Avenue near New Hampshire Avenue are parallel.
51. Show that New Hampshire Avenue is not perpendicular to Pennsylvania Avenue.


52. a. The graphs of  $y = x$  and  $y = -x$  are shown on the standard screen at the right. The product of the slopes is  $-1$ . Explain why the lines do not appear to be perpendicular.

- b. **Graphing Calculator** Graph  $y = x$  and  $y = -x$  on a graphing calculator. In the **ZOOM** feature, choose the square screen. What do you notice?



53. **Open-Ended** Write an equation for a line parallel to the graph of  $4x - y = 1$ .

54. Are the graphs of  $2x + 7y = 6$  and  $7y = 2x + 6$  parallel? Explain.
55. Are the graphs of  $8x + 3y = 6$  and  $8x - 3y = 6$  perpendicular? Explain.

 **56. Writing** Are all horizontal lines parallel? Explain.

Tell whether each statement is *true* or *false*. Explain your choice.


57. Two lines with positive slopes can be perpendicular.

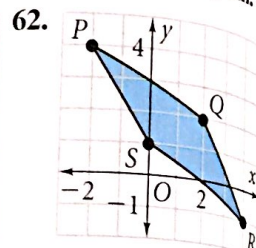
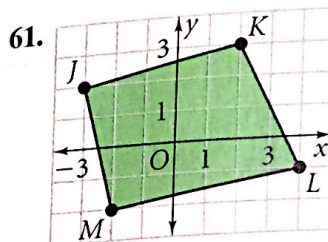
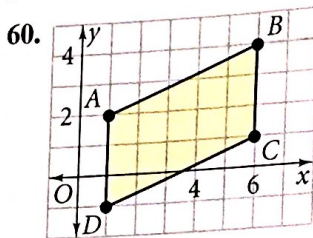
58. Two lines with positive slopes can be parallel.


59. The graphs of two different direct variations can be parallel.

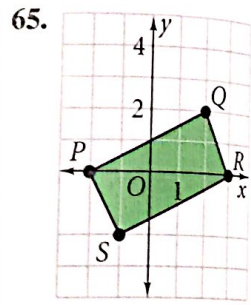
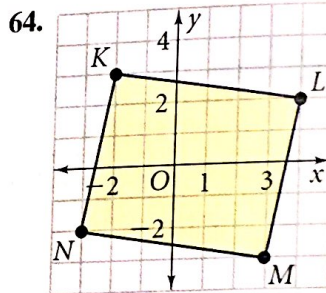
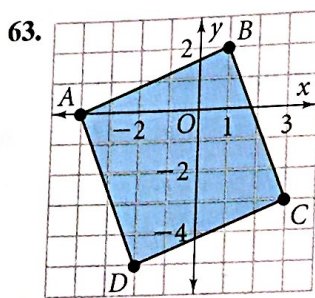
### Problem Solving Hint



For Exercises 57–59, sketch a graph to help you understand the statement in each exercise.


 **Geometry** A quadrilateral with both pairs of opposite sides parallel is a parallelogram. Use slopes to determine whether each figure is a parallelogram.



 **Geometry** A quadrilateral with four right angles is a rectangle. Use slopes to determine whether each figure is a rectangle.



 **Challenge**  **66. Geometry** A quadrilateral with two pairs of parallel sides and with diagonals that are perpendicular is a rhombus. Quadrilateral  $ABCD$  has vertices  $A(-2, 2)$ ,  $B(1, 6)$ ,  $C(6, 6)$ , and  $D(3, 2)$ . Show that  $ABCD$  is a rhombus.

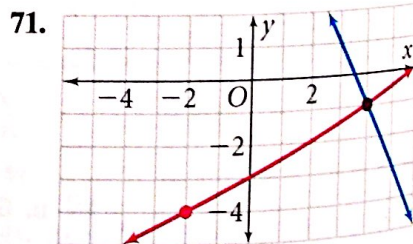
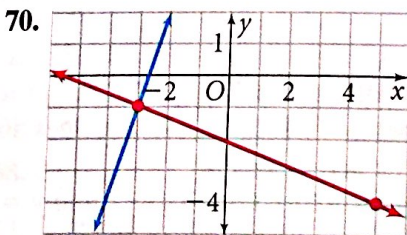
 **67. Geometry** A triangle with two sides that are perpendicular to each other is a right triangle. Triangle  $PQR$  has vertices  $P(3, 3)$ ,  $Q(2, -2)$ , and  $R(0, 1)$ . Determine whether  $PQR$  is a right triangle. Explain.

Tell whether the lines in each pair are *parallel*, *perpendicular*, or *neither*.

68.  $ax - by = c$ ;  $-ax + by = d$

69.  $ax + by = c$ ;  $bx - ay = d$

Assume the two lines are perpendicular. Find an equation for each line.



72. For what value of  $k$  are the graphs of  $3x + 12y = 8$  and  $6y = kx - 5$  parallel? Perpendicular?