

A

Selected Answers

- 1.1.1. $(2/3)x + (1/3)$
- 1.1.2. $y = -2x$
- 1.1.3. $(-2/3)x + (1/3)$
- 1.1.4. $y = 2x + 2, 2, -1$
- 1.1.5. $y = -x + 6, 6, 6$
- 1.1.6. $y = x/2 + 1/2, 1/2, -1$
- 1.1.7. $y = 3/2$, y -intercept: $3/2$, no x -intercept
- 1.1.8. $y = (-2/3)x - 2, -2, -3$
- 1.1.9. yes
- 1.1.10. $y = 0, y = -2x + 2, y = 2x + 2$
- 1.1.11. $y = 75t$ (t in hours); 164 minutes
- 1.1.12. $y = (9/5)x + 32, (-40, -40)$
- 1.1.13. $y = 0.15x + 10$
- 1.1.14. $0.03x + 1.2$
- 1.1.15. (a) $y = \begin{cases} 0 & 0 \leq x < 100 \\ (x/10) - 10 & 100 \leq x \leq 1000 \\ x - 910 & 1000 < x \end{cases}$
- 1.1.16. $y = \begin{cases} 0.15x & 0 \leq x \leq 19450 \\ 0.28x - 2528.50 & 19450 < x \leq 47050 \\ 0.33x - 4881 & 47050 < x \leq 97620 \end{cases}$
- 1.1.17. (a) $P = -0.0001x + 2$
(b) $x = -10000P + 20000$
- 1.1.18. $(2/25)x - (16/5)$
- 1.2.1. (a) $x^2 + y^2 = 9$
(b) $(x - 5)^2 + (y - 6)^2 = 9$
(c) $(x + 5)^2 + (y + 6)^2 = 9$
(d) $x^2 + (y - 3)^2 = 9$
(e) $x^2 + (y + 3)^2 = 9$
(f) $(x - 3)^2 + y^2 = 9$
- 1.2.2. (a) $\Delta x = 2, \Delta y = 3, m = 3/2,$
 $y = (3/2)x - 3, \sqrt{13}$
(b) $\Delta x = -1, \Delta y = 3, m = -3,$
 $y = -3x + 2, \sqrt{10}$
(c) $\Delta x = -2, \Delta y = -2, m = 1,$
 $y = x, \sqrt{8}$
- 1.2.6. $(x + 2/7)^2 + (y - 41/7)^2 = 1300/49$
- 1.3.1. $\{x \mid x \geq 3/2\}$
- 1.3.2. $\{x \mid x \neq -1\}$
- 1.3.3. $\{x \mid x \neq 1 \text{ and } x \neq -1\}$
- 1.3.4. $\{x \mid x < 0\}$
- 1.3.5. $\{x \mid x \in \mathbb{R}\}$, i.e., all x
- 1.3.6. $\{x \mid x \geq 0\}$
- 1.3.7. $\{x \mid h - r \leq x \leq h + r\}$
- 1.3.8. $\{x \mid x \geq 1 \text{ or } x < 0\}$
- 1.3.9. $\{x \mid -1/3 < x < 1/3\}$
- 1.3.10. $\{x \mid x \geq 0 \text{ and } x \neq 1\}$
- 1.3.11. $\{x \mid x \geq 0 \text{ and } x \neq 1\}$
- 1.3.12. \mathbb{R}
- 1.3.13. $\{x \mid x \geq 3\}, \{x \mid x \geq 0\}$
- 1.3.14. $A = x(500 - 2x), \{x \mid 0 \leq x \leq 250\}$
- 1.3.15. $V = r(50 - \pi r^2), \{r \mid 0 < r \leq \sqrt{50/\pi}\}$
- 1.3.16. $A = 2\pi r^2 + 2000/r, \{r \mid 0 < r < \infty\}$
- 2.1.1. $-5, -2.47106145, -2.4067927, -2.400676, -2.4$
- 2.1.2. $-4/3, -24/7, 7/24, 3/4$
- 2.1.3. $-0.107526881, -0.11074197, -0.1110741, \frac{-1}{3(3 + \Delta x)} \rightarrow \frac{-1}{9}$
- 2.1.4. $\frac{3 + 3\Delta x + \Delta x^2}{1 + \Delta x} \rightarrow 3$
- 2.1.5. $3.31, 3.003001, 3.0000, 3 + 3\Delta x + \Delta x^2 \rightarrow 3$
- 2.1.6. m
- 2.2.1. $10, 25/2, 20, 15, 25, 35.$
- 2.2.2. $5, 4.1, 4.01, 4.001, 4 + \Delta t \rightarrow 4$
- 2.2.3. $-10.29, -9.849, -9.8049, -9.8 - 4.9\Delta t \rightarrow -9.8$
- 2.3.1. 7
- 2.3.2. 5
- 2.3.3. 0
- 2.3.4. undefined
- 2.3.5. $1/6$
- 2.3.6. 0
- 2.3.7. 3
- 2.3.8. 172
- 2.3.9. 0
- 2.3.10. 2
- 2.3.11. does not exist
- 2.3.12. $\sqrt{2}$
- 2.3.13. $3a^2$
- 2.3.14. 512
- 2.3.15. -4
- 2.3.16. 0
- 2.3.18. (a) 8, (b) 6, (c) dne, (d) -2 , (e) -1 , (f) 8, (g) 7, (h) 6, (i) 3, (j) $-3/2$, (k) 6, (l) 2
- 2.4.1. $-x/\sqrt{169 - x^2}$
- 2.4.2. $-9.8t$
- 2.4.3. $2x + 1/x^2$
- 2.4.4. $2ax + b$
- 2.4.5. $3x^2$
- 2.4.8. $-2/(2x + 1)^{3/2}$
- 2.4.9. $5/(t + 2)^2$
- 2.4.10. $y = -13x + 17$
- 2.4.11. -8
- 2.5.2. Yes; $M = 1$
- 2.5.3. Yes; $M = 1$
- 2.5.4. No
- 2.5.5. No
- 2.5.6. -0.5 or 1.3 or 3.2
- 2.5.7. 0.2 or 1.3
- 3.1.1. $100x^{99}$

