

Solutions Manual for Calculus with Applications Brief Version 12th Lial

SOLUTIONS MANUAL SAMPLE PREVIEW

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RESOURCE TYPE

Solutions Manual

Complete Instructor Answers

Answers to selected writing exercises are provided.

Answers to Prerequisite Skills Diagnostic Test

1. 20% 2. $51/35$ 3. $x + y = 75$ 4. $s \geq 4p$ 5. $-20/3$ (Sec. R.4) 6. $-11/5$ (Sec. R.4) 7. $(-2, 5]$ (Sec. R.5)
 8. $x \leq -3$ (Sec. R.5) 9. $y \geq -17/2$ (Sec. R.5) 10. $p > 3/2$ (Sec. R.5) 11. $-y^2 + 4y - 6$ (Sec. R.1)
 12. $x^3 - x^2 + x + 3$ (Sec. R.1) 13. $a^2 - 4ab + 4b^2$ (Sec. R.1) 14. $3pq(1 + 2p + 3q)$ (Sec. R.2)
 15. $(3x + 5)(x - 2)$ (Sec. R.2) 16. $(a - 6)/(a + 2)$ (Sec. R.3) 17. $(x^2 + 5x - 2)/[x(x - 1)(x + 1)]$ (Sec. R.3)
 18. $(-2 \pm \sqrt{7})/3$ (Sec. R.4) 19. $(-\infty, -3) \cup [1, \infty)$ (Sec. R.5) 20. $x^6y/4$ (Sec. R.6) 21. $2/(p^2q)$ (Sec. R.6)
 22. $(m - k)/(km)$ (Sec. R.6) 23. $(x^2 + 1)^{-1/2}(3x^2 + x + 5)$ (Sec. R.6) 24. $4b^2$ (Sec. R.7) 25. $(4 + \sqrt{10})/3$ (Sec. R.7)
 26. $|y - 5|$ (Sec. R.7)

Chapter R Algebra Reference

Exercises R.1 (page R-5–R-6)

For exercises . . .	1–8	9, 10	11–16	17–24	25–28
Refer to example . . .	2	3	4	5	6

1. $-x^2 + x + 9$ 2. $-6y^2 + 3y + 10$ 3. $(3/2)z^2 + (5/6)z + 2$
 4. $(1/2)t^2 + (1/2)t + 2/3$ 5. $-16q^2 + 4q + 6$ 6. $9r^2 - 4r + 19$ 7. $-0.327x^2 - 2.805x - 1.458$
 8. $0.8r^2 + 3.6r - 1.5$ 9. $-18m^3 - 27m^2 + 9m$ 10. $-12x^4 + 30x^2 + 36x$ 11. $9t^2 + 9ty - 10y^2$
 12. $18k^2 - 7kq - q^2$ 13. $4 - 9x^2$ 14. $36m^2 - 25$ 15. $(6/25)y^2 + (11/40)yz + (1/16)z^2$
 16. $(15/16)r^2 - (7/12)rs - (2/9)s^2$ 17. $27p^3 - 1$ 18. $15p^3 + 13p^2 - 10p - 8$ 19. $8m^3 + 1$
 20. $12k^4 + 21k^3 - 5k^2 + 3k + 2$ 21. $3x^2 + xy + 2xz - 2y^2 - 3yz - z^2$ 22. $2r^2 + 2rs - 5rt - 4s^2 + 8st - 3t^2$
 23. $x^3 + 6x^2 + 11x + 6$ 24. $x^3 - 2x^2 - 5x + 6$ 25. $x^2 + 4x + 4$ 26. $4a^2 - 16ab + 16b^2$
 27. $x^3 - 6x^2y + 12xy^2 - 8y^3$ 28. $27x^3 + 27x^2y + 9xy^2 + y^3$

Exercises R.2 (page R-9)

For exercises . . .	1–4	5–15	16–20	21–32
Refer to example . . .	1	2, 3	3, 2nd CAUTION	4

1. $7a^2(a + 2)$ 2. $3y(y^2 + 8y + 3)$ 3. $13p^2q(p^2q - 3p + 2q)$
 4. $10m^2(6m^2 - 12mn + 5n^2)$ 5. $(m + 2)(m - 7)$ 6. $(x + 5)(x - 1)$ 7. $(z + 4)(z + 5)$ 8. $(b - 7)(b - 1)$
 9. $(a - 5b)(a - b)$ 10. $(s - 5t)(s + 7t)$ 11. $(y - 7z)(y + 3z)$ 12. $(3x + 7)(x - 1)$ 13. $(3a + 7)(a + 1)$
 14. $(5y + 2)(3y - 1)$ 15. $(7m + 2n)(3m + n)$ 16. $6(a - 10)(a + 2)$ 17. $3m(m + 3)(m + 1)$ 18. $2(2a + 3)(a + 1)$
 19. $2a^2(4a - b)(3a + 2b)$ 20. $12x^2(x - y)(2x + 5y)$ 21. $(x + 8)(x - 8)$ 22. $(3m + 5)(3m - 5)$
 23. $10(x + 4)(x - 4)$ 24. Prime 25. $(z + 7y)^2$ 26. $(s - 5t)^2$ 27. $(3p - 4)^2$ 28. $(a - 6)(a^2 + 6a + 36)$
 29. $(3r - 4s)(9r^2 + 12rs + 16s^2)$ 30. $3(m + 5)(m^2 - 5m + 25)$ 31. $(x - y)(x + y)(x^2 + y^2)$
 32. $(2a - 3b)(2a + 3b)(4a^2 + 9b^2)$

Exercises R.3 (page R-12)

