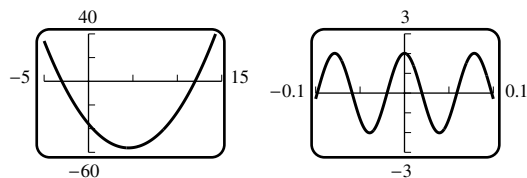




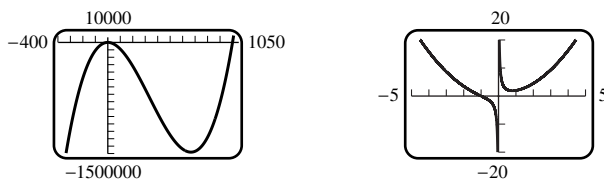
ANSWERS TO ODD-NUMBERED EXERCISES

► **Appendix A (Page A1)**

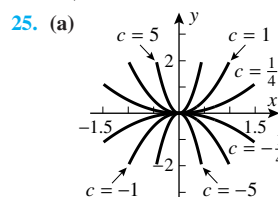
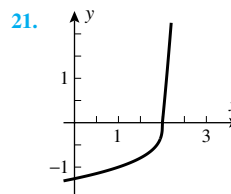
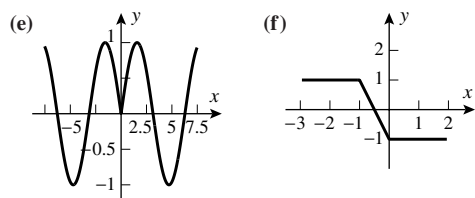
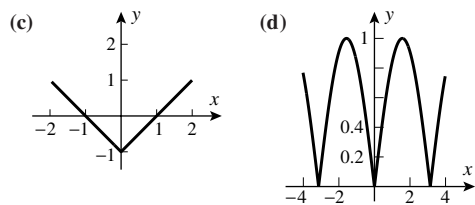
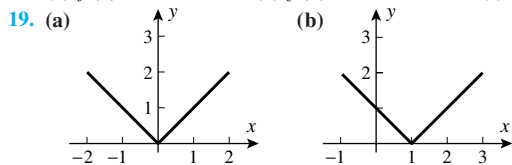
1. (e) 3. (b), (c) 5. $[-3, 3] \times [0, 5]$
 7. $[-5, 14] \times [-60, 40]$ 9. $[-0.1, 0.1] \times [-3, 3]$



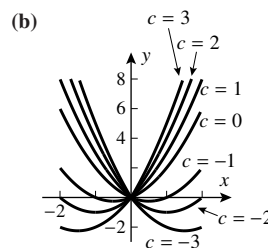
11. $[-400, 1050] \times [-1500000, 10000]$ 13. $[-2, 2] \times [-20, 20]$



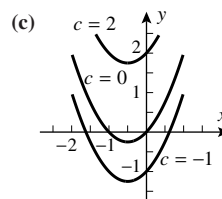
17. (a) $f(x) = \sqrt{16 - x^2}$ (b) $f(x) = -\sqrt{16 - x^2}$ (c) no



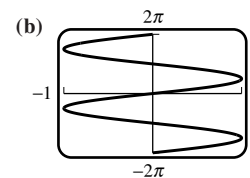
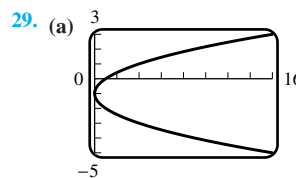
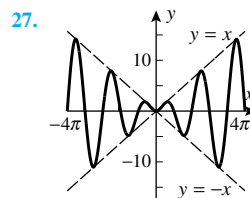
The graph is stretched in the vertical direction, and reflected across the x -axis if $c < 0$.



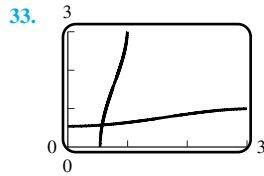
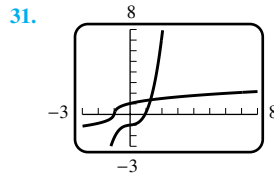
The graph is translated so its vertex is on the parabola $y = -x^2$.



The graph is translated vertically.



