Section 1.2 Exercises

In Exercises 1–4, **(a)** write a formula for the function and **(b)** use the formula to find the indicated value of the function.

1. the area A of a circle as a function of its diameter d; the area of a circle of diameter 4 in.
2. the height h of an equilateral triangle as a function of its side length s; the height of an equilateral triangle of side length 3 m
3. the surface area S of a cube as a function of the length of the cube's edge e; the surface area of a cube of edge length 5 ft
4. the volume V of a sphere as a function of the sphere's radius r; the volume of a sphere of radius 3 cm

In Exercises 5–12, **(a)** identify the domain and range and **(b)** sketch the graph of the function.

5. $y = 4 - x^2$ **6.** $y = x^2 - 9$

7. $y = 2 + \sqrt{x - 1}$ **8.** $y = -\sqrt{-x}$

9. $y = \dfrac{1}{x - 2}$ **10.** $y = \sqrt[4]{-x}$

11. $y = 1 + \dfrac{1}{x}$ **12.** $y = 1 + \dfrac{1}{x^2}$

In Exercises 13–20, use a grapher to **(a)** identify the domain and range and **(b)** draw the graph of the function.

13. $y = \sqrt[3]{x}$ **14.** $y = 2\sqrt{3 - x}$

15. $y = \sqrt[3]{1 - x^2}$ **16.** $y = \sqrt{9 - x^2}$

17. $y = x^{2/5}$ **18.** $y = x^{3/2}$

19. $y = \sqrt[3]{x - 3}$ **20.** $y = \dfrac{1}{\sqrt{4 - x^2}}$

In Exercises 21–30, determine whether the function is even, odd, or neither. Try to answer without writing anything (except the answer).

21. $y = x^4$ **22.** $y = x + x^2$

23. $y = x + 2$ **24.** $y = x^2 - 3$

25. $y = \sqrt{x^2 + 2}$ **26.** $y = x + x^3$

27. $y = \dfrac{x^3}{x^2 - 1}$ **28.** $y = \sqrt[3]{2 - x}$

29. $y = \dfrac{1}{x - 1}$ **30.** $y = \dfrac{1}{x^2 - 1}$

In Exercises 31–34, graph the piecewise-defined functions.

31. $f(x) = \begin{cases} 3 - x, & x \le 1 \\ 2x, & 1 < x \end{cases}$ **32.** $f(x) = \begin{cases} 1, & x < 0 \\ \sqrt{x}, & x \ge 0 \end{cases}$

33. $f(x) = \begin{cases} 4 - x^2, & x < 1 \\ (3/2)x + 3/2, & 1 \le x \le 3 \\ x + 3, & x > 3 \end{cases}$

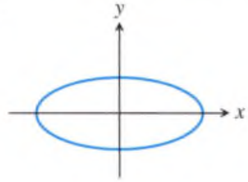
34. $f(x) = \begin{cases} x^2, & x < 0 \\ x^3, & 0 \le x \le 1 \\ 2x - 1, & x > 1 \end{cases}$

35. Writing to Learn The *vertical line test* to determine whether a curve is the graph of a function states: If every vertical line in the xy-plane intersects a given curve in at most one point, then the curve is the graph of a function. Explain why this is true.

36. Writing to Learn For a curve to be *symmetric about the x-axis*, the point (x, y) must lie on the curve if and only if the point $(x, -y)$ lies on the curve. Explain why a curve that is symmetric about the x-axis is not the graph of a function, unless the function is $y = 0$.

In Exercises 37–40, use the vertical line test (see Exercise 35) to determine whether the curve is the graph of a function.

37.



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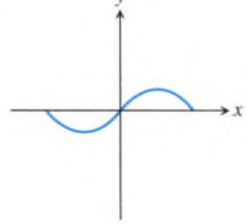

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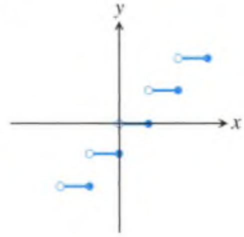

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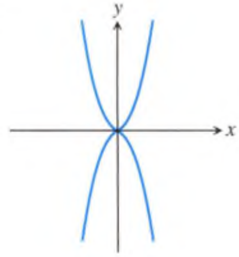

In Exercises 41–48, write a piecewise formula for the function.

