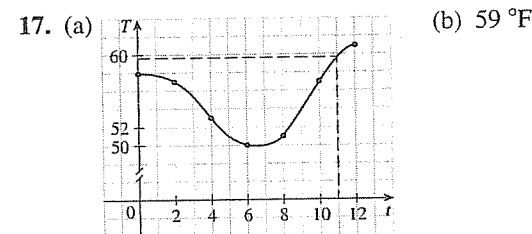
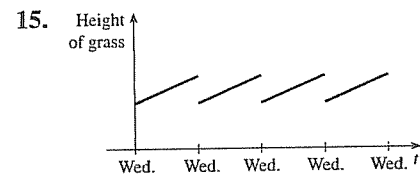
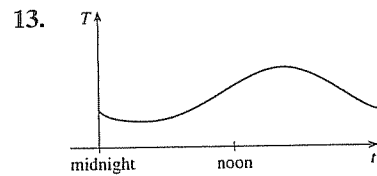
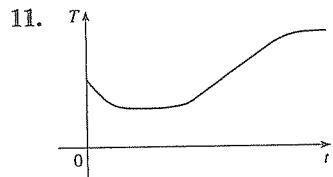


Answers to Odd-Numbered Exercises

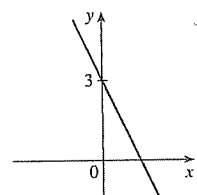
Chapter 1

Exercises 1.1 □ page 22

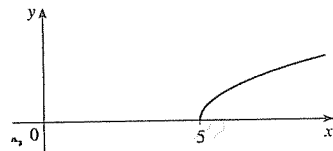
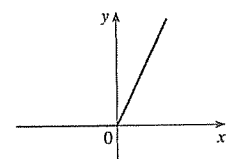
1. (a) -2 (b) 2.8 (c) -3, 1 (d) -2.5, 0.3
 (e) $[-3, 3]$, $[-2, 3]$ (f) $[-1, 3]$
 3. $[-85, 115]$, $[-325, 485]$, $[-210, 200]$
 5. Yes, $[-3, 2]$, $[-2, 2]$ 7. No 9. Diet or illness



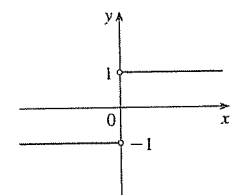
19. -4, 10, $3\sqrt{2}$, $5 + 7\sqrt{2}$, $2x^2 - 3x - 4$, $2x^2 + 7x + 1$, $4x^2 + 6x - 8$, $8x^2 + 6x - 4$
 21. $-(h^2 + 3h + 2)$, $x + h - x^2 - 2xh - h^2$, $1 - 2x - h$
 23. $\{x \mid x \neq \pm 1\} = (-\infty, -1) \cup (-1, 1) \cup (1, \infty)$
 25. $\{x \mid x \leq 0 \text{ or } x \geq 6\} = (-\infty, 0] \cup [6, \infty)$ 27. $(-\infty, \infty)$
 29. $(-\infty, \infty)$ 31. $[5, \infty)$



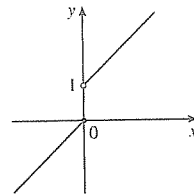
33. $(-\infty, \infty)$



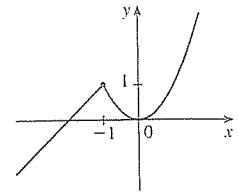
35. $(-\infty, 0) \cup (0, \infty)$



37. $(-\infty, \infty)$



39. $(-\infty, \infty)$



41. $f(x) = -\frac{7}{6}x - \frac{4}{3}$, $-2 \leq x \leq 4$ 43. $f(x) = 1 - \sqrt{-x}$

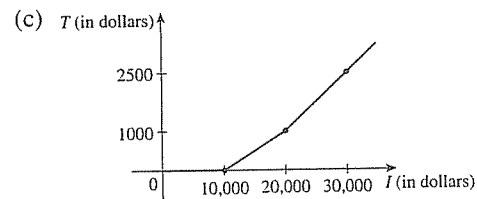
45. $f(x) = \begin{cases} x + 1 & \text{if } -1 \leq x \leq 2 \\ 6 - 1.5x & \text{if } 2 < x \leq 4 \end{cases}$