A46 Answers to Odd-Numbered Exercises



35. (a) $x = 4 \cos t, y = 3 \sin t$ (b) $x = -1 + 4 \cos t, y = 2 + 3 \sin t$

Appendix B (Page B1)

1. (a) $\frac{5}{12}\pi$ (b) $\frac{13}{6}\pi$ (c) $\frac{1}{9}\pi$ (d) $\frac{23}{30}\pi$

3. (a) 12° (b) $(270/\pi)^\circ$ (c) 288° (d) 540°

	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\csc \theta$	$\sec \theta$	$\cot \theta$
(a)	$\sqrt{21}/5$	$2/5$	$\sqrt{21}/2$	$5/\sqrt{21}$	$5/2$	$2/\sqrt{21}$
(b)	$3/4$	$\sqrt{7}/4$	$3/\sqrt{7}$	$4/3$	$4/\sqrt{7}$	$\sqrt{7}/3$
(c)	$3/\sqrt{10}$	$1/\sqrt{10}$	3	$\sqrt{10}/3$	$\sqrt{10}$	$1/3$

7. $\sin \theta = 3/\sqrt{10}, \cos \theta = 1/\sqrt{10}$ 9. $\tan \theta = \sqrt{21}/2, \csc \theta = 5/\sqrt{21}$

11. 1.8

	θ	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\csc \theta$	$\sec \theta$	$\cot \theta$
(a)	225°	$-1/\sqrt{2}$	$-1/\sqrt{2}$	1	$-\sqrt{2}$	$-\sqrt{2}$	1
(b)	-210°	$1/2$	$-\sqrt{3}/2$	$-1/\sqrt{3}$	2	$-2/\sqrt{3}$	$-\sqrt{3}$
(c)	$5\pi/3$	$-\sqrt{3}/2$	$1/2$	$-\sqrt{3}$	$-2/\sqrt{3}$	2	$-1/\sqrt{3}$
(d)	$-3\pi/2$	1	0	—	1	—	0

	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\csc \theta$	$\sec \theta$	$\cot \theta$
(a)	$4/5$	$3/5$	$4/3$	$5/4$	$5/3$	$3/4$
(b)	$-4/5$	$3/5$	$-4/3$	$-5/4$	$5/3$	$-3/4$
(c)	$1/2$	$-\sqrt{3}/2$	$-1/\sqrt{3}$	2	$-2/\sqrt{3}$	$-\sqrt{3}$
(d)	$-1/2$	$\sqrt{3}/2$	$-1/\sqrt{3}$	-2	$2/\sqrt{3}$	$-\sqrt{3}$
(e)	$1/\sqrt{2}$	$1/\sqrt{2}$	1	$\sqrt{2}$	$\sqrt{2}$	1
(f)	$1/\sqrt{2}$	$-1/\sqrt{2}$	-1	$\sqrt{2}$	$-\sqrt{2}$	-1

17. (a) 1.2679 (b) 3.5753

- 19.

	$\sin \theta$	$\cos \theta$	$\tan \theta$	$\csc \theta$	$\sec \theta$	$\cot \theta$
(a)	$a/3$	$\sqrt{9-a^2}/3$	$a/\sqrt{9-a^2}$	$3/a$	$3/\sqrt{9-a^2}$	$\sqrt{9-a^2}/a$
(b)	$a/\sqrt{a^2+25}$	$5/\sqrt{a^2+25}$	$a/5$	$\sqrt{a^2+25}/a$	$\sqrt{a^2+25}/5$	$5/a$
(c)	$\sqrt{a^2-1}/a$	$1/a$	$\sqrt{a^2-1}$	$a/\sqrt{a^2-1}$	a	$1/\sqrt{a^2-1}$