For exercises . . .	1–12	13–38
Refer to example . . .	1	2

1. $v/7$ 2. $5p/2$ 3. $8/9$ 4. $2/(t + 2)$ 5. $x - 2$ 6. $4(y + 2)$ 7. $(m - 2)/(m + 3)$
 8. $(r + 2)/(r + 4)$ 9. $3(x - 1)/(x - 2)$ 10. $(z - 3)/(z + 2)$ 11. $(m^2 + 4)/4$ 12. $(2y + 1)/(y + 1)$ 13. $3k/5$
 14. $25p^2/9$ 15. $9/(5c)$ 16. 2 17. $1/4$ 18. $3/10$ 19. $2(a + 4)/(a - 3)$ 20. $2/(r + 2)$ 21. $(k - 2)/(k + 3)$
 22. $(m + 6)/(m + 3)$ 23. $(m - 3)/(2m - 3)$ 24. $2(2n - 1)/(3n - 5)$ 25. 1 26. $(6 + p)/(2p)$ 27. $(12 - 15y)/(10y)$
 28. $137/(30m)$ 29. $(3m - 2)/[m(m - 1)]$ 30. $(r - 6)/[r(2r + 3)]$ 31. $14/[3(a - 1)]$ 32. $23/[20(k - 2)]$
 33. $(7x + 1)/[(x - 2)(x + 3)(x + 1)]$ 34. $(y^2 + 1)/[(y + 3)(y + 1)(y - 1)]$ 35. $k(k - 13)/[(2k - 1)(k + 2)(k - 3)]$
 36. $m(3m - 19)/[(3m - 2)(m + 3)(m - 4)]$ 37. $(4a + 1)/[a(a + 2)]$ 38. $(5x^2 + 4x - 4)/[x(x - 1)(x + 1)]$

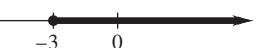
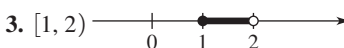
Exercises R.4 (page R-17)

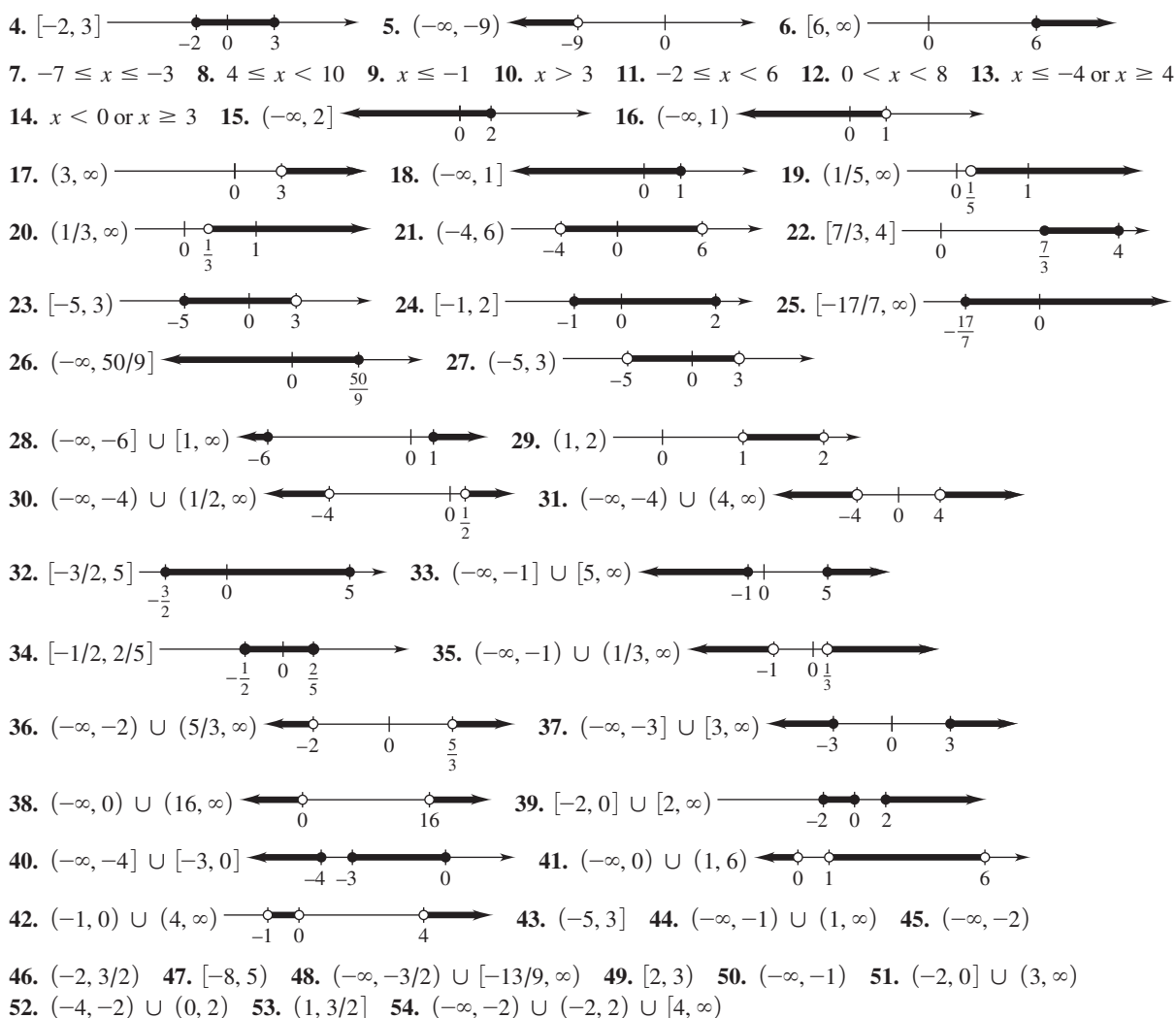
For exercises . . .	1–8	9–26	27–37
Refer to example . . .	2	3–5	6, 7

