 2.3 HW

9. Only linear equations have graphs that are straight lines.

10. The product of the slopes of two nonvertical perpendicular lines is −1.

For each equation, find the slope. If the slope is undefined, state this.

11. $y - 9 = 3$ 0

12. $x + 1 = 7$ Undefined

13. $8x = 6$ Undefined

14. $y - 3 = 5$ 0

15. $3y = 28$ 0

16. $19 = -6y$ 0

17. $9 + x = 12$ Undefined

18. $2x = 18$ Undefined

19. $2x - 4 = 3$ Undefined

20. $5y - 1 = 16$ 0

21. $5y - 4 = 35$ 0

22. $2x - 17 = 3$ Undefined

Aha! **23.** $4y - 3x = 9 - 3x$ 0

24. $x - 4y = 12 - 4y$ Undefined

25. $5x - 2 = 2x - 7$ Undefined

26. $5y + 3 = y + 9$ 0

27. $y = -\frac{2}{3}x + 5$ $-\frac{2}{3}$

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

Graph.

29. $y = 5$ ⊡

30. $x = -1$ ⊡

31. $x = 3$ ⊡

32. $y = 2$ ⊡

33. $f(x) = -2$ ⊡

34. $g(x) = -3$ ⊡

35. $3x = -15$ ⊡

36. $2x = 10$ ⊡

37. $3 \cdot g(x) = 15$ ⊡

38. $3 - f(x) = 2$ ⊡

Find the intercepts. Then graph by using the intercepts, if possible, and a third point as a check.

39. $x + y = 4$ ⊡

40. $x + y = 5$ ⊡

41. $f(x) = 2x - 1$ ⊡

42. $f(x) = 3x + 12$ ⊡

43. $3x + 5y = -15$ ⊡

44. $5x - 4y = 20$ ⊡

45. $2x - 3y = 18$ ⊡

46. $3x + 2y = -18$ ⊡

47. $3y = -12x$ ⊡

48. $5y = 15x$ ⊡

49. $f(x) = 3x - 7$ ⊡

50. $g(x) = 2x - 9$ ⊡

51. $5y - x = 5$ ⊡

52. $y - 3x = 3$ ⊡

53. $0.2y - 1.1x = 6.6$ ⊡

54. $\frac{1}{3}x + \frac{1}{2}y = 1$ ⊡

For each function, determine which of the given viewing windows will show both intercepts.

55. $f(x) = 20 - 4x$ (c)

a) $[-10, 10, -10, 10]$ **b)** $[-5, 10, -5, 10]$
c) $[-10, 10, -10, 30]$ **d)** $[-10, 10, -30, 10]$

56. $g(x) = 3x + 7$ (a)

a) $[-10, 10, -10, 10]$ **b)** $[-1, 15, -1, 15]$
c) $[-15, 5, -15, 5]$ **d)** $[-10, 10, -30, 0]$

57. $p(x) = -35x + 7000$ (d)

a) $[-10, 10, -10, 10]$
b) $[-35, 0, 0, 7000]$
c) $[-1000, 1000, -1000, 1000]$
d) $[0, 500, 0, 10{,}000]$

58. $r(x) = 0.2 - 0.01x$ (b)

a) $[-10, 10, -10, 10]$ **b)** $[-5, 30, -1, 1]$
c) $[-1, 1, -5, 30]$ **d)** $[0, 0.01, 0, 0.2]$

Without graphing, tell whether the graphs of each pair of equations are parallel.

59. $x + 8 = y$, $y - x = -5$ Yes

60. $2x - 3 = y$, $y - 2x = 9$ Yes

61. $y + 9 = 3x$, $3x - y = -2$ Yes

62. $y + 8 = -6x$, $-2x + y = 5$ No

63. $f(x) = 3x + 9$, $2y = -6x - 2$ No

64. $f(x) = -7x - 9$, $-3y = 21x + 7$ Yes

Without graphing, tell whether the graphs of each pair of equations are perpendicular.

65. $f(x) = 4x - 3$, $4y = 7 - x$ Yes

66. $2x - 5y = -3$, $2x + 5y = 4$ No

67. $x + 2y = 7$, $2x + 4y = 4$ No

68. $y = -x + 7$, $f(x) = x + 3$ Yes

For each equation, **(a)** *determine the slope of a line parallel to its graph, and* **(b)** *determine the slope of a line perpendicular to its graph.*

69. $y = \frac{7}{8}x - 3$ ⊡

70. $y = -\frac{9}{10}x + 4$ ⊡

71. $y = -\frac{1}{4}x - \frac{5}{8}$ ⊡

72. $y = \frac{1}{6}x - \frac{3}{11}$ ⊡

73. $20x - y = 12$ ⊡

74. $y + 15x = 30$ ⊡

75. $x + y = 4$ ⊡

76. $x - y = 19$ ⊡

Write an equation for a linear function parallel to the given line with the given y-intercept.