21. (a) $3\pi/4 \pm n\pi, n = 0, 1, 2, \dots$
 (b) $\pi/3 \pm 2n\pi$ and $5\pi/3 \pm 2n\pi, n = 0, 1, 2, \dots$
23. (a) $\pi/6 \pm n\pi, n = 0, 1, 2, \dots$
 (b) $4\pi/3 \pm 2n\pi$ and $5\pi/3 \pm 2n\pi, n = 0, 1, 2, \dots$
25. (a) $3\pi/4 \pm n\pi, n = 0, 1, 2, \dots$
 (b) $\pi/6 \pm n\pi, n = 0, 1, 2, \dots$
27. (a) $\pi/3 \pm 2n\pi$ and $2\pi/3 \pm 2n\pi, n = 0, 1, 2, \dots$
 (b) $\pi/6 \pm 2n\pi$ and $11\pi/6 \pm 2n\pi, n = 0, 1, 2, \dots$
29. $\sin \theta = 2/5, \cos \theta = -\sqrt{21}/5, \tan \theta = -2/\sqrt{21},$
 $\csc \theta = 5/2, \sec \theta = -5/\sqrt{21}, \cot \theta = -\sqrt{21}/2$
31. (a) $\theta = \pm n\pi, n = 0, 1, 2, \dots$ (b) $\theta = \pi/2 \pm n\pi, n = 0, 1, 2, \dots$
 (c) $\theta = \pm n\pi, n = 0, 1, 2, \dots$ (d) $\theta = \pm n\pi, n = 0, 1, 2, \dots$
 (e) $\theta = \pi/2 \pm n\pi, n = 0, 1, 2, \dots$ (f) $\theta = \pm n\pi, n = 0, 1, 2, \dots$
33. (a) $2\pi/3$ cm (b) $10\pi/3$ cm 35. $\frac{2}{5}$
37. (a) $\frac{2\pi - \theta}{2\pi} R$ (b) $\frac{\sqrt{4\pi\theta - \theta^2}}{2\pi} R$ 39. $\frac{21}{4}\sqrt{3}$ 41. 9.2 ft
43. $h = d(\tan \beta - \tan \alpha)$ 45. (a) $4\sqrt{5}/9$ (b) $-\frac{1}{9}$
47. $\sin 3\theta = 3 \sin \theta \cos^2 \theta - \sin^3 \theta, \cos 3\theta = \cos^3 \theta - 3 \sin^2 \theta \cos \theta$

61. (a) $\cos \theta$ (b) $-\sin \theta$ (c) $-\cos \theta$ (d) $\sin \theta$
69. (a) 153° (b) 45° (c) 117° (d) 89° 71. (a) 60° (b) 117°

Appendix C (Page C1)

1. (a) $q(x) = x^2 + 4x + 2, r(x) = -11x + 6$
 (b) $q(x) = 2x^2 + 4, r(x) = 9$
 (c) $q(x) = x^3 - x^2 + 2x - 2, r(x) = 2x + 1$
3. (a) $q(x) = 3x^2 + 6x + 8, r(x) = 15$
 (b) $q(x) = x^3 - 5x^2 + 20x - 100, r(x) = 504$
 (c) $q(x) = x^4 + x^3 + x^2 + x + 1, r(x) = 0$
5.

x	0	1	-3	7
$p(x)$	-4	-3	101	5001
7. (a) $q(x) = x^2 + 6x + 13, r = 20$ (b) $q(x) = x^2 + 3x - 2, r = -4$
9. (a) $\pm 1, \pm 2, \pm 3, \pm 4, \pm 6, \pm 8, \pm 12, \pm 24$
 (b) $\pm 1, \pm 2, \pm 5, \pm 10, \pm \frac{1}{3}, \pm \frac{2}{3}, \pm \frac{5}{3}, \pm \frac{10}{3}$ (c) $\pm 1, \pm 17$
11. $(x+1)(x-1)(x-2)$ 13. $(x+3)^3(x+1)$
15. $(x+3)(x+2)(x+1)^2(x-3)$ 17. -3 19. $-2, -\frac{2}{3}, -1 \pm \sqrt{3}$
21. $-2, 2, 3$ 23. 2, 5 25. 7 cm

Appendix E (Page E1)

1. (a) rational (b) integer, rational (c) integer, rational (d) rational
 (e) integer, rational (f) irrational (g) rational
 (h) integer, rational 3. (a) $\frac{41}{333}$ (b) $\frac{115}{9}$ (c) $\frac{20943}{550}$ (d) $\frac{537}{1250}$
5. (a) $\frac{256}{81}$ (b) worse
7.