1. -12 2. $3/4$ 3. 12 4. $-3/8$ 5. $-7/8$ 6. $-6/11$ 7. 4 8. $-10/19$ 9. $-3, -2$
 10. $-1, 3$ 11. 7 12. $-2, 5/2$ 13. $-1/4, 2/3$ 14. 2, 5 15. $-3, 3$ 16. $-4, 1/2$ 17. 0, 4
 18. $(5 + \sqrt{13})/6 \approx 1.434$, $(5 - \sqrt{13})/6 \approx 0.232$ 19. $(2 + \sqrt{10})/2 \approx 2.581$, $(2 - \sqrt{10})/2 \approx -0.581$
 20. $(-1 + \sqrt{5})/2 \approx 0.618$, $(-1 - \sqrt{5})/2 \approx -1.618$ 21. $5 + \sqrt{5} \approx 7.236$, $5 - \sqrt{5} \approx 2.764$
 22. $(4 + \sqrt{6})/5 \approx 1.290$, $(4 - \sqrt{6})/5 \approx 0.310$ 23. 1, $5/2$ 24. No real number solutions
 25. $(-1 + \sqrt{73})/6 \approx 1.257$, $(-1 - \sqrt{73})/6 \approx -1.591$ 26. $-1, 0$ 27. 3 28. 12 29. $-59/6$ 30. 6 31. 3 32. $-5/2$
 33. $2/3$ 34. 1 35. 2 36. No solution 37. No solution

Exercises R.5 (page R-22)

For exercises . . .	1–14	15–26	27–38	39–42	43–54
Refer to example . . .	Figure 1, Example 2	2	3	4	5–7

1. $(-\infty, 4)$ 
 2. $[-3, \infty)$  3. $[1, 2)$ 



Exercises R.6 (page R-26)

For exercises . . .	1-8	9-26	27-36	37-50	51-56
Refer to example . . .	1	2	3,4	5	6

1. $1/64$ 2. $1/81$ 3. 1 4. 1 5. $-1/9$ 6. $1/9$ 7. 36 8. $27/64$
9. $1/64$ 10. 8^5 11. $1/10^8$ 12. 7 13. x^2 14. 1 15. $8k^3$ 16. $1/(3z^7)$ 17. $x^5/(3y^3)$ 18. $m^3/5^4$ 19. a^3b^6
20. $49/(c^6d^4)$ 21. $(a+b)/(ab)$ 22. $(1-ab^2)/b^2$ 23. $2(m-n)[mn(m+n^2)]$ 24. $(3n^2+4m)/(mn^2)$
25. $xy/(y-x)$ 26. $y^4/(xy-1)^2$ 27. 11 28. 3 29. 4 30. -25 31. $1/2$ 32. $4/3$ 33. $1/16$ 34. $1/5$ 35. $4/3$
36. $1000/1331$ 37. 9 38. 3 39. 64 40. 1 41. x^4/y^4 42. b/a^3 43. r 44. $12^3/y^8$ 45. $3k^{3/2}/8$ 46. $1/(2p^2)$
47. $a^{2/3}b^2$ 48. $y^2/(x^{1/6}z^{5/4})$ 49. $h^{1/3}t^{1/5}/k^{2/5}$ 50. m^3p/n 51. $3x(x^2+3x)^2(x^2-5)$ 52. $6x(x^3+7)(-2x^3-5x+7)$
53. $5x(x^2-1)^{-1/2}(x^2+1)$ 54. $3(6x+2)^{-1/2}(27x+5)$ 55. $(2x+5)(x^2-4)^{-1/2}(4x^2+5x-8)$
56. $(4x^2+1)(2x-1)^{-1/2}(36x^2-16x+1)$

Exercises R.7 (page R-30)

For exercises . . .	1-22	23-26	27-40	41-44
Refer to example . . .	1,2	3	4	5

1. 5 2. 6 3. -5 4. $5\sqrt{2}$ 5. $20\sqrt{5}$ 6. $4y^2\sqrt{2y}$ 7. 9 8. 8
9. $7\sqrt{2}$ 10. $9\sqrt{3}$ 11. $9\sqrt{7}$ 12. $-2\sqrt{7}$ 13. $5\sqrt[3]{2}$ 14. $3\sqrt[3]{5}$ 15. $xyz^2\sqrt{2x}$ 16. $4r^3s^4t^6\sqrt{10rs}$ 17. $4xy^2z^3\sqrt[3]{2y^2}$
18. $x^2yz^2\sqrt[4]{y^3z^3}$ 19. $ab\sqrt{ab(b-2a^2+b^3)}$ 20. $p^2\sqrt{pq(pq-q^4+p^2)}$ 21. $\sqrt[6]{a^5}$ 22. $b^2\sqrt[4]{b}$ 23. $|4-x|$
24. $|3y+5|$ 25. Cannot be simplified 26. Cannot be simplified 27. $5\sqrt{7}/7$ 28. $\sqrt{10}/2$ 29. $-\sqrt{3}/2$ 30. $\sqrt{2}$
31. $-3(1+\sqrt{2})$ 32. $-5(2+\sqrt{6})/2$ 33. $3(2-\sqrt{2})$ 34. $(5-\sqrt{10})/3$ 35. $(\sqrt{r}+\sqrt{3})/(r-3)$
36. $5(\sqrt{m}+\sqrt{5})/(m-5)$ 37. $\sqrt{y}+\sqrt{5}$ 38. $(z+\sqrt{5z}-\sqrt{z}-\sqrt{5})/(z-5)$ 39. $-2x-2\sqrt{x(x+1)}-1$
40. $[p^2+p+2\sqrt{p(p^2-1)}-1]/(-p^2+p+1)$ 41. $-1/[2(1-\sqrt{2})]$ 42. $1/(3+\sqrt{3})$
43. $-1/[2x-2\sqrt{x(x+1)}+1]$ 44. $2/[p+\sqrt{p(p-2)}]$