47. $A(L) = 10L - L^2$, $0 < L < 10$

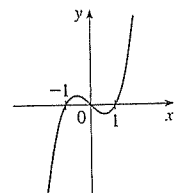
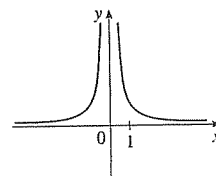
49. $A(x) = \sqrt{3}x^2/4$, $x > 0$ 51. $S(x) = x^2 + (8/x)$, $x > 0$

53. $V(x) = 4x^3 - 64x^2 + 240x$, $0 < x < 6$

55. (a)  (b) \$400, \$1900

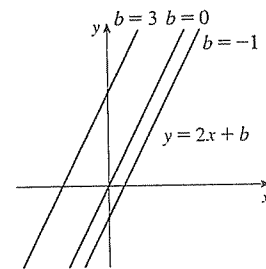


57. (a) $(-5, 3)$ (b) $(-5, -3)$
 59. Even 61. Neither 63. Odd

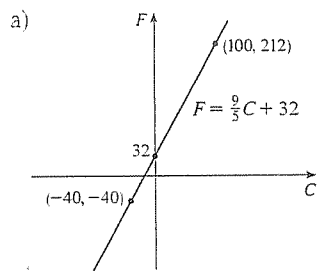
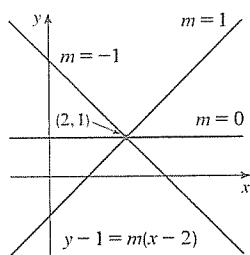


Exercises 1.2 □ page 35

1. (a) Root (b) Algebraic (c) Polynomial (degree 9)
 (d) Rational (e) Trigonometric (f) Logarithmic
 3. (a) h (b) f (c) g
 5. (a) $y = 2x + b$, where b is the y-intercept



$y = mx + 1 - 2m$,
 re m is the slope.
 graph at right.
 $y = 2x - 3$



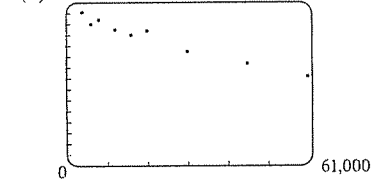
(b) $\frac{9}{5}$, change in $^{\circ}\text{F}$ for every $^{\circ}\text{C}$ change; 32, Fahrenheit temperature corresponding to 0°C

a) $T = \frac{1}{6}N + \frac{307}{6}$ (b) $\frac{1}{6}$, change in $^{\circ}\text{F}$ for every chirp per minute change (c) 76°F

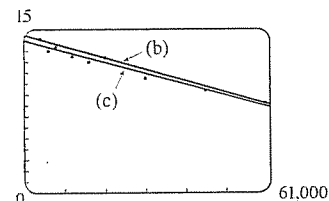
(a) $P = 0.434d + 15$ (b) 196 ft

(a) Cosine (b) Linear

(a) 15 Yes, appropriate



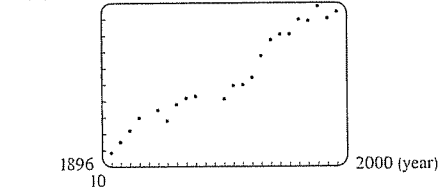
$y = -0.000105357x + 14.521429$



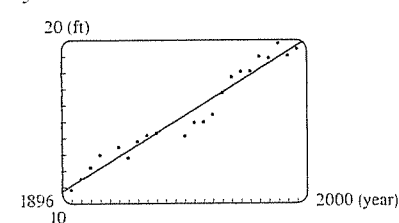
$y = -0.0000997855x + 13.950764$ [See graph in (b).]

