Solutions for Calculus with Applications Brief Version 12th Edition by Lial

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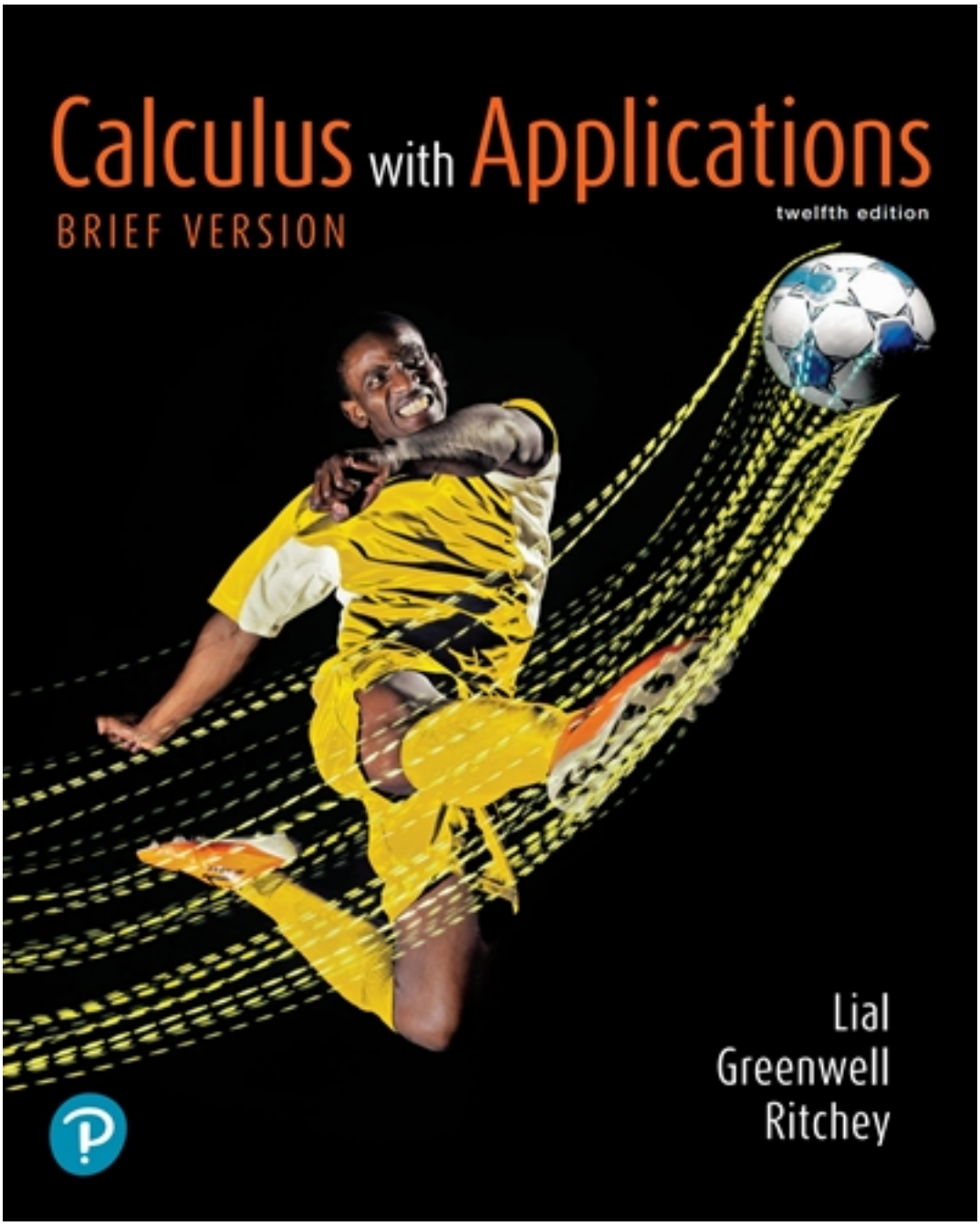


Solutions

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)

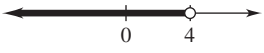
For exercises . . .	1–8	9–26	27–37
Refer to example . . .	2	3–5	6,7

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

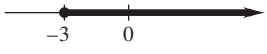
Exercises R.5 (page R-22)