Chapter 1 Linear Functions**Exercises 1.1 (page 13–17)**

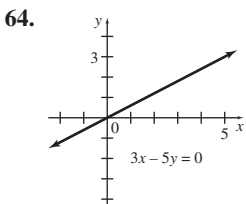
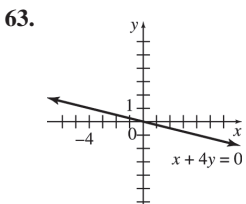
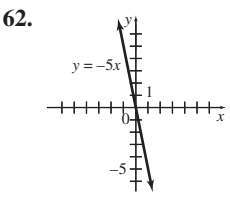
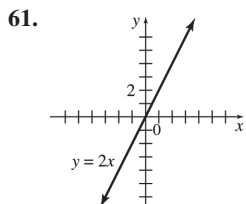
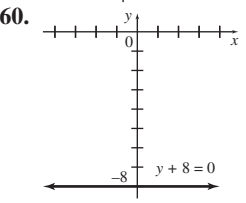
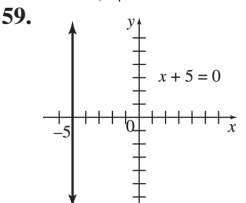
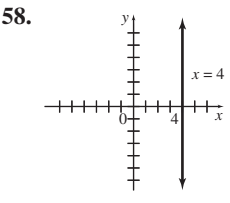
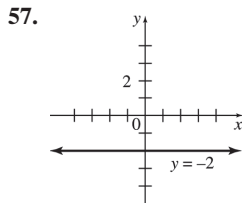
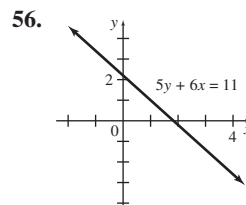
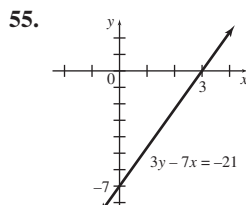
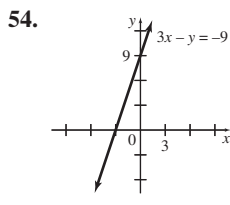
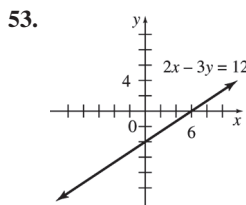
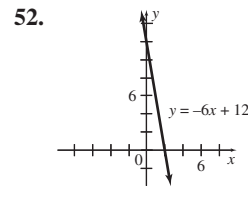
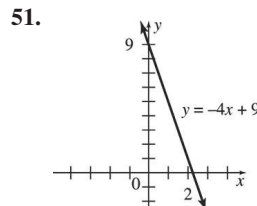
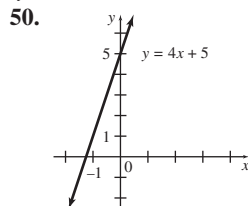
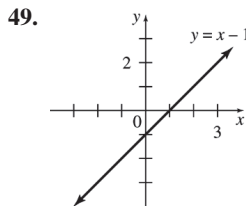
For exercises . . .	5–8	9–12	17,33,34	18,35–38	19–21	22,31	23–28	29,30	32	49–64	65–79
Refer to example . . .	1	3	8	9	4	7	5	2	6	11,12	10,13

W1. -3 **W2.** $y = -2x - 13$

W3. $y = (2/5)x + 19/30$

W4. $y = (2/3)x - 7/3$

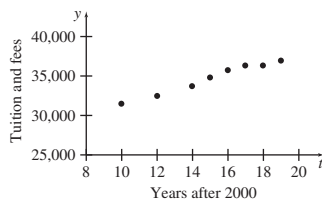
1. False 2. True 3. False 4. False 5. $3/5$ 6. $-7/4$ 7. Not defined 8. 0 9. 1 10. 3 11. $5/9$ 12. $-4/7$
 13. Not defined 14. 0 15. 0 16. 0 17. 2 18. $-1/4$ 19. $y = -2x + 5$ 20. $y = -x + 6$ 21. $y = -7$ 22. $x = -8$
 23. $y = -(1/3)x + 10/3$ 24. $y = -x + 7$ 25. $y = 6x - 7/2$ 26. $y = (21/32)x + 33/16$ 27. $x = -8$ 28. $y = 3$
 29. $x + 2y = -6$ 30. $2x - y = -4$ 31. $x = -6$ 32. $y = 7$ 33. $3x + 2y = 0$ 34. $2x - y = 9$ 35. $x - y = 7$
 36. $3x + 2y = 6$ 37. $5x - y = -4$ 38. $3x + 6y = -2$ 39. No 40. (a) $k = -1/2$ (b) $k = -7/2$ 43. (a) 44. (f)
 45. -4 46. $1/2$ 48. (a) $y = -(b/a)x + b$ (b) a and b



65. (a) 12,000; $y = 12,000x + 3000$ (b) 8 years 1 month 66. (a) 0.9; each additional cupcake costs \$0.90

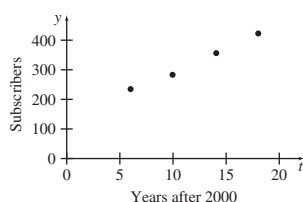
(b) $y = 0.9x + 36$ (c) \$198

67. (a)



Yes (b) $y = 598t + 25,522$; the slope indicates that the annual cost of tuition and fees at private four-year colleges is increasing by about \$598 per year. (c) The year 2035 is too far in the future to rely on this equation to predict costs; too many other factors may influence these costs by then.

68. (a)



The number of subscribers appears to be increasing at a nearly linear rate.

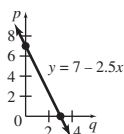
(b) $y = 15.729t + 138.67$ (c) $y = 15.688t + 139.42$

(e) 390.33 million; 390.43 million

69. (a) $y = 4.317t + 87.049$ (b) 173.4, which is slightly more than the actual CPI (c) It is increasing at a rate of approximately 4.3 per year. 70. (a) $y = 0.53t - 0.043$ (b) About 10.2 yr 71. (a) $u = 0.85(220 - x) = 187 - 0.85x$, $l = 0.7(220 - x) = 154 - 0.7x$ (b) 140 to 170 beats per minute (c) 126 to 153 beats per minute (d) The women are 16 and 52. Their pulse is 143 beats per minute. 72. Approximately 4.3 m/sec 73. About 86 yr 74. (a) $y = -1.93t + 267$ (b) 2026 75. (a) $y = 13,104.18t - 406,022$ (b) About 1,166,480 76. (a) $y = 0.12t + 25.12$ (b) $y = 0.14t + 22.54$ (c) Women (d) 2038 (e) 30.6 77. (a) There appears to be a linear relationship. (b) $y = 76.9x$ (c) About 780 megaparsecs (about 1.5×10^{22} mi) (d) About 12.4 billion yr 78. (a) $T = 0.03t + 15$ (b) About 2103 (c) $T = 0.02t + 15$; about 2170 79. (a) $y_o = 4.625t - 19.25$ (b) $y = 4.75t - 41.5$ (c) The percent of Americans who had listened to online radio in the previous month increased by 4.625% per year, while the percent of U.S. cellphone users who had ever listened to online radio in a car using a phone increased by 4.75% per year.

