

Answers to Exercises 23–42 are on page AA4–AA5.

## EXERCISE SET 2.3

## Concept Check

In Exercises 1 and 2, complete the sentence with *increases* or *decreases*.

- If a line has a negative slope, then as the value of  $y$  increases, the value of  $x$  decreases.
- If a line has a positive slope, then as the value of  $y$  decreases, the value of  $x$  decreases.

In Exercises 3 and 4, complete the sentence with *vertical* or *horizontal*.

- The graph of a line with zero slope is horizontal.
- The graph of a line whose slope is undefined is vertical.

In Exercises 5 to 8, determine the slope of the line and the coordinates of the  $y$ -intercept.

- $y = 4x - 5$   $m = 4$ ;  $y$ -intercept:  $(0, -5)$
- $y = 3 - 2x$   $m = -2$ ;  $y$ -intercept:  $(0, 3)$
- $f(x) = \frac{2x}{3}$   $m = \frac{2}{3}$ ;  $y$ -intercept:  $(0, 0)$
- $f(x) = -1$   $m = 0$ ;  $y$ -intercept:  $(0, -1)$

In Exercises 9 to 12, determine whether the graphs of the two equations are parallel, perpendicular, or neither parallel nor perpendicular.

- $y = 3x - 4$ ;  $y = -3x + 2$  Neither
- $y = -\frac{2}{3}x + 1$ ;  $y = 2 - \frac{2x}{3}$  Parallel
- $f(x) = 3x - 1$ ;  $y = -\frac{x}{3} - 1$  Perpendicular
- $f(x) = \frac{4x}{3} + 2$ ;  $f(x) = 2 - \frac{3}{4}x$  Perpendicular

In Exercises 13 to 22, find the slope of the line that passes through the given points.

- $(3, 4)$  and  $(1, 7)$   $-\frac{3}{2}$
- $(4, 0)$  and  $(0, 2)$   $-\frac{1}{2}$
- $(3, -7)$  and  $(3, 2)$  Undefined
- $(-3, 4)$  and  $(1, 7)$   $\frac{3}{4}$
- $(-3, 4)$  and  $(2, 4)$   $0$
- $(0, 0)$  and  $(3, 0)$   $0$
- $(-3, 4)$  and  $(-4, -2)$   $6$
- $(-5, -1)$  and  $(-3, 4)$   $\frac{5}{2}$
- $(-4, \frac{1}{2})$  and  $(\frac{7}{3}, \frac{7}{2})$   $\frac{9}{19}$
- $(\frac{1}{2}, 4)$  and  $(\frac{7}{4}, 2)$   $-\frac{8}{5}$

In Exercises 23 to 34, graph  $y$  as a function of  $x$  by using the slope and  $y$ -intercept of each line.

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

In Exercises 35 to 42, graph each equation by first writing the equation in slope–intercept form. Check the graph by finding the  $x$ - and  $y$ -intercepts.

- $2x + y = 5$
- $4x + 3y - 12 = 0$
- $2x - 5y = -15$
- $x + 2y = 6$
- $x - y = 4$
- $2x + 3y + 6 = 0$
- $3x - 4y = 8$
- $x - 3y = 9$

In Exercises 43 to 54, find the equation of the line satisfying the given conditions. Write the equation in the form  $y = mx + b$ .

- $y$ -intercept  $(0, 3)$ , slope  $1$   $y = x + 3$
- $y$ -intercept  $(0, 5)$ , slope  $-2$   $y = -2x + 5$
- $y$ -intercept  $(0, \frac{1}{2})$ , slope  $\frac{3}{4}$   $y = \frac{3}{4}x + \frac{1}{2}$
- $y$ -intercept  $(0, \frac{3}{4})$ , slope  $-\frac{2}{3}$   $y = -\frac{2}{3}x + \frac{3}{4}$
- $y$ -intercept  $(0, 4)$ , slope  $0$   $y = 4$
- $y$ -intercept  $(0, -1)$ , slope  $\frac{1}{2}$   $y = \frac{1}{2}x - 1$
- Through  $(-3, 2)$ , slope  $-4$   $y = -4x - 10$
- Through  $(-5, -1)$ , slope  $-3$   $y = -3x - 16$
- Through  $(3, 1)$  and  $(-1, 4)$   $y = -\frac{3}{4}x + \frac{13}{4}$
- Through  $(5, -6)$  and  $(2, -8)$   $y = \frac{2}{3}x - \frac{28}{3}$

53. Through  $(7, 11)$  and  $(2, -1)$   $y = \frac{12}{5}x - \frac{29}{5}$

54. Through  $(-5, 6)$  and  $(-3, -4)$   $y = -5x - 19$

In Exercises 55 to 66, find the equation of the line, in slope-intercept form, that satisfies the given conditions.