About 11.5 per 100 population (e) About 6% (f) No

(a) 20 (ft) Yes, appropriate



$y = -158.24x + 0.089$ (c) 20 ft (d) No



$y = 0.00233x^3 - 13.065x^2 + 24,463.108x - 15,265,793.873$;
 2 million

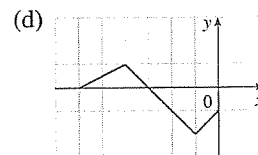
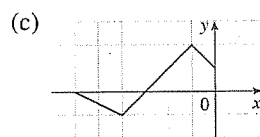
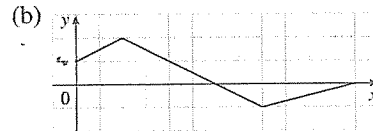
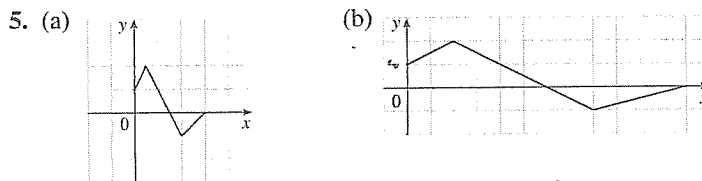
Exercises 1.3 □ page 46

1. (a) $y = f(x) + 3$ (b) $y = f(x) - 3$ (c) $y = f(x - 3)$

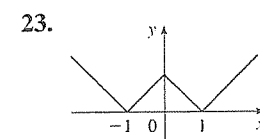
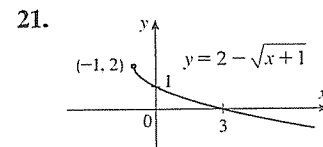
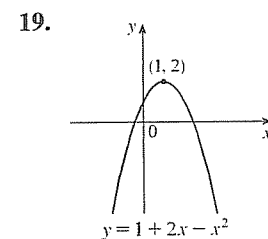
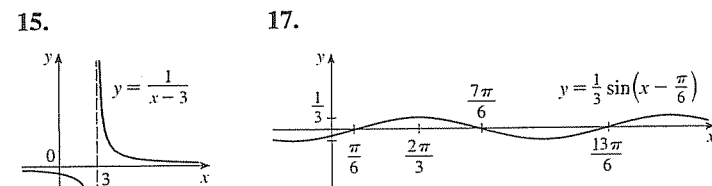
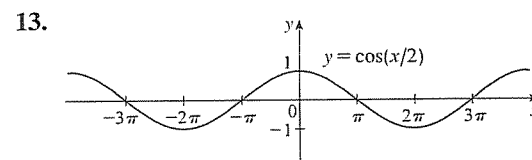
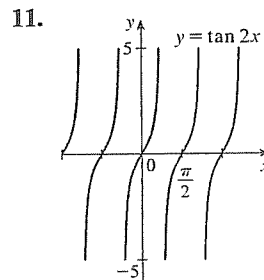
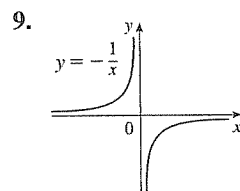
(d) $y = f(x + 3)$ (e) $y = -f(x)$ (f) $y = f(-x)$

(g) $y = 3f(x)$ (h) $y = \frac{1}{3}f(x)$

3. (a) 3 (b) 1 (c) 4 (d) 5 (e) 2

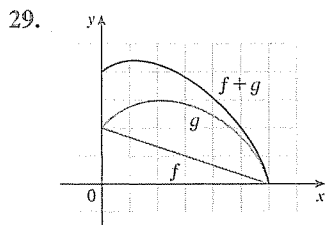
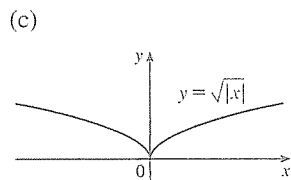
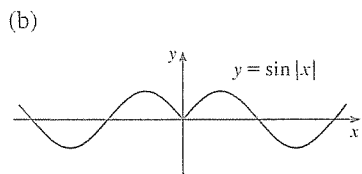


7. $y = -\sqrt{-x^2 - 5x - 4} - 1$

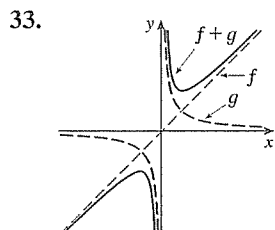


25. $L(t) = 12 + 2 \sin\left[\frac{2\pi}{365}(t - 80)\right]$

27. (a) The portion of the graph of $y = f(x)$ to the right of the y -axis is reflected in the y -axis.