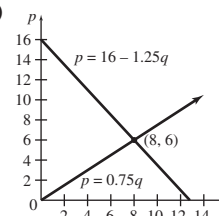
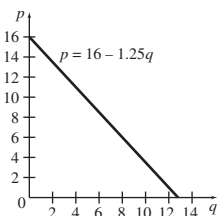
Exercises 1.2 (page 24–27)

W1. 60 W2.



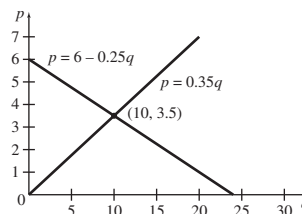
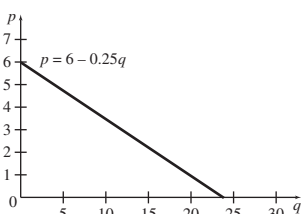
For exercises . . .	9–18	23–26	27–30, 41, 42, 49, 50	31–36	37–40, 43–48	51–53
Refer to example . . .	1	4	5, 6	2, 3	7	8

1. True 2. False 3. True 4. True 5. False 6. True 7. True 8. True 9. -3 10. -13 11. 22 12. 12 13. 0
14. 2 15. -4 16. $-9/2$ 17. $7 - 5t$ 18. $2k^2 - 3$ 23. If $R(x)$ is the cost of renting a snowboard for x hours, then $R(x) = 2.25x + 10$. 24. If $C(x)$ is the cost of downloading x songs, then $C(x) = 0.99x + 10$. 25. If $C(x)$ is the cost of parking a car for x hours, then $C(x) = 0.75x + 2$. 26. If $R(x)$ is the cost of renting a car for x miles, then $R(x) = 44 + 0.28x$.
27. $C(x) = 30x + 100$ 28. $C(x) = 45x + 35$ 29. $C(x) = 75x + 550$ 30. $C(x) = 120x + 12,500$ 31. (a) \$16 (b) \$11
(c) \$6 (d) 640 watches (e) 480 watches (f) 320 watches
(g) (h) 0 watches (i) About 1333 watches (j) About 2667 watches (k)
(l) 800 watches, \$6

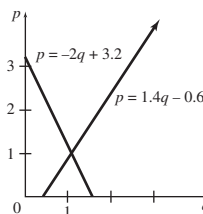
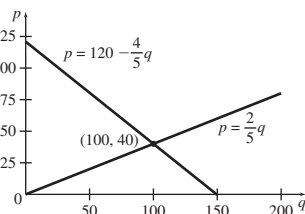


32. (a) \$6 (b) \$5 (c) \$3.90 (d) 600 quarts (e) 1100 quarts (f) 1440 quarts

- (g) (h) 0 quarts (i) 800 quarts (j) 1800 quarts (k)
(l) 1000 quarts; \$3.50



33. (a) (b) 100 tubs, \$40 34. (a) (b) About 1120 lb; about \$0.96



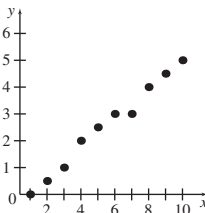
35. $D(q) = 6.9 - 0.4q$ 36. $D(q) = 9 - 0.35q$ 37. (a) 2 units (b) \$980 (c) 52 units 38. (a) 3 units (b) \$3211
(c) 13 units 39. (a) $C(x) = 3.50x + 90$ (b) 17 shirts (c) 108 shirts 40. (a) $C(x) = 2.15x + 525$ (b) 188
(c) 545 books 41. (a) $C(x) = 0.097x + 1.32$ (b) \$1.32 (c) \$98.32 (d) \$98.417 (or \$98.42) (e) 9.7¢ (f) 9.7¢, the cost of producing one additional cup of coffee would be 9.7¢. 42. (a) $C(x) = 500,000 + 4.75x$ (b) \$500,000 (c) \$975,000
(d) \$4.75; each additional item costs \$4.75 to produce. 43. Break-even quantity is 45 units; don't produce; $P(x) = 20x - 900$
44. Break-even quantity is about 41 units; produce; $P(x) = 145x - 6000$ 45. Break-even quantity is -50 units; impossible to make a profit when $C(x) > R(x)$ for all positive x ; $P(x) = -10x - 500$ (always a loss) 46. Break-even quantity is -50 units; impossible to make a profit when $C(x) > R(x)$ for all positive x ; $P(x) = -100x - 5000$ (always a loss). 47. 5 48. 26

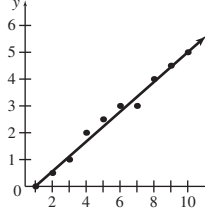
49. (a) About 23 acorns per square meter (b) 34; the number of deer tick larvae per 400 squares meters in the spring will increase by 34 for each additional acorn per square meter in the preceding fall. 50. (a) $f_i(t) = 2.8t + 35$ (b) $f_d(t) = -2.2t + 100$
 (c) 2003 51. (a) 14.4°C (b) -28.9°C (c) 122°F 52. (a) 98.6°F (b) 97.7°F to 99.5°F 53. -40°
 54. (a) $C(x) = 3.308 \times 10^9 + 7.17x$ (b) \$4.168 billion (c) 166 million MWh

Exercises 1.3 (page 33–40)

