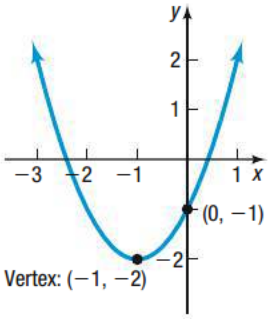
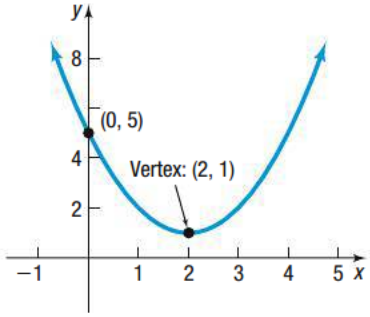
In Problems 49–54, determine the quadratic function whose graph is given.

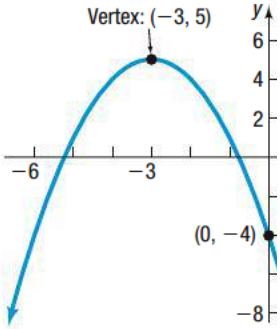
49.



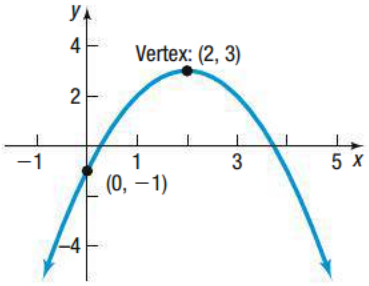
50.



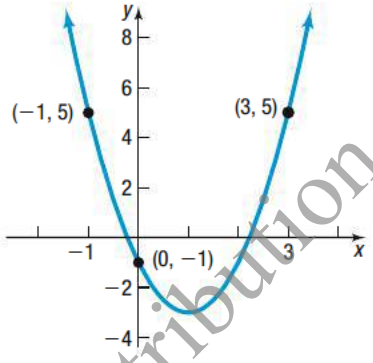
51.



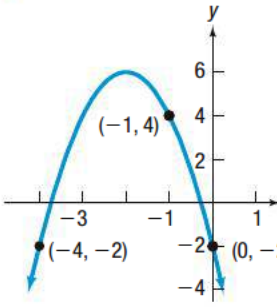
52.



53.



54.



In Problems 55–62, determine, without graphing, whether the given quadratic function has a maximum value or a minimu then find the value.

55. $f(x) = 2x^2 + 12x$

56. $f(x) = -2x^2 + 12x$

57. $f(x) = 2x^2 + 12x - 3$

58. $f(x) = 4x^2 -$

59. $f(x) = -x^2 + 10x - 4$

60. $f(x) = -2x^2 + 8x + 3$

61. $f(x) = -3x^2 + 12x + 1$

62. $f(x) = 4x^2 -$

Mixed Practice

In Problems 63–74, (a) graph each function, (b) determine the domain and the range of the function, and (c) determine function is increasing and where it is decreasing.

63. $f(x) = x^2 - 2x - 15$

64. $g(x) = x^2 - 2x - 8$

65. $F(x) = 2x - 5$

66. $f(x) = \frac{3}{2}x -$

67. $g(x) = -2(x - 3)^2 + 2$

68. $h(x) = -3(x + 1)^2 + 4$

69. $f(x) = 2x^2 + x + 1$

70. $G(x) = 3x^2 +$

71. $h(x) = -\frac{2}{5}x + 4$

72. $f(x) = -3x + 2$

73. $H(x) = -4x^2 - 4x - 1$

74. $F(x) = -4x^2 +$

Applications and Extensions

75. The graph of the function $f(x) = ax^2 + bx + c$ has vertex at $(0, 2)$ and passes through the point $(1, 8)$. Find a, b, and c.

76. The graph of the function $f(x) = ax^2 + bx +$ at $(1, 4)$ and passes through the point $(-1, -8$ and c.

In Problems 77–82, for the given functions f and g,
(a) Graph f and g on the same Cartesian plane.
(b) Solve $f(x) = g(x)$.
(c) Use the result of part (b) to label the points of intersection of the graphs of f and g.
(d) Shade the region for which $f(x) > g(x)$, that is, the region below f and above g.

77. $f(x) = 2x - 1; \quad g(x) = x^2 - 4$

78. $f(x) = -2x - 1; \quad g(x) = x^2 - 9$

79. $f(x) = -x^2 + 4; \quad g(x) = -2x + 1$

80. $f(x) = -x^2 + 9; \quad g(x) = 2x + 1$

81. $f(x) = -x^2 + 5x; \quad g(x) = x^2 + 3x - 4$

82. $f(x) = -x^2 + 7x - 6; \quad g(x) = x^2 + x - 6$

Answer Problems 83 and 84 using the following: A quadratic function of the form $f(x) = ax^2 + bx + c$ with $b^2 - 4ac > 0$ written in the form $f(x) = a(x - r_1)(x - r_2)$, where r_1 and r_2 are the x-intercepts of the graph of the quadratic function.

83. (a) Find a quadratic function whose x-intercepts are -3 and 1 with $a = 1$; $a = 2$; $a = -2$; $a = 5$.

84. (a) Find a quadratic function whose x-intercepts 3 with $a = 1$; $a = 2$; $a = -2$; $a = 5$.

(b) How does the value of a affect the intercepts?
(c) How does the value of a affect the axis of symmetry?
(d) How does the value of a affect the vertex?
(e) Compare the x-coordinate of the vertex with the midpoint of the x-intercepts. What might you conclude?

(b) How does the value of a affect the intercepts
(c) How does the value of a affect the axis of sy
(d) How does the value of a affect the vertex?
(e) Compare the x-coordinate of the verte midpoint of the x-intercepts. What might you