4.2

19–40 ■ Sketch the graph of the function.

19. $f(x) = 3$

20. $f(x) = -5$

21. $f(x) = 2x + 3$

22. $f(x) = 6 - 3x$

23. $f(x) = -x + 4, \quad -1 \leq x \leq 4$

24. $f(x) = \dfrac{x+3}{2}, \quad -2 \leq x \leq 2$

25. $f(x) = -x^2$

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

27. $g(x) = x^3 - 8$

28. $g(x) = 4x^2 - x^4$

29. $g(x) = \sqrt{-x}$

30. $g(x) = \sqrt{6 - 2x}$

31. $F(x) = \dfrac{1}{x}$

32. $F(x) = \dfrac{2}{x+4}$

33. $H(x) = |2x|$

34. $H(x) = |x + 1|$

35. $G(x) = |x| + x$

36. $G(x) = |x| - x$

59–72 ■ Sketch the graph of the piecewise defined function.

59. $f(x) = \begin{cases} 0 & \text{if } x < 2 \\ 1 & \text{if } x \geq 2 \end{cases}$

60. $f(x) = \begin{cases} 1 & \text{if } x \leq 1 \\ x + 1 & \text{if } x > 1 \end{cases}$

61. $f(x) = \begin{cases} 3 & \text{if } x < 2 \\ x - 1 & \text{if } x \geq 2 \end{cases}$

62. $f(x) = \begin{cases} 1 - x & \text{if } x < -2 \\ 5 & \text{if } x \geq -2 \end{cases}$

63. $f(x) = \begin{cases} x & \text{if } x \leq 0 \\ x + 1 & \text{if } x > 0 \end{cases}$

64. $f(x) = \begin{cases} 2x + 3 & \text{if } x < -1 \\ 3 - x & \text{if } x \geq -1 \end{cases}$

65. $f(x) = \begin{cases} -1 & \text{if } x < -1 \\ 1 & \text{if } -1 \leq x \leq 1 \\ -1 & \text{if } x > 1 \end{cases}$

66. $f(x) = \begin{cases} -1 & \text{if } x < -1 \\ x & \text{if } -1 \leq x \leq 1 \\ 1 & \text{if } x > 1 \end{cases}$

67. $f(x) = \begin{cases} 2 & \text{if } x \leq -1 \\ x^2 & \text{if } x > -1 \end{cases}$

68. $f(x) = \begin{cases} 1 - x^2 & \text{if } x \leq 2 \\ x & \text{if } x > 2 \end{cases}$

4.5

17–32 ■ Sketch the graph of the function, not by plotting points, but by starting with the graph of a standard function and applying transformations.

17. $f(x) = (x - 2)^2$

18. $f(x) = (x + 7)^2$

19. $f(x) = -(x + 1)^2$

20. $f(x) = 1 - x^2$

21. $f(x) = x^3 + 2$

22. $f(x) = -x^3$

23. $y = 1 + \sqrt{x}$

24. $y = 2 - \sqrt{x + 1}$

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

26. $y = 3 - 2(x - 1)^2$

27. $y = 5 + (x + 3)^2$

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

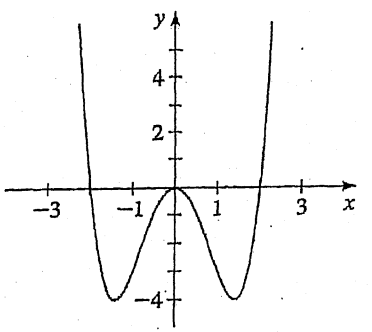
29. $y = |x| - 1$

30. $y = |x - 1|$

31. $y = |x + 2| + 2$

32. $y = 2 - |x|$

46. The graph of $f(x) = x^4 - 4x^2$ is shown. Use this graph to sketch the graph of $g(x) = |x^4 - 4x^2|$.



47–48 ■ Sketch the graph of each function.

47. (a) $f(x) = 4x - x^2$ (b) $g(x) = |4x - x^2|$

48. (a) $f(x) = x^3$ (b) $g(x) = |x^3|$

4.6

1–14 ■ Sketch the graph of the given parabola and state the coordinates of its vertex and its intercepts.

1. $y = x^2 - 8x$

2. $y = x^2 + 6x$

3. $y = 2x^2 - 6x$

4. $y = -x^2 + 10x$

5. $y = x^2 + 4x + 1$

6. $y = x^2 - 2x + 2$

7. $y = x^2 + 6x + 8$

8. $y = -x^2 - 4x + 4$

9. $y = 2x^2 + 4x + 3$

10. $y = -3x^2 + 6x - 2$

11. $y = 2x^2 - 20x + 57$

12. $y = 2x^2 + x - 6$

13. $y = -4x^2 - 16x + 3$

14. $y = 6x^2 + 12x - 5$

15–24 ■ A quadratic function is given.
(a) Express the quadratic function in standard form.
(b) Sketch its graph.
(c) Find its maximum or minimum value.

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

16. $f(x) = x + x^2$

17. $f(x) = x^2 + 2x - 1$

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

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

20. $f(x) = 1 - 6x - x^2$

21. $g(x) = 3x^2 - 12x + 13$

22. $g(x) = 2x^2 + 8x + 11$

23. $h(x) = 1 - x - x^2$

24. $h(x) = 3 - 4x - 4x^2$