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. $(-\infty, 4)$



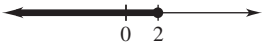
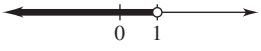
2. $[-3, \infty)$

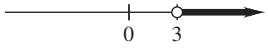
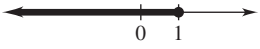


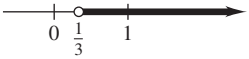
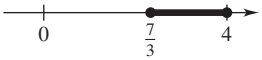
3. $[1, 2)$

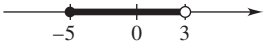
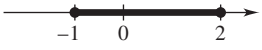
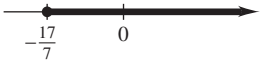
4. $[-2, 3]$  **5.** $(-\infty, -9)$  **6.** $[6, \infty)$ 

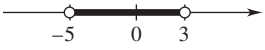
7. $-7 \le x \le -3$ **8.** $4 \le x < 10$ **9.** $x \le -1$ **10.** $x > 3$ **11.** $-2 \le x < 6$ **12.** $0 < x < 8$ **13.** $x \le -4$ or $x \ge 4$

14. $x < 0$ or $x \ge 3$ **15.** $(-\infty, 2]$  **16.** $(-\infty, 1)$ 

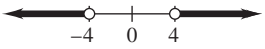
17. $(3, \infty)$  **18.** $(-\infty, 1]$  **19.** $(1/5, \infty)$ 

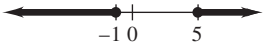
20. $(1/3, \infty)$  **21.** $(-4, 6)$  **22.** $[7/3, 4]$ 

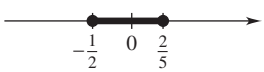
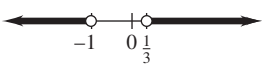
23. $[-5, 3)$  **24.** $[-1, 2]$  **25.** $[-17/7, \infty)$ 

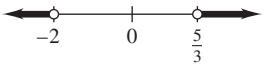
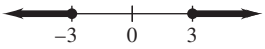
26. $(-\infty, 50/9]$  **27.** $(-5, 3)$ 

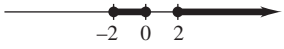
28. $(-\infty, -6] \cup [1, \infty)$  **29.** $(1, 2)$ 

30. $(-\infty, -4) \cup (1/2, \infty)$  **31.** $(-\infty, -4) \cup (4, \infty)$ 

32. $[-3/2, 5]$  **33.** $(-\infty, -1] \cup [5, \infty)$ 

34. $[-1/2, 2/5]$  **35.** $(-\infty, -1) \cup (1/3, \infty)$ 

36. $(-\infty, -2) \cup (5/3, \infty)$  **37.** $(-\infty, -3] \cup [3, \infty)$ 

38. $(-\infty, 0) \cup (16, \infty)$  **39.** $[-2, 0] \cup [2, \infty)$ 

40. $(-\infty, -4] \cup [-3, 0]$  **41.** $(-\infty, 0) \cup (1, 6)$ 

42. $(-1, 0) \cup (4, \infty)$  **43.** $(-5, 3]$ **44.** $(-\infty, -1) \cup (1, \infty)$ **45.** $(-\infty, -2)$

46. $(-2, 3/2)$ **47.** $[-8, 5)$ **48.** $(-\infty, -3/2) \cup [-13/9, \infty)$ **49.** $[2, 3)$ **50.** $(-\infty, -1)$ **51.** $(-2, 0] \cup (3, \infty)$
52. $(-4, -2) \cup (0, 2)$ **53.** $(1, 3/2]$ **54.** $(-\infty, -2) \cup (-2, 2) \cup [4, \infty)$

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

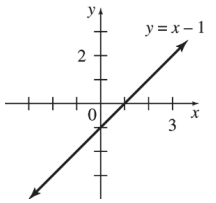
1. 5 **2.** 6 **3.** -5 **4.** $5\sqrt{2}$ **5.** $20\sqrt{5}$ **6.** $4y^2\sqrt{2y}$ **7.** 9 **8.** 8
9. $7\sqrt{2}$ **10.** $9\sqrt{3}$ **11.** $9\sqrt{7}$ **12.** $-2\sqrt{7}$ **13.** $5\sqrt[3]{2}$ **14.** $3\sqrt[3]{5}$ **15.** $xyz^2\sqrt{2x}$ **16.** $4r^3s^4t^6\sqrt{10rs}$ **17.** $4xy^2z^3\sqrt[3]{2y^2}$
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.** $2/[p + \sqrt{p(p - 2)}]$

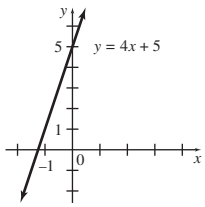
Chapter 1 Linear Functions

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

49.