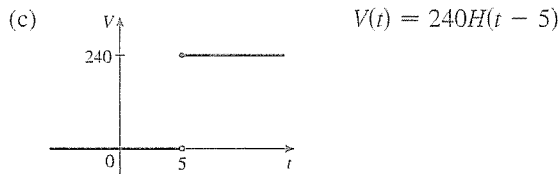
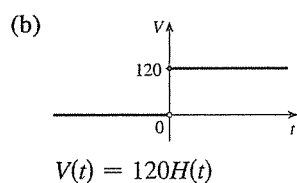
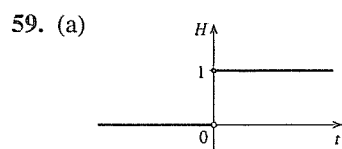


31. $(f + g)(x) = x^3 + 5x^2 - 1, (-\infty, \infty)$
 $(f - g)(x) = x^3 - x^2 + 1, (-\infty, \infty)$
 $(fg)(x) = 3x^5 + 6x^4 - x^3 - 2x^2, (-\infty, \infty)$
 $(f/g)(x) = (x^3 + 2x^2)/(3x^2 - 1), \{x \mid x \neq \pm 1/\sqrt{3}\}$

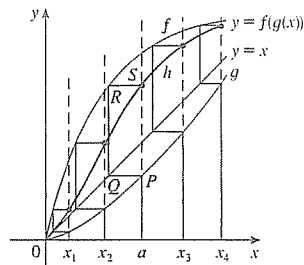


35. $(f \circ g)(x) = 3(6x^2 + 7x + 2), (-\infty, \infty)$
 $(g \circ f)(x) = 6x^2 - 3x + 2, (-\infty, \infty)$
 $(f \circ f)(x) = 8x^4 - 8x^3 + x, (-\infty, \infty)$
 $(g \circ g)(x) = 9x + 8, (-\infty, \infty)$
 37. $(f \circ g)(x) = 1/(x^3 + 2x), \{x \mid x \neq 0\}$
 $(g \circ f)(x) = (1/x^3) + (2/x), \{x \mid x \neq 0\}$
 $(f \circ f)(x) = x, \{x \mid x \neq 0\}$
 $(g \circ g)(x) = x^9 + 6x^7 + 12x^5 + 10x^3 + 4x, (-\infty, \infty)$
 39. $(f \circ g)(x) = \sin(1 - \sqrt{x}), [0, \infty)$
 $(g \circ f)(x) = 1 - \sqrt{\sin x}, \{x \mid x \in [2n\pi, \pi + 2n\pi], n \text{ an integer}\}$
 $(f \circ f)(x) = \sin(\sin x), (-\infty, \infty)$
 $(g \circ g)(x) = 1 - \sqrt{1 - \sqrt{x}}, [0, 1]$

41. $(f \circ g \circ h)(x) = \sqrt{x-1} - 1$
 43. $(f \circ g \circ h)(x) = (\sqrt{x} - 5)^4 + 1$
 45. $g(x) = x - 9, f(x) = x^5$ 47. $g(x) = x^2, f(x) = x/(x + 4)$
 49. $g(t) = \cos t, f(t) = \sqrt{t}$
 51. $h(x) = x^2, g(x) = 3^x, f(x) = 1 - x$
 53. $h(x) = \sqrt{x}, g(x) = \sec x, f(x) = x^4$
 55. (a) 4 (b) 3 (c) 0 (d) Does not exist; $f(6) = 6$ is not in the domain of g . (e) 4 (f) -2
 57. (a) $r(t) = 60t$ (b) $(A \circ r)(t) = 3600\pi t^2$; the area of the circle as a function of time