55. The graph is parallel to the graph of  $y = 2x + 3$  and passes through the point whose coordinates are  $(2, -4)$ .  $y = 2x - 8$

56. The graph is parallel to the graph of  $y = -x + 1$  and passes through the point whose coordinates are  $(-2, 4)$ .  $y = -x + 2$

57. The graph is parallel to the graph of  $y = -\frac{3}{4}x + 3$  and passes through the point whose coordinates are  $(-4, 2)$ .  
 $y = -\frac{3}{4}x - 1$

58. The graph is parallel to the graph of  $y = \frac{2}{3}x - 1$  and passes through the point whose coordinates are  $(-3, -5)$ .  $y = \frac{2}{3}x - 3$

59. The graph is parallel to the graph of  $2x - 5y = 2$  and passes through the point whose coordinates are  $(5, 2)$ .  $y = \frac{2}{5}x$

60. The graph is parallel to the graph of  $x + 3y = 4$  and passes through the point whose coordinates are  $(-3, -1)$ .

61. The graph is perpendicular to the graph of  $y = 2x - 5$  and passes through the point whose coordinates are  $(3, -4)$ .  
 $y = -\frac{1}{2}x - \frac{5}{2}$

62. The graph is perpendicular to the graph of  $y = -x + 3$  and passes through the point whose coordinates are  $(-5, 2)$ .  
 $y = x + 7$

63. The graph is perpendicular to the graph of  $y = -\frac{3}{4}x + 1$  and passes through the point whose coordinates are  $(-6, 0)$ .  
 $y = \frac{4}{3}x + 8$

64. The graph is perpendicular to the graph of  $3x - 2y = 5$  and passes through the point whose coordinates are  $(-3, 4)$ .  
 $y = -\frac{2}{3}x + 2$

65. The graph is perpendicular to the graph of  $-x - 4y = 6$  and passes through the point whose coordinates are  $(5, 2)$ .  
 $y = 4x - 18$

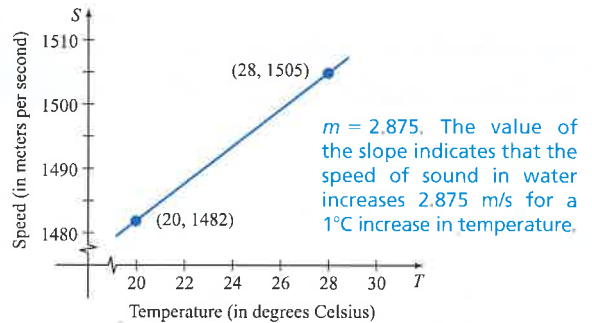
66. The graph is perpendicular to the graph of  $5x - y = 2$  and passes through the point whose coordinates are  $(10, -2)$ .  
 $y = -\frac{1}{5}x$

In Exercises 67 to 70, find the zero of  $f$ . Verify that the solution of  $f(x) = 0$  is the same as the  $x$ -coordinate of the  $x$ -intercept of the graph of  $y = f(x)$ .

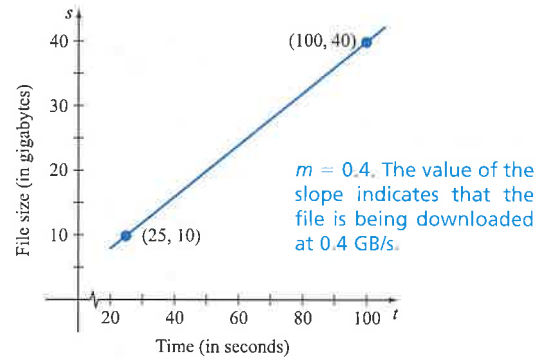
67.  $f(x) = 3x - 12$     4    68.  $f(x) = -2x - 4$     -2

69.  $f(x) = \frac{1}{4}x + 5$     -20    70.  $f(x) = -\frac{1}{3}x + 2$     6

71. **Oceanography** The graph at the top of the right side column shows the relationship between the speed of sound in water and the temperature of the water. Find the slope of this line, and write a sentence that explains the meaning of the slope in the context of this problem.



72. **Computer Science** The following graph shows the relationship between the time, in seconds, it takes to download a file and the size of the file, in gigabytes. Find the slope of the line between the two points shown on the graph. Write a sentence that states the meaning of the slope in the context of this problem.



73. **Automotive Technology** The following table shows the U.S. Environmental Protection Agency (EPA) fuel economy values for selected two-seater cars for the 2009 model year. (Source: <http://www.fueleconomy.gov>.)

EPA Fuel Economy Values for Selected Two-Seater Cars

Car	City, $c$ (mpg)	Highway, $H$ (mpg)
Audi, TT Roadster	23	31
BMW, M3	14	20
Ferrari, 458 Italia	12	18
Lamborghini, Gallarado	12	20
Chevrolet, Corvette	16	26
Maserati, Gran Turismo	13	21

a. Using the data for the Lamborghini and the Audi, find a linear function that predicts highway miles per gallon in terms of city miles per gallon.  $H(c) = c + 8$

b. Using your model, predict the highway miles per gallon for a Porsche Cayman, whose city fuel efficiency is 19 miles per gallon.    27 mpg

74. **Consumer Credit** The amount of revolving consumer credit (such as credit cards) gradually decreased between