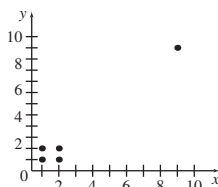
For exercises . . .	7(b),8,11(a), 14(d),15(d), 16(e),17(e),18(e), 20(b),21(b),22(b), 23(d), 24(b),25(d), 26(c),27(b),29(d), 30(c),32(a),33(d), 34(d),35(d),36	7(c),14(a),15(a), 16(a),17(a),18(a), 20(c),21(a)(c), 22(a)(c), 23(b),24(c), 25(a),26(a),27(c), 29(a),30(b),31(a), 32(b),33(a)(b), 34(a)(b),35(c)	7(d),14(b), 15(b),16(c), 17(c),18(c), 25(b),26(b), 27(d), 29(b)(c), 31(b)(c), 32(c)	9(a)(b), 10(a)(b), 12(a), 19(b)(d), 28(a)(b)	9(c),10(c), 20(d)	14(c),15(c), 16(d),17(d), 18(d),19(f), 25(c),33(c), 34(c)
Refer to example . . .	4	1	2	1,4	5	3

1. True 2. False 3. False 4. True

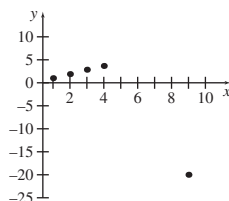
7. (a)
- 
- (b) 0.993 (c)
- $Y = 0.555x - 0.5$

- (d) 5.6
- 

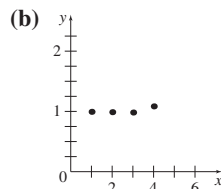
8. (c) 9. (a)
- $Y = 0.9783x + 0.0652$
- ; 0.9783 (b)
- $Y = 1.5$
- ; 0 (c) The point (9, 9) is an outlier that has a strong effect on the least squares line and the correlation coefficient.

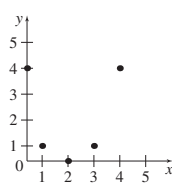


10. (a)
- $Y = -2.887x + 8.969$
- ;
- -0.8880
- (b)
- $Y = x$
- ; 1

- (c)
- 
- The point (9, -20) is an outlier that has a strong effect on the least squares line and the correlation coefficient.

11. (a) 0.7746



12. (a)
- $Y = 2$
- ; 0 (b)
- 

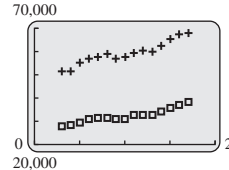
14. (a)
- $Y = 0.06815x + 1.844$

- (b) \$3.548 trillion (c) 2061 (d) 0.7907; fairly strong positive correlation

15. (a)
- $Y = -0.2333x + 8.872$
- (b) About 2900 (c) 2030 (d)
- -0.9991
- ; strong negative correlation

16. (a)
- $Y = 0.815x + 19.4$
- (b) By about 0.815 per year (c) 40.6 (d) 2032 (e) 0.9953; strong positive correlation

17. (a)
- $Y = -3.21x + 98.7$
- (b) By about 3.21 percent per year (c) 21.7% (d) 2025 (e)
- -0.9896
- ; strong negative correlation

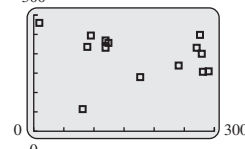
18. (a)
- $Y = 176.84x + 812.28$
- (b) By about \$176.84 billion per year (c) About \$6117 billion (d) 2035 (e) 0.9952; strong positive correlation. 19. (a)
- 
- Yes

- (b)
- $Y = 615.16x + 26,104$
- ; 0.9516; strong positive correlation

- (c) By about \$615 per year

- (d)
- $Y = 1071.91x + 48,383$
- ; 0.9568; strong positive correlation

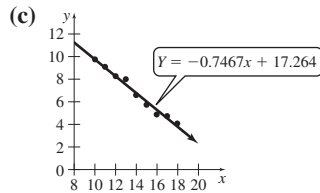
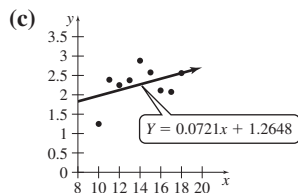
- (e) By about \$1072 per year (f) 2088; 2030

20. (a)
- 

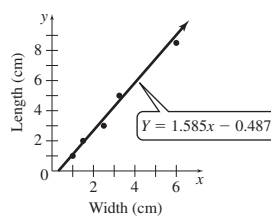
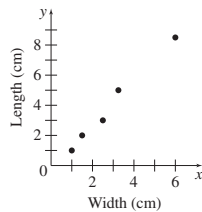
- (b)
- -0.2050
- ; there is a negative correlation between the price and the distance.

- (c) Philadelphia; 0.0006244 (d)
- $Y = 3.964 \times 10^{-5}x + 191.16$
- ;
- 3.964×10^{-5}
- dollars (much less than a penny)

- 21. (a)** $Y = 0.0721x + 1.2648$ **(b)** 0.4298 **22. (a)** $Y = -0.7467x + 17.264$ **(b)** -0.9900

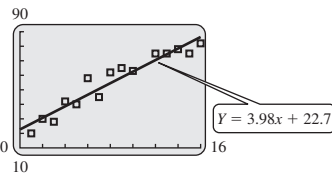
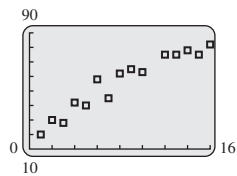


- 23. (a)** Yes **(b)** $Y = 1.585x - 0.487$



- (c)** No; it gives negative values for small widths. **(d)** 0.999

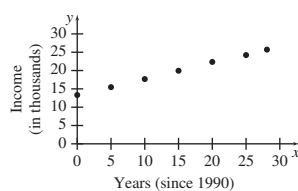
- 24. (a)** 90 **(b)** 0.959, yes **(c)** 90 **25. (a)** $Y = 0.212x - 0.309$



- (b)** 15.2 chirps per second
(c) 86.4°F **(d)** 0.835

- 26. (a)** $Y = -0.06857x + 17.53$ **(b)** 15.1 **(c)** -0.7286 ; fairly strong negative correlation

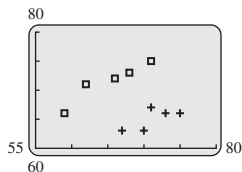
- 27. (a)** Yes **(b)** 0.9998; yes **(c)** $Y = 0.4411x + 13.335$ **(d)** About \$30,979



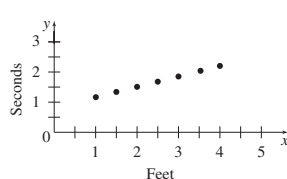
- 28. (a)** $Y = -0.08915x + 74.28$; $r = -0.1035$. The taller the student, the shorter is the ideal partner's height.