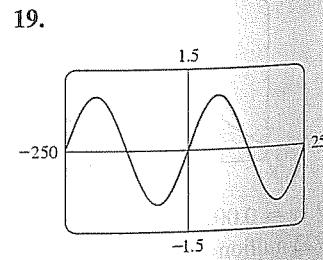
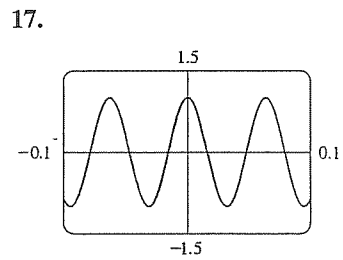
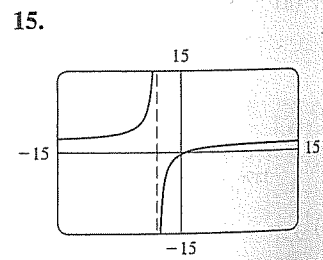
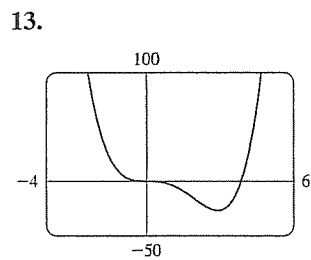
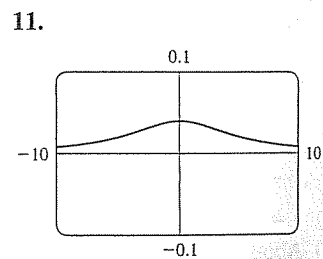
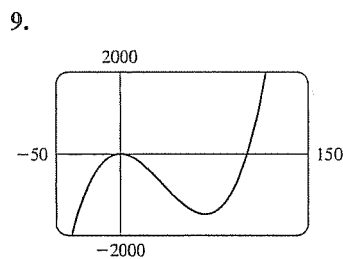
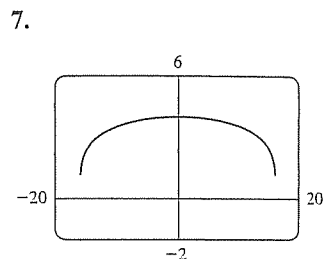
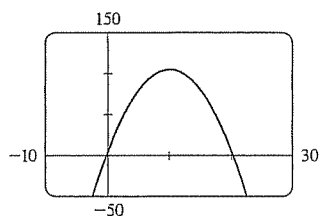


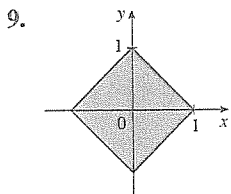
61. $g(x) = x^2 + x - 1$ 63. Yes
 65. (a) $P(a, g(a)), Q(g(a), g(a))$ (b) $(g(a), f(g(a)))$
 (d)



Exercises 1.4 □ page 55

1. (d) 3. (c)
 5.





9. 11. 5
 13. $x \in [-1, 1 - \sqrt{3}] \cup (1 + \sqrt{3}, 3]$
 15. 40 mi/h
 19. $f_n(x) = x^{2^{n+1}}$

Chapter 2

Exercises 2.1 □ page 89

1. (a) -44.4, -38.8, -27.8, -22.2, -16.6
 (b) -33.3 (c) $-33\frac{1}{3}$
 3. (a) (i) 0.236068 (ii) 0.242641 (iii) 0.248457
 (iv) 0.249844 (v) 0.249984 (vi) 0.267949 (vii) 0.258343
 (viii) 0.251582 (ix) 0.250156 (x) 0.250016
 (b) $\frac{1}{4}$ (c) $y = \frac{1}{4}x + 1$
 5. (a) (i) -32 ft/s (ii) -25.6 ft/s (iii) -24.8 ft/s
 (iv) -24.16 ft/s (b) -24 ft/s
 7. (a) (i) $\frac{13}{6}$ ft/s (ii) $\frac{7}{6}$ ft/s (iii) $\frac{19}{24}$ ft/s (iv) $\frac{331}{600}$ ft/s (b) $\frac{1}{2}$ ft/s
 (c) (d)