Line	2	3	4	5	6	7
Blocks	3, 4	1, 2	3, 4	2, 4, 5	1, 2	3, 4
9. (a), (d), (f) 11. (a) all values (b) none 13. (a) yes (b) no
15. (a) $\{x : x \text{ is a positive odd integer}\}$ (b) $\{x : x \text{ is an even integer}\}$
 (c) $\{x : x \text{ is irrational}\}$ (d) $\{x : x \text{ is an integer and } 7 \leq x \leq 10\}$
17. (a) false (b) true (c) true (d) false (e) true (f) true (g) true
19. (a) (b)
 (c) (d)
 (e) (f)
21. (a) $[-2, 2]$ (b) $(-\infty, -2) \cup (2, +\infty)$
23. 25.
27. 29.
31. 33.
35. 37.
39. 41.
43. 45. $(-\infty, -3) \cup [2, +\infty)$
47. $77 \leq F \leq 104$ 55. $(-\infty, -\frac{1}{2})$

Answers to Odd-Numbered Exercises A47

► Exercise Set F (Page F1)

1. (a) 7 (b) $\sqrt{2}$ (c) k^2 (d) k^2 3. $x \leq 3$ 5. all real x
 7. $x \geq 0$ or $x = -\frac{2}{3}$ 9. $x \geq -5$
 13. (a) 2 (b) 1 (c) 14 (d) $3 + \sqrt{2}$ (e) 7 (f) 5
 15. (a) -9 (b) 7 (c) 12
 17. $-\frac{5}{6}, \frac{3}{2}$ 19. $\frac{1}{2}, \frac{5}{2}$ 21. $-\frac{11}{10}, \frac{11}{8}$ 23. $1, \frac{17}{5}$
 25. $(-9, -3)$ 27. $[-\frac{3}{2}, \frac{9}{2}]$ 29. $(-\infty, -3) \cup (-1, +\infty)$
 31. $(-\infty, \frac{1}{2}] \cup [\frac{9}{2}, +\infty)$ 33. $(-\infty, \frac{1}{2}) \cup (\frac{3}{2}, +\infty)$
 35. $[\frac{1}{8}, \frac{1}{2}] \cup (\frac{1}{2}, \frac{7}{8}]$ 37. $x \in (-\infty, 2] \cup [3, +\infty)$ 39. -3, 9

► Appendix G (Page G1)

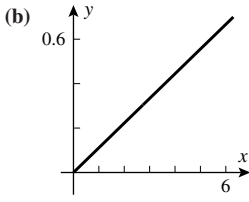
1. $(-4, 7)$ 3. (a)
- (b) (c) (d) (e) (f)
- 5.
7. 9.
11. 13. (a) $\frac{1}{2}$ (b) -1 (c) 0 (d) not defined
 15. (a) yes (b) no

17. 19. $\text{III} < \text{II} < \text{IV} < \text{I}$
 21. (a) 14 (b) $-\frac{1}{3}$
 23. 29
 25. $\frac{13}{7}$
29. (a) (b) (c) (d)
31. (a) (b) (c)
33.

	(a)	(b)	(c)	(d)	(e)
Slope	3	-1/4	-3/5	0	-b/a
y-intercept	2	3	8/5	1	b
35. (a) $y = \frac{3}{2}x - 3$ (b) $y = -\frac{3}{4}x$ 37. $y = -2x + 4$
 39. $y = 4x + 7$ 41. $y = -\frac{1}{3}x + 6$ 43. $y = 11x - 18$
 45. $y = \frac{1}{2}x + 2$ 47. $y = 1$ 49. (a) parallel (b) perpendicular (c) parallel (d) perpendicular (e) neither
 51. (a) $-\frac{3}{2}$ 53. the union of the graphs of $x - y = 0$ and $x + y = 0$
 (b) $\frac{4}{5}$ (c) $\frac{5}{2}$ (d) $-\frac{15}{2}$ (e) -4