50.


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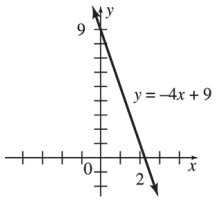

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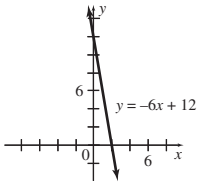

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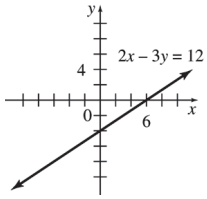

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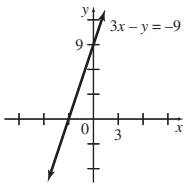

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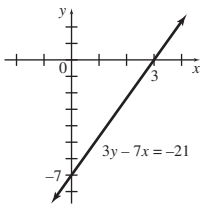

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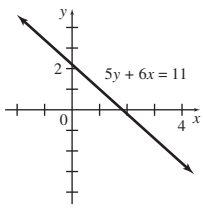

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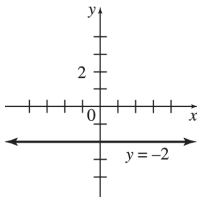

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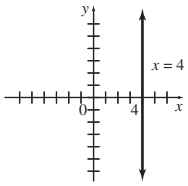

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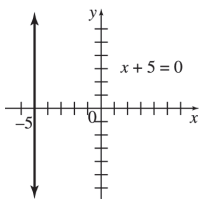

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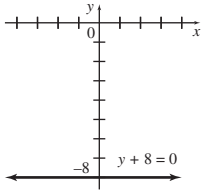

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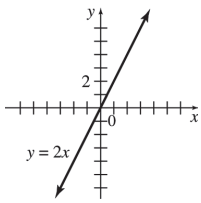

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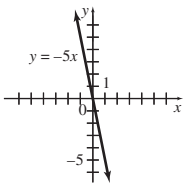
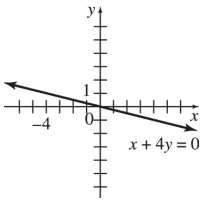
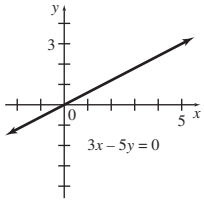
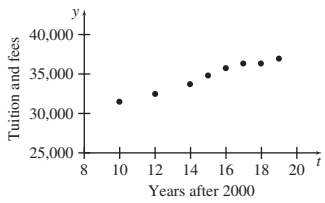


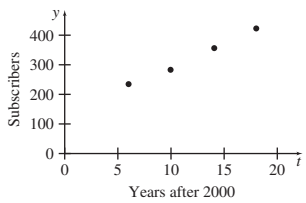
63.


64.


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)**


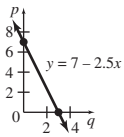
The number of subscribers appears to be increasing at a nearly linear rate.
(b) $y = 15.729t + 138.67$ **(c)** $y = 15.688t + 139.42$
(e) 390.33 million; 390.43 million

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)

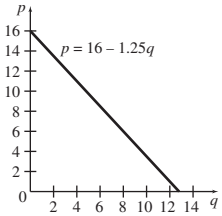
For exercises . . .	9–18	23–26	27–30,41,42,49,50	31–36	37–40,43–48	51–53
Refer to example . . .	1	4	5,6	2,3	7	8

W1. 60 **W2.**

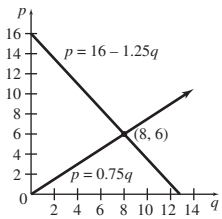


1. True **2.** False **3.** True **4.** True **5.** False **6.** True **7.** True **8.** True **9.** -3 **10.** -13 **11.** 22 **12.** 12 **13.** 0 **14.** 2 **15.** -4 **16.** $-9/2$ **17.** $7 - 5t$ **18.** $2k^2 - 3$ **23.** If $R(x)$ is the cost of renting a snowboard for x hours, then $R(x) = 2.25x + 10$. **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)