9. (a) 0, 1.7321, -1.0847, -2.7433, 4.3301, -2.8173, 0, -2.1651, -2.6061, -5, 3.4202; no (c) -31.4

Exercises 2.2 □ page 99

1. Yes
 3. (a) $\lim_{x \rightarrow -3} f(x) = \infty$ means that the values of $f(x)$ can be made arbitrarily large (as large as we please) by taking x sufficiently close to -3 (but not equal to -3).
 (b) $\lim_{x \rightarrow 4^+} f(x) = -\infty$ means that the values of $f(x)$ can be made arbitrarily large negative by taking x sufficiently close to 4 through values larger than 4.
 5. (a) 3 (b) 2 (c) -2 (d) Does not exist (e) 1
 (f) -1 (g) -1 (h) -1 (i) -3
 7. (a) 2 (b) -1 (c) 1 (d) 1 (e) 2
 (f) Does not exist
 9. (a) ∞ (b) $-\infty$ (c) $-\infty$ (d) ∞ (e) $-\infty$
 (f) $x = -9, x = -4, x = 3, x = 7$
 11. (a) 1 (b) 0 (c) Does not exist
 13.

15. 0.806452, 0.641026, 0.510204, 0.409836, 0.369004, 0.336689, 0.165563, 0.193798, 0.229358, 0.274725, 0.302115, 0.330022; $\frac{1}{3}$

17. -0.003884, -0.003941, -0.003988, -0.003994, -0.003999, -0.004124, -0.004061, -0.004012, -0.004006, -0.004001; -0.004
 19. 0.459698, 0.489670, 0.493369, 0.496261, 0.498336, 0.499583, 0.499896, 0.499996; $\frac{1}{2}$
 21. ∞ 23. ∞ 25. $-\infty$ 27. $-\infty$ 29. $-\infty; \infty$
 31. (a) 2.71828 (b)

33. (a) 4
 35. (a) 0.998000, 0.638259, 0.358484, 0.158680, 0.038851, 0.008928, 0.001465; 0
 (b) 0.000572, -0.000614, -0.000907, -0.000978, -0.000993, -0.001000; -0.001
 37. No matter how many times we zoom in toward the origin, the graph appears to consist of almost-vertical lines. This indicates more and more frequent oscillations as $x \rightarrow 0$.
 39. $x \approx \pm 0.90, \pm 2.24; x = \pm \sin^{-1}(\pi/4), \pm(\pi - \sin^{-1}(\pi/4))$

Exercises 2.3 □ page 109

1. (a) 5 (b) 9 (c) 2 (d) $-\frac{1}{3}$ (e) $-\frac{3}{8}$ (f) 0
 (g) Does not exist (h) $-\frac{6}{11}$
 3. 75 5. $\frac{1}{2}$ 7. -3 9. 0 11. Does not exist
 13. $-\frac{1}{5}$ 15. -10 17. 4 19. 6 21. $-\sqrt{2}/4$
 23. 108 25. $-\frac{1}{2}$ 27. $-\frac{1}{4}$ 29. (a), (b) $\frac{2}{3}$ 33. 1
 37. 0 39. Does not exist 41. Does not exist
 43. (a)

- (b) (i) 1
 (ii) -1
 (iii) Does not exist
 (iv) 1

45. (a) (i) 2 (ii) -2 (b) No (c)

47. (a) (i) -2 (ii) Does not exist (iii) -3
 (b) (i) $n - 1$ (ii) n (c) a is not an integer.
 57. 15; -1

Exercises 2.4 □ page 120

1. (a) $|x - 2| < 0.02$ (b) $|x - 2| < 0.002$
 3. $\frac{4}{3}$ (or any smaller positive number)
 5. 1.44 (or any smaller positive number)
 7. 0.6875 (or any smaller positive number)
 9. 0.11, 0.012 (or smaller positive numbers)
 11. 0.07 (or any smaller positive number)
 13. (a) $\sqrt{1000/\pi}$ cm (b) Within approximately 0.0445 cm
 (c) Radius; area; $\sqrt{1000/\pi}$; 1000; 5; ≈ 0.0445 39. Within 0.1