 55. 59. $\frac{49}{6}$

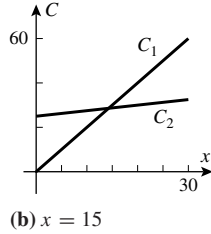
A48 Answers to Odd-Numbered Exercises

61. (a) $y = x/9$ (b)  (c) 26.11 in (d) 135 lb

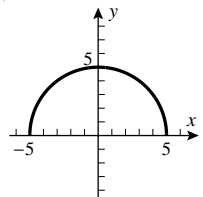
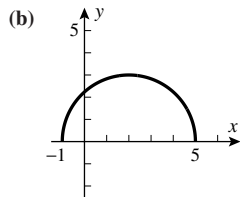
63. $y = 1.2x + 2$ 65. (a) $T_C = \frac{5}{9}(T_F - 32)$ (b) $\frac{5}{9}$
(c) -40° (F or C) (d) 37° C

67. (a) $p = 0.098h + 1$ (b) 10.20 m

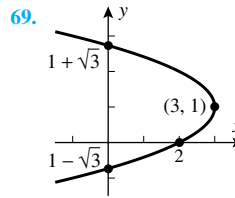
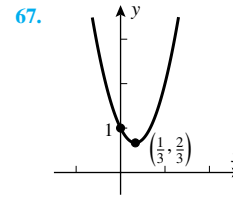
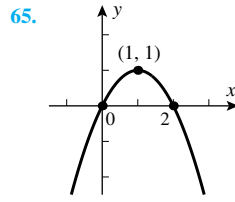
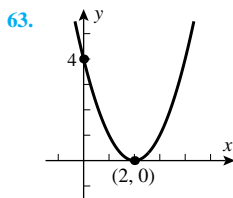
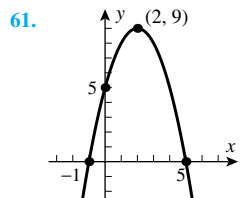
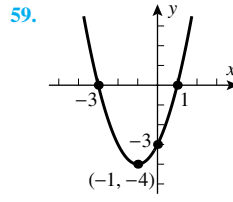
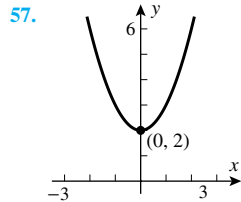
69. (a) $r = -0.0125t + 0.8$ 71. (a) $C_1 = 2x$, $C_2 = 25 + (x/4)$
(b) 64 days



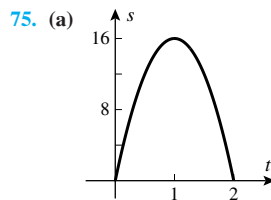
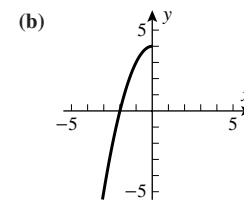
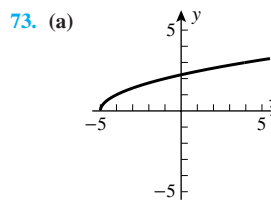
Appendix H (Page H1)

1. in the proof of Theorem H.1 3. (a) 10 (b) (4, 5)
5. (a) $\sqrt{29}$ (b) $(-\frac{9}{2}, -5)$ 11. 0 13. $y = -3x + 4$
15. $(-\frac{29}{8}, -\frac{23}{4})$ 17. 3 21. 4 23. (a) (0, 0); 5 (b) (1, 4); 4
(c) $(-1, -3)$; $\sqrt{5}$ (d) (0, -2); 1 25. $(x - 3)^2 + (y + 2)^2 = 16$
27. $(x + 4)^2 + (y - 8)^2 = 64$ 29. $(x + 3)^2 + (y + 4)^2 = 25$
31. $(x - 1)^2 + (y - 1)^2 = 2$ 33. circle; center (1, 2), radius 4
35. circle; center $(-1, 1)$, radius $\sqrt{2}$ 37. the point $(-1, -1)$
39. circle; center (0, 0), radius $\frac{1}{3}$ 41. no graph
43. circle; center $(-\frac{5}{4}, -\frac{1}{2})$, radius $\frac{3}{2}$
45. (a) $y = -\sqrt{16 - x^2}$ (b) $y = 2 + \sqrt{3 - 2x - x^2}$
47. (a)  (b) 