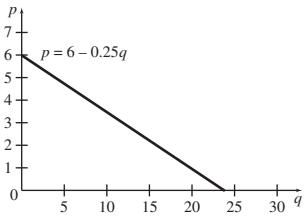
(h) 0 watches **(i)** About 1333 watches **(j)** About 2667 watches **(k)**



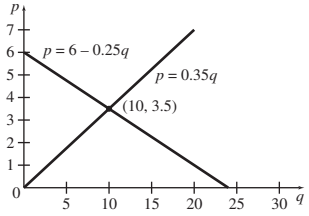
(l) 800 watches, \$6

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

(g)

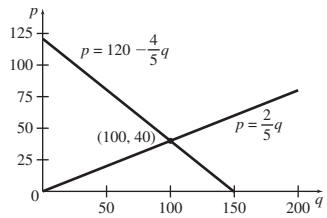


(h) 0 quarts **(i)** 800 quarts **(j)** 1800 quarts **(k)**

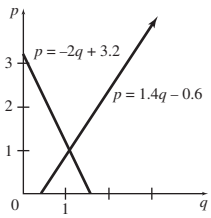


(l) 1000 quarts; \$3.50

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

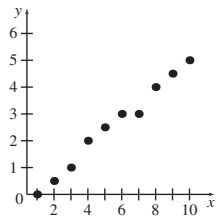
49. **(a)** About 23 acorns per square meter **(b)** 34; the number of deer tick larvae per 400 squares meters in the spring will increase by 34 for each additional acorn per square meter in the preceding fall. **50.** **(a)** $f_t(t) = 2.8t + 35$ **(b)** $f_d(t) = -2.2t + 100$ **(c)** 2003 **51.** **(a)** 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)

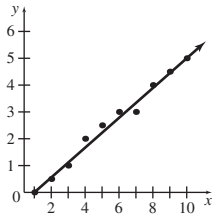
For exercises . . .	7(b),8,11(a), 14(d),15(d), 16(e),17(e),18(e), 20(b),21(b),22(b), 23(d), 24(b),25(d), 26(c),27(b),29(d), 30(c),32(a),33(d), 34(d),35(d),36	7(c),14(a),15(a), 16(a),17(a),18(a), 20(c),21(a)(c), 22(a)(c), 23(b),24(c), 25(a),26(a),27(c), 29(a),30(b),31(a), 32(b),33(a)(b), 34(a)(b),35(c)	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)**

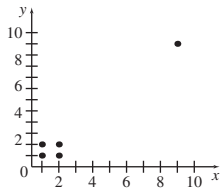


(b) 0.993 **(c)** $Y = 0.555x - 0.5$

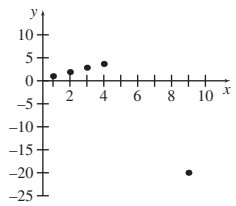


(d) 5.6

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.

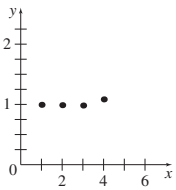


10. **(a)** $Y = -2.887x + 8.969$; −0.8880 **(b)** $Y = x$; 1 **(c)**

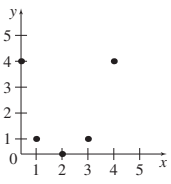


The point (9, −20) is an outlier that has a strong effect on the least squares line and the correlation coefficient.

11. **(a)** 0.7746 **(b)**



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

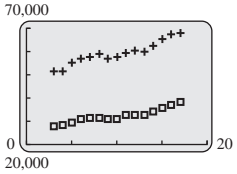
15. **(a)** $Y = -0.2333x + 8.872$ **(b)** About 2900 **(c)** 2030 **(d)** −0.9991; strong negative correlation

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

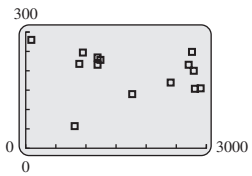
18. **(a)** $Y = 176.84x + 812.28$ **(b)** By about \$176.84 billion per year **(c)** About \$6117 billion **(d)** 2035 **(e)** 0.9952; strong positive correlation.