- (b)** Females: $Y = 0.6674x + 27.89$; $r = 0.9459$; males: $Y = 0.4348x + 34.04$; $r = 0.7049$

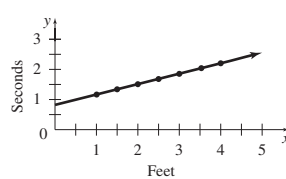
- (c)** 80 **29. (a)** $Y = -0.0067x + 14.75$ **(b)** 12 **(c)** 11 **(d)** -0.13 **(e)** There is no linear relationship.



- 30. (a)**



- (b)**



$Y = 0.366x + 0.803$; the line seems to fit the data.

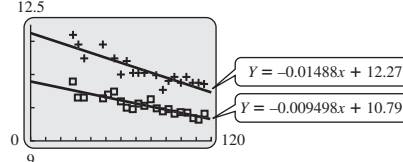
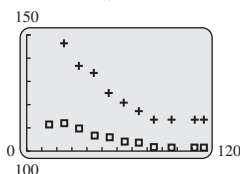
- (c)** $r = 0.995$ indicates a good fit, which confirms the conclusion in part (b).

- 31. (a)** $Y = 14.9x + 2820$ **(b)** 5060, compared to actual 5000; 6990, compared to actual 7000; 9080, compared to actual 9000

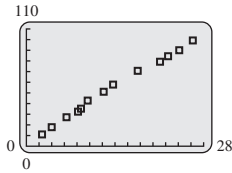
- (c)** 6250 BTUs; 6500 BTU air conditioner **32. (a)** -0.995 ; yes **(b)** $Y = -0.0769x + 5.91$ **(c)** 2.07 points

- 33. (a)** $Y = -0.1178x + 113.10$ **(b)** $Y = -0.3441x + 147.89$ **(c)** $x \approx 154$; the women will catch up to the men in the year 2054. **(d)** $r_{men} = -0.9608$; $r_{women} = -0.9208$; both sets of data points closely fit a line with negative slope.

- (e)** 150 **34. (a)** $Y = -0.009498x + 10.79$ **(b)** $Y = -0.01488x + 12.27$ **(c)** $x \approx 275$; the women will catch up to the men in the year 2175. **(d)** $r_{men} = -0.8834$; $r_{women} = -0.8915$; both sets of data points closely fit a line with negative slope. **(e)**



35. (a) 3.816 miles per hour (b)



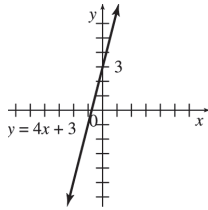
- Yes (c) $Y = 3.714x + 3.809$ 36. (a) 0.5259
 (d) 0.9969; yes (b) 0.2926
 (e) 3.714 miles per hour (c) -0.0956

Chapter 1 Review Exercises (page 42–46)

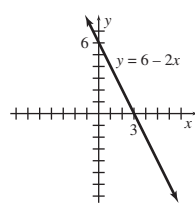
For exercises . . .	1–6, 15–47, 57(a)(b), 63(a)(b)	7–10, 13, 48–56, 59, 62	11, 12, 14, 57(c)(f), 58, 60, 61, 63(c)(e), 64, 65
Refer to section . . .	1	2	3

1. False 2. False 3. True 4. False 5. True 6. False 7. True 8. False 9. False 10. False 11. False
 12. True 14. Σx , Σy , Σxy , Σx^2 , Σy^2 , and n . 15. 1 16. 2 17. $-2/11$ 18. Undefined 19. $-4/3$ 20. 4
 21. 0 22. 0 23. 5 24. $1/5$ 25. $y = (2/3)x - 13/3$ 26. $y = -(1/4)x + 2$ 27. $y = -x - 3$ 28. $y = -(7/5)x - 1/5$
 29. $y = -10$ 30. $y = 5$ 31. $2x - 7 = 10$ 32. $5x - 8y = -40$ 33. $x = -1$ 34. $x = 7$ 35. $y = -5$ 36. $x = -3$

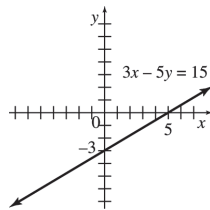
37.



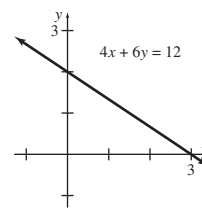
38.



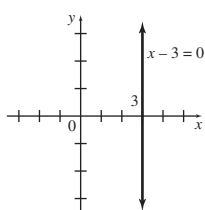
39.



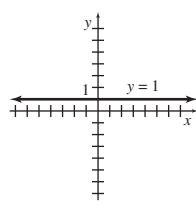
40.



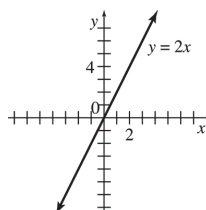
41.



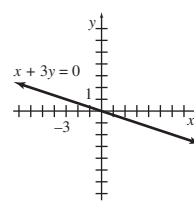
42.



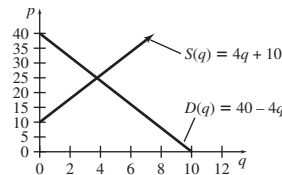
43.



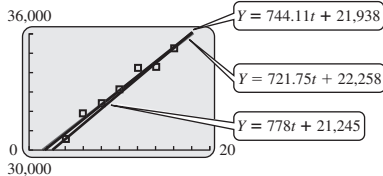
44.