49. $y = -\frac{3}{4}x + \frac{25}{4}$ 51. (a) inside (b) largest $3\sqrt{5}$, smallest $\sqrt{5}$
53. $(1/3, \pm\sqrt{8}/3)$ 55. (a) equation: $2x^2 + 2y^2 - 12x + 8y + 1 = 0$
(b) center (3, -2), radius $5/\sqrt{2}$



71. (a) $x = \sqrt{3 - y}$
(b) $x = 1 - \sqrt{y + 1}$



77. (a) $y = 150 - \frac{3}{2}x$
(b) $A = 150x - \frac{3}{2}x^2$
(c) 3750 ft²

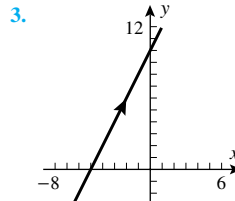
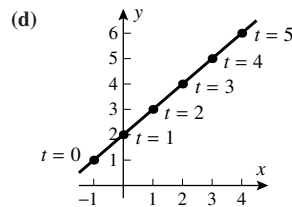
79. (a) $(-5 - \sqrt{33})/4 < x < (-5 + \sqrt{33})/4$ (b) $-\infty < x < +\infty$
81. (a) 30 ft (b) 2.6 s (c) 2.1 s

Appendix I (Page I1)

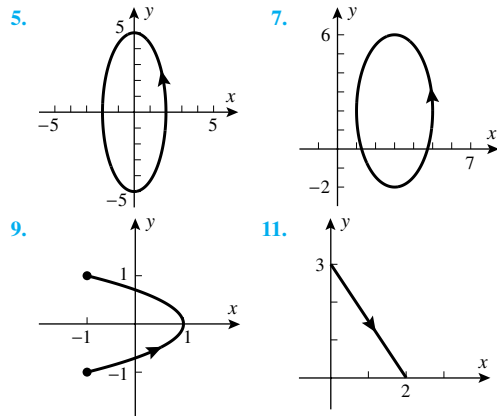
1. (a) $y = x + 2$

(c)

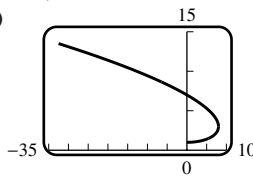
t	0	1	2	3	4	5
x	-1	0	1	2	3	4
y	1	2	3	4	5	6



Answers to Odd-Numbered Exercises A49

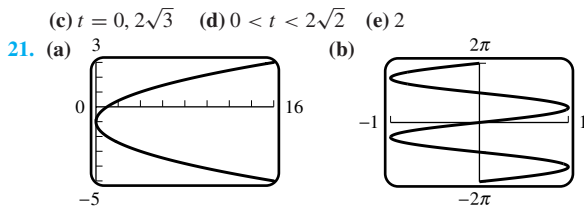


13. $x = 5 \cos t, y = -5 \sin t, 0 \leq t \leq 2\pi$ 15. $x = 2, y = t$
 17. $x = t^2, y = t, -1 \leq t \leq 1$
 19. (a)

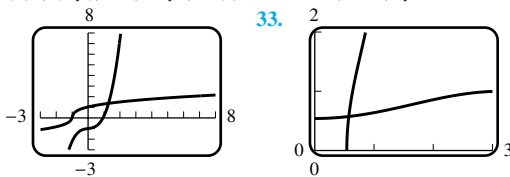


(b)

t	0	1	2	3	4	5
x	0	5.5	8	4.5	-8	-32.5
y	1	1.5	3	5.5	9	13.5



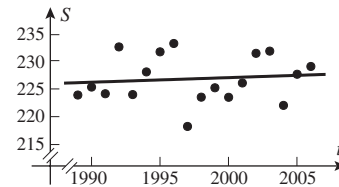
- Responses to True-False questions may be abridged to save space.
 23. True; the graph is the upper half of the unit circle.
 25. False; the graph is the reflection of the graph of $y = f(x)$ about the line $y = x$
 27. (b) $\frac{1}{2}$ (c) $\frac{3}{4}$
 29. (b) (x_0, y_0) to (x_1, y_1) (c) $x = 3 - 2(t - 1), y = -1 + 5(t - 1)$
 31.