77. $y = 3x - 2$; $(0, 9)$ $f(x) = 3x + 9$

78. $y = -5x + 7$; $(0, -2)$ $f(x) = -5x - 2$

79. $2x + y = 3$; $(0, -5)$ $f(x) = -2x - 5$

80. $3x = y + 10$; $(0, 1)$ $f(x) = 3x + 1$

81. $2x + 5y = 8$; $\left(0, -\frac{1}{3}\right)$ $f(x) = -\frac{2}{5}x - \frac{1}{3}$

82. $3x - 6y = 4$; $\left(0, \frac{4}{5}\right)$ $f(x) = \frac{1}{2}x + \frac{4}{5}$

Aha! **83.** $3y = 12$; $(0, -5)$ $f(x) = -5$

84. $5 = 10y$; $(0, 12)$ $f(x) = 12$

Write an equation for a linear function perpendicular to the given line with the given y-intercept.

85. $y = x - 3$; $(0, 4)$ $f(x) = -x + 4$

86. $y = 2x - 7$; $(0, -3)$ $f(x) = -\frac{1}{2}x - 3$

⊡ Answers to Exercises 29–54 and 69–76 are on p. IA-5.

87. $2x + 3y = 6$; $(0, -4)$ $f(x) = \frac{3}{2}x - 4$

88. $4x + 2y = 8$; $(0, 8)$ $f(x) = \frac{1}{2}x + 8$

89. $5x - y = 13$; $\left(0, \frac{1}{5}\right)$ $f(x) = -\frac{1}{5}x + \frac{1}{5}$

90. $2x - 5y = 7$; $\left(0, -\frac{1}{8}\right)$ $f(x) = -\frac{5}{2}x - \frac{1}{8}$

Determine whether each equation is linear. Find the slope of any nonvertical lines.

91. $5x - 3y = 15$ Linear; $\frac{5}{3}$

92. $3x + 5y + 15 = 0$ Linear; $-\frac{3}{5}$

93. $16 + 4y = 10$ Linear; 0

94. $3x - 12 = 0$ Linear; line is vertical

95. $xy = 10$ Not linear

96. $y = \dfrac{10}{x}$ Not linear

97. $3y = 7(2x - 4)$ Linear; $\frac{14}{3}$

98. $2(5 - 3x) = 5y$ Linear; $-\frac{6}{5}$

99. $g(x) = \dfrac{1}{x}$ Not linear

100. $f(x) = x^3$ Not linear

101. $\dfrac{f(x)}{5} = x^2$ Not linear

102. $\dfrac{g(x)}{2} = 3 + x$ Linear; 2

TW **103.** *Engineering.* Wind friction, or *air resistance,* increases with speed. Following are some measurements made in a wind tunnel. Plot the data and explain why a linear function does or does not give an approximate fit.

Velocity (in kilometers per hour)	Force of Resistance (in newtons)
10	3
21	4.2
34	6.2
40	7.1
45	15.1
52	29.0

TW **104.** *Meteorology.* Wind chill is a measure of how cold the wind makes you feel. Below are some measurements of wind chill for a 15-mph breeze. How can you tell from the data that a linear function will give an approximate fit?

Temperature	15-mph Wind Chill
30°F	19°F
25°F	13°F
20°F	6°F
15°F	0°F
10°F	−7°F
5°F	−13°F
0°F	−19°F

Source: National Oceanic & Atmospheric Administration, as reported in USA TODAY.com, 2004

SKILL REVIEW

To prepare for Section 2.4, review multiplying fractions and simplifying expressions (Sections 1.2 and 1.3).

Simplify.

105. $-\frac{3}{10}\left(\frac{10}{3}\right)$ [1.2] -1

106. $2\left(-\frac{1}{2}\right)$ [1.2] -1

107. $-3[x - (-1)]$ [1.3] $-3x - 3$

108. $-10[x - (-7)]$ [1.3] $-10x - 70$

109. $\frac{2}{3}\left[x - \left(-\frac{1}{2}\right)\right] - 1$ [1.3] $\frac{2}{3}x - \frac{2}{3}$

110. $-\frac{3}{2}\left(x - \frac{2}{5}\right) - 3$ [1.3] $-\frac{3}{2}x - \frac{12}{5}$

SYNTHESIS

TW **111.** Jim tries to avoid working with fractions as often as possible. Under what conditions will graphing using intercepts allow him to avoid fractions? Why?

TW **112.** Under what condition(s) will the x- and y-intercepts of a line coincide? What would the equation for such a line look like?

113. Give an equation, in standard form, for the line whose x-intercept is 5 and whose y-intercept is -4. $4x - 5y = 20$

114. Find the x-intercept of $y = mx + b$, assuming that $m \neq 0$. $\left(-\dfrac{b}{m}, 0\right)$

In Exercises 115–118, assume that r, p, and s are nonzero constants and that x and y are variables. Determine whether each equation is linear.

115. $rx + 3y = p^2 - s$ Linear

116. $py = sx - r^2y - 9$ Linear

117. $r^2x = py + 5$ Linear

118. $\dfrac{x}{r} - py = 17$ Linear

119. Suppose that two linear equations have the same y-intercept but that equation A has an x-intercept that is half the x-intercept of equation B. How do the slopes compare?

The slope of equation B is $\frac{1}{2}$ the slope of equation A.

Consider the linear equation

$$ax + 3y = 5x - by + 8.$$

120. Find a and b if the graph is a horizontal line passing through $(0, 4)$. $a = 5, b = -1$

121. Find a and b if the graph is a vertical line passing through $(4, 0)$. $a = 7, b = -3$

122. Since a vertical line is not the graph of a function, many graphing calculators cannot graph equations of the form $x = a$. Some graphing calculators can draw vertical lines using the DRAW menu. Use the