45. (a) $y = 24.4t + 100$ (b) Imports from China are increasing by about \$24.4 billion per year. (c) \$588 billion (d) 2027
 46. (a) $y = 5.78t + 16$ (b) Exports to China are increasing by about \$5.78 billion per year. (c) \$132 billion (d) 2041
 47. (a) $y = 1187t - 76,887$ (b) The median income for all U.S. households is increasing by about \$1187 per year. (c) \$71,488
 (d) 2033 48. (a) 2.5 lb; 5 lb (b) 3.5 lb; 4 lb (c) 5.5 lb; 2 lb (d) (e) \$25 per pound (f) 3.75 lb

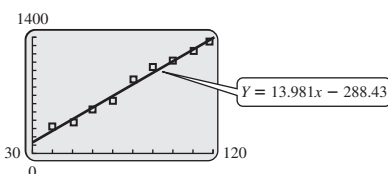


49. (a) $p = S(q) = 0.5q + 10$ (b) $p = D(q) = -0.5q + 72.50$ (c) \$41.25, 62.5 dietary supplement pills
 50. $C(x) = 30x + 60$ 51. $C(x) = 180x + 2000$ 52. $C(x) = 30x + 85$ 53. $C(x) = 46x + 120$ 54. (a) 5 cartons
 (b) \$2000 55. (a) 40 pounds (b) \$280 56. (a) $E(x) = 352 + 42x$ (where x is in thousands) (b) $R(x) = 130x$ (where x is in thousands)
 (c) More than 4000 chips 57. (a) $y = 778t + 21,245$ (b) $y = 721.75t + 22,258$ (c) $y = 744.11t + 21,938$
 (d) 0.9888



58. (a)
- $Y = 13.981x - 288.43$
- (b) \$1459.20

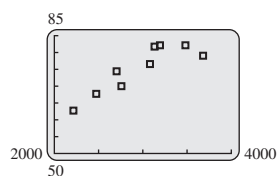
(c)



Yes (d) 0.9928; strong positive correlation

59. (a) $b(t) = -0.725t + 64.5$; $p(t) = -0.075t + 47.8$;
 $c(t) = 0.556t + 54.2$ (b) Beef is decreasing by about 0.725 lb/year;
 pork is decreasing by about 0.075 lb/yr; chicken is increasing by about
 0.556 lb/yr (c) 2009 (d) Beef: 50.0 lb; pork: 46.3 lb; chicken: 65.3 lb

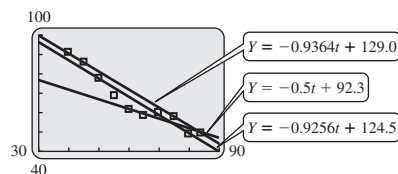
60. (a) 0.8988; yes (b)


Yes (c) $Y = 0.01315t + 35.92$ (d) 81.87

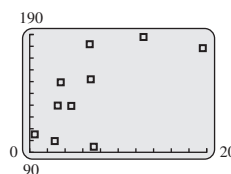
61. (a) $Y = 0.9724x + 31.43$ (b) About 216 (c) 0.93

62. (a) $m(t) = 0.2t + 29.6$ (b) The percent of never-married males is increasing by about 0.2 percent per year. (c) $f(t) = 0.24t + 22.8$

(d) The percent of never-married females is increasing by about 0.24 percent per year. (e) Males: 35.6%; females: 30.0%

63. (a) $y = -0.9364t + 129.0$ (b) $y = -0.5t + 92.3$ (c) $Y = -0.9256t + 124.5$


(e) -0.9614 64. (a) 0.6683; yes, but the fit is not very good. (b)


(c) $Y = 4.159t + 112.78$

(d) \$4159 65. (a) 0.4529

(b) 0.3955 (c) -0.4768

Extended Application: Predicting Life Expectancy (page 46)

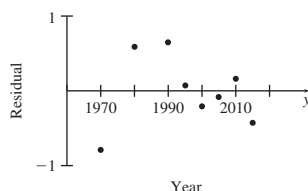
1. $Y = 0.134t - 188.63$

2. 66.09 years

3. The poor prediction isn't surprising, since we were extrapolating far beyond the range of the original data.

5.

x	y	Predicted value	Residual
1970	74.7	75.48	-0.78
1980	77.4	76.82	0.58
1990	78.8	78.16	0.64
1995	78.9	78.83	0.07
2000	79.3	79.50	-0.20
2005	80.1	80.17	-0.07
2010	81.0	80.84	0.16
2015	81.1	81.51	-0.41



6. You'll get 0 slope and 0 intercept, because you've already subtracted out the linear component of the data.

7. A cubic would fit the data: $Y = 0.0001052x^3 - 0.6303x^2 + 12.5936x - 838,720.8$.

Chapter 2 Nonlinear Functions

Exercises 2.1 (page 58–62)

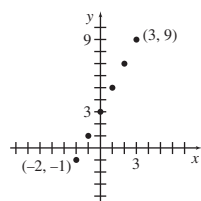
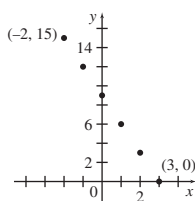
For exercises . . .	5–12	13–20	21–36	37–44	45–60, 82,83	61–66	67–74	75,76,81	77–80	84,85
Refer to example . . .	2,3	4(b)	4(a),(c)–(e)	3(d)	5	6	7	1	8	9

W1. $3/2, -3/2$ W2. $1/2, -5$ W3. $[-4, 4]$ W4. $(-\infty, -4] \cup [7, \infty)$

1. False 2. False 3. False 4. True

5. Not a function 6. Function 7. Function 8. Not a function 9. Function 10. Function 11. Not a function

12. Not a function

13. $(-2, -1), (-1, 1), (0, 3), (1, 5), (2, 7), (3, 9)$; range: $\{-1, 1, 3, 5, 7, 9\}$

14. $(-2, 15), (-1, 12), (0, 9), (1, 6), (2, 3), (3, 0)$; range: $\{0, 3, 6, 9, 12, 15\}$

15. $(-2, 3/2), (-1, 2), (0, 5/2), (1, 3), (2, 7/2), (3, 4)$; range: $\{3/2, 2, 5/2, 3, 7/2, 4\}$