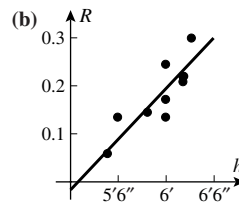
- 35.
37. (a) $x = 4 \cos t, y = 3 \sin t$ (b) $x = -1 + 4 \cos t, y = 2 + 3 \sin t$
 39. (a) ellipses with fixed center, varying axes of symmetry (b) (assume $a \neq 0, b \neq 0$) ellipses with varying center, fixed axes of symmetry
 (c) circles of radius 1 with centers on line $y = x - 1$

► Appendix J (Page J1)

1. II 3. $S = 0.0815686t + 63.7661$, coefficient = 0.104805



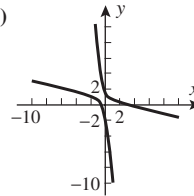
5. (a) $p = 0.0146T + 3.98, 0.9999$ (b) 3.25 atm (c) $\approx -272^\circ\text{C}$
 7. (a) $R = 0.00723T + 1.55$ (b) $\approx -214^\circ\text{C}$
 9. (a) $S = 0.50179\omega - 0.00643$ (b) ≈ 16.0 lb
 11. (a) $R = 0.2087h - 1.0549, 0.842333$



13. (a) 181.8 km/s/Mly (b) 1.492×10^{10} years (c) increase
 15. $T = 849.5 + 143.5 \sin\left[\frac{\pi}{183}t - \frac{\pi}{2}\right]$ 17. $t = 0.445\sqrt{d}$

► Appendix K (Page K1)

1. circle 3. parabola 5. ellipse
 9. (a) hyperbola (b) $y = -\frac{9}{2}x - \frac{1}{2} + \frac{1}{2}\sqrt{73x^2 + 42x + 17}$
 (c)



► Appendix L (Page L1)

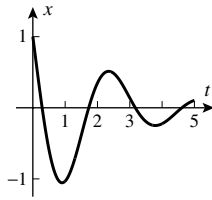
3. $y = c_1 e^x + c_2 e^{-4x}$ 5. $y = c_1 e^x + c_2 x e^x$
 7. $y = c_1 \cos x + c_2 \sin x$ 9. $y = c_1 + c_2 e^x$
 11. $y = c_1 e^{2t} + c_2 t e^{2t}$ 13. $y = e^{-2x}(c_1 \cos 3x + c_2 \sin 3x)$
 15. $y = c_1 e^{-x/4} + c_2 e^{x/2}$ 17. $y = 3e^x - 2e^{-3x}$
 19. $y = 2e^{-3x} + x e^{-3x}$ 21. $y = -e^{-2x}(3 \cos x + 6 \sin x)$
 23. (a) $y'' - 3y' - 10y = 0$
 (b) $y'' - 8y' + 16y = 0$ (c) $y'' + 2y' + 17y = 0$
 25. (a) $k < 0$ or $k > 4$ (b) 0, 4 (c) $0 < k < 4$
 27. (a) $y = (1/x)[c_1 \cos(\ln x) + c_2 \sin(\ln x)]$
 (b) $y = c_1 x^{1+\sqrt{3}} + c_2 x^{1-\sqrt{3}}$
 33. (a) $x(t) = 0.4 \cos(t/2)$ m (b) period = 4π s, frequency = $\frac{1}{4\pi}$ Hz
 (c) (d) $t = \pi$ s
 (e) $t = 2\pi$ s

35. (a) Maximum speed occurs when $x = 0$.
 (b) Minimum speed occurs when $x = \pm x_0$.

A50 Answers to Odd-Numbered Exercises

39. (a) $x = e^{-1.2t} + 3.2te^{-1.2t}$ (b) 1.427364 cm

41. (a) $x = e^{-t/2} \cos(\sqrt{19}t/2) - \frac{6}{19} \sqrt{19}e^{-t/2} \sin(\sqrt{19}t/2)$



(b) 1.0545 cm

(c) -3.210357 cm/s (d) 3.210357 cm/s²

43. (a) $x = (4 + 2v_0)e^{-3t/2} - (3 + 2v_0)e^{-2t}$

(b) $8e^{-3t/2} - 7e^{-2t}$, $2e^{-3t/2} - e^{-2t}$, $-4e^{-3t/2} + 5e^{-2t}$