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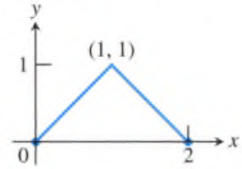

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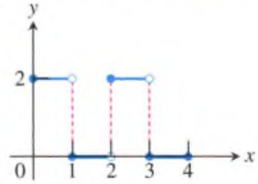

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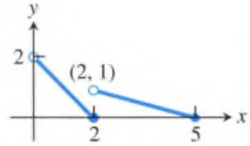

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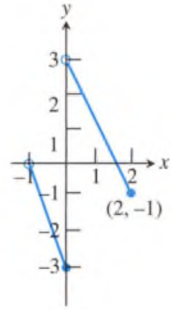

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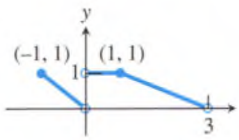

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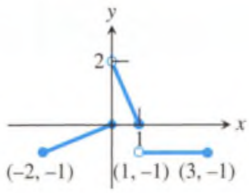

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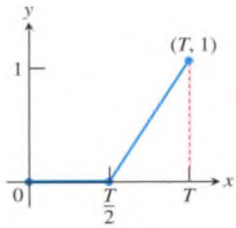

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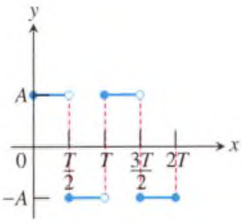


In Exercises 49 and 50, **(a)** draw the graph of the function. Then find its **(b)** domain and **(c)** range.

49. $f(x) = -|3 - x| + 2$ **50.** $f(x) = 2|x + 4| - 3$

In Exercises 51 and 52, find

(a) $f(g(x))$ **(b)** $g(f(x))$ **(c)** $f(g(0))$

(d) $g(f(0))$ **(e)** $g(g(-2))$ **(f)** $f(f(x))$

51. $f(x) = x + 5, \quad g(x) = x^2 - 3$

52. $f(x) = x + 1, \quad g(x) = x - 1$

53. Copy and complete the following table.

	$g(x)$	$f(x)$	$(f \circ g)(x)$
(a)	?	$\sqrt{x-5}$	$\sqrt{x^2-5}$
(b)	?	$1+1/x$	x
(c)	$1/x$	?	x
(d)	$\sqrt{x}$	?	$\lvert x \rvert, x \geq 0$

54. ***Broadway Season Statistics*** Table 1.5 shows the gross revenue for the Broadway season in millions of dollars for several years.

Table 1.5 Broadway Season Revenue

Year	Amount ($ millions)
1997	558
1998	588
1999	603
2000	666
2001	643
2002	721
2003	771

Source: The League of American Theatres and Producers, Inc., New York, NY, as reported in *The World Almanac and Book of Facts, 2005.*

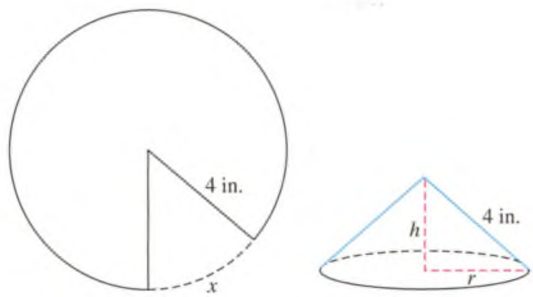
(a) Find the quadratic regression for the data in Table 1.5. Let $x = 0$ represent 1990, $x = 1$ represent 1991, and so forth.

(b) Superimpose the graph of the quadratic regression equation on a scatter plot of the data.

(c) Use the quadratic regression to predict the amount of revenue in 2008.

(d) Now find the linear regression for the data and use it to predict the amount of revenue in 2008.

55. ***The Cone Problem*** Begin with a circular piece of paper with a 4-in. radius as shown in (a). Cut out a sector with an arc length of x. Join the two edges of the remaining portion to form a cone with radius r and height h, as shown in (b).



(a) (b)

(a) Explain why the circumference of the base of the cone is $8\pi - x$.

(b) Express the radius r as a function of x.

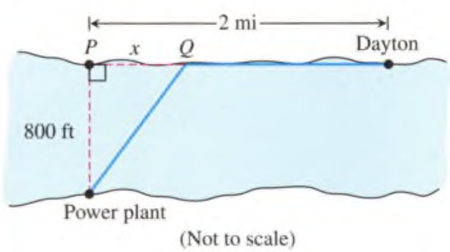
(c) Express the height h as a function of x.

(d) Express the volume V of the cone as a function of x.

56. ***Industrial Costs*** Dayton Power and Light, Inc., has a power plant on the Miami River where the river is 800 ft wide. To lay a new cable from the plant to a location in the city 2 mi downstream on the opposite side costs \$180 per foot across the river and \$100 per foot along the land.

(a) Suppose that the cable goes from the plant to a point Q on the opposite side that is x ft from the point P directly opposite the plant. Write a function $C(x)$ that gives the cost of laying the cable in terms of the distance x.

(b) Generate a table of values to determine if the least expensive location for point Q is less than 2000 ft or greater than 2000 ft from point P.



(Not to scale)