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

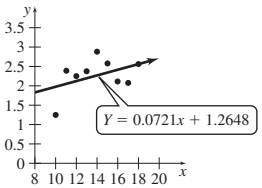
20. **(a)**



No **(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)

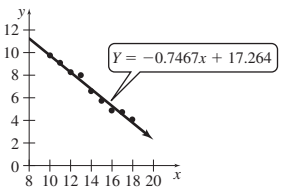
21. **(a)** $Y = 0.0721x + 1.2648$ **(b)** 0.4298

(c)

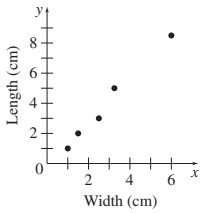


22. **(a)** $Y = -0.7467x + 17.264$ **(b)** -0.9900

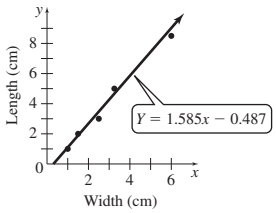
(c)



23. **(a)**

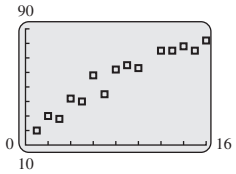


Yes **(b)** $Y = 1.585x - 0.487$

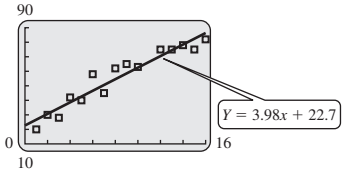


(c) No; it gives negative values for small widths. **(d)** 0.999

24. **(a)**



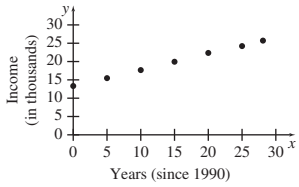
(b) 0.959, yes **(c)**



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

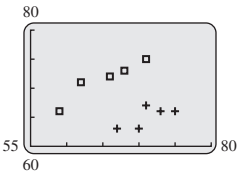
27. **(a)**



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

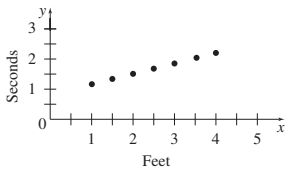
28. **(a)** $Y = -0.08915x + 74.28$; $r = -0.1035$. The taller the student, the shorter is the ideal partner's height.
(b) Females: $Y = 0.6674x + 27.89$; $r = 0.9459$; males: $Y = 0.4348x + 34.04$; $r = 0.7049$

(c)

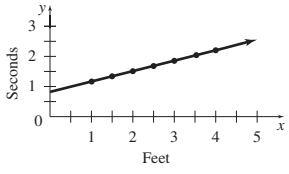


29. **(a)** $Y = -0.0067x + 14.75$ **(b)** 12 **(c)** 11 **(d)** -0.13 **(e)** There is no linear relationship.

30. **(a)**



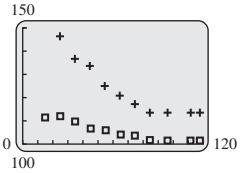
(b)



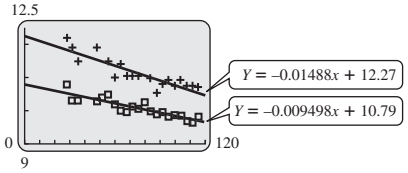
$Y = 0.366x + 0.803$; the line seems to fit the data.
(c) $r = 0.995$ indicates a good fit, which confirms the conclusion in part (b).

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.

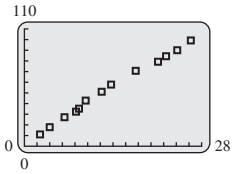
(e)



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)** $Y = 3.714x + 3.809$ **(d)** 0.9969; yes **(e)** 3.714 miles per hour

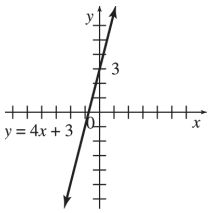
36. **(a)** 0.5259 **(b)** 0.2926 **(c)** −0.0956

Chapter 1 Review Exercises (page 42–46)

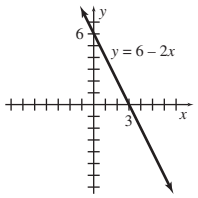
For exercises . . .	1–6,15–47,57(a)(b), 63(a)(b)	7–10,13, 48–56,59,62	11,12,14,57(c)(f),58, 60,61,63(c)(e),64,65
Refer to section . . .	1	2	3

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.** $x = -3$

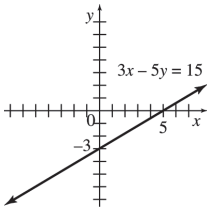
37.



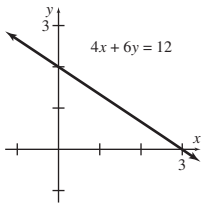
38.



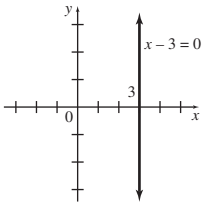
39.



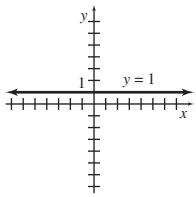
40.



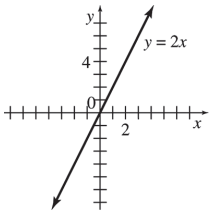
41.



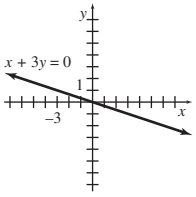
42.



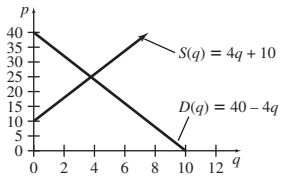
43.



44.

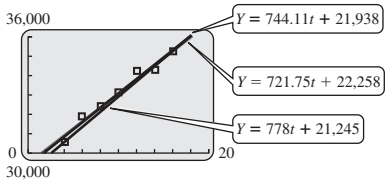


45. **(a)** $y = 24.4t + 100$ **(b)** Imports from China are increasing by about $24.4 billion per year. **(c)** $588 billion **(d)** 2027
46. **(a)** $y = 5.78t + 16$ **(b)** Exports to China are increasing by about $5.78 billion per year. **(c)** $132 billion **(d)** 2041
47. **(a)** $y = 1187t - 76{,}887$ **(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)**



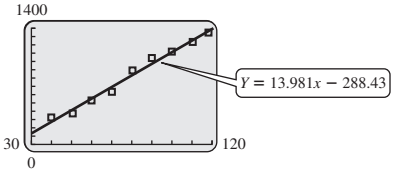
(e) $25 per pound **(f)** 3.75 lb

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)



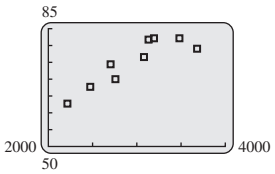
(f) 0.9888

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)**

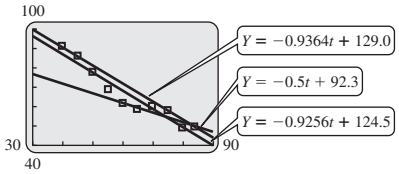


Yes **(c)** $Y = 0.01315t + 35.92$ **(d)** 81.87

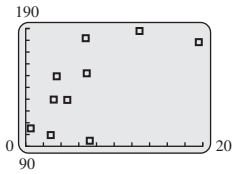
61. **(a)** $Y = 0.9724x + 31.43$ **(b)** About 216 **(c)** 0.93

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)

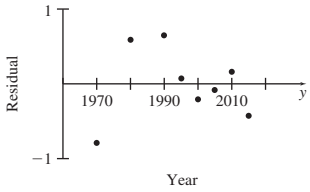
1. $Y = 0.134t - 188.63$

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

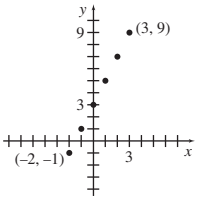
W1. 3/2, −3/2 **W2.** 1/2, −5 **W3.** $[-4, 4]$ **W4.** $(-\infty, -4] \cup [7, \infty)$

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

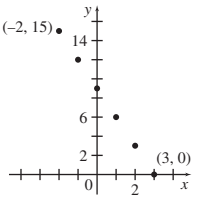
5. Not a function **6.** Function **7.** Function **8.** Not a function **9.** Function **10.** Function **11.** Not a function

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: $\{3/2, 2, 5/2, 3, 7/2, 4\}$