- 3.1.2.** $-100x^{-101}$
3.1.3. $-5x^{-6}$
3.1.4. $\pi x^{\pi-1}$
3.1.5. $(3/4)x^{-1/4}$
3.1.6. $-(9/7)x^{-16/7}$
3.2.1. $15x^2 + 24x$
3.2.2. $-20x^4 + 6x + 10/x^3$
3.2.3. $-30x + 25$
3.2.4. $6x^2 + 2x - 8$
3.2.5. $3x^2 + 6x - 1$
3.2.6. $9x^2 - x/\sqrt{625 - x^2}$
3.2.7. $y = 13x/4 + 5$
3.2.8. $y = 24x - 48 - \pi^3$
3.2.9. $-49t/5 + 5, -49/5$
3.2.11. $\sum_{k=1}^n ka_k x^{k-1}$
3.2.12. $x^3/16 - 3x/4 + 4$
3.3.1. $3x^2(x^3 - 5x + 10) + x^3(3x^2 - 5)$
3.3.2. $(x^2 + 5x - 3)(5x^4 - 18x^2 + 6x - 7) + (2x + 5)(x^5 - 6x^3 + 3x^2 - 7x + 1)$
3.3.3. $\frac{\sqrt{625 - x^2}}{2\sqrt{x}} - \frac{x\sqrt{x}}{\sqrt{625 - x^2}}$
3.3.4. $\frac{-1}{x^{19}\sqrt{625 - x^2}} - \frac{20\sqrt{625 - x^2}}{x^{21}}$
3.3.5. $f' = 4(2x - 3), y = 4x - 7$
3.4.1. $\frac{3x^2}{x^3 - 5x + 10} - \frac{x^3(3x^2 - 5)}{(x^3 - 5x + 10)^2}$
3.4.2. $\frac{2x + 5}{x^5 - 6x^3 + 3x^2 - 7x + 1} - \frac{(x^2 + 5x - 3)(5x^4 - 18x^2 + 6x - 7)}{(x^5 - 6x^3 + 3x^2 - 7x + 1)^2}$
3.4.3. $\frac{1}{2\sqrt{x}\sqrt{625 - x^2}} + \frac{x^{3/2}}{(625 - x^2)^{3/2}}$
3.4.4. $\frac{-1}{x^{19}\sqrt{625 - x^2}} - \frac{20\sqrt{625 - x^2}}{x^{21}}$
3.4.5. $y = 17x/4 - 41/4$
3.4.6. $y = 11x/16 - 15/16$
3.4.8. $y = 19/169 - 5x/338$
3.4.9. $13/18$
3.5.1. $4x^3 - 9x^2 + x + 7$
3.5.2. $3x^2 - 4x + 2/\sqrt{x}$
3.5.3. $6(x^2 + 1)^2x$
3.5.4. $\sqrt{169 - x^2} - x^2/\sqrt{169 - x^2}$
3.5.5. $\frac{(2x - 4)\sqrt{25 - x^2} - (x^2 - 4x + 5)x/\sqrt{25 - x^2}}{(x^2 - 4x + 5)x/\sqrt{25 - x^2}}$
3.5.6. $-x/\sqrt{r^2 - x^2}$
3.5.7. $2x^3/\sqrt{1 + x^4}$
3.5.8. $\frac{1}{4\sqrt{x}(5 - \sqrt{x})^{3/2}}$
3.5.9. $6 + 18x$
3.5.10. $\frac{2x + 1}{1 - x} + \frac{x^2 + x + 1}{(1 - x)^2}$
3.5.11. $-1/\sqrt{25 - x^2} - \sqrt{25 - x^2}/x^2$
3.5.12. $\frac{1}{2} \left(\frac{-169}{x^2} - 1 \right) / \sqrt{\frac{169}{x} - x}$
3.5.13. $\frac{3x^2 - 2x + 1/x^2}{2\sqrt{x^3 - x^2 - (1/x)}}$
3.5.14. $\frac{300x}{(100 - x^2)^{5/2}}$
3.5.15. $\frac{1 + 3x^2}{3(x + x^3)^{2/3}}$
3.5.16. $\left(4x(x^2 + 1) + \frac{4x^3 + 4x}{2\sqrt{1 + (x^2 + 1)^2}} \right) / 2\sqrt{(x^2 + 1)^2 + \sqrt{1 + (x^2 + 1)^2}}$
3.5.17. $5(x + 8)^4$
3.5.18. $-3(4 - x)^2$
3.5.19. $6x(x^2 + 5)^2$
3.5.20. $-12x(6 - 2x^2)^2$
3.5.21. $24x^2(1 - 4x^3)^{-3}$
3.5.22. $5 + 5/x^2$
3.5.23. $-8(4x - 1)(2x^2 - x + 3)^{-3}$
3.5.24. $1/(x + 1)^2$
3.5.25. $3(8x - 2)/(4x^2 - 2x + 1)^2$
3.5.26. $-3x^2 + 5x - 1$
3.5.27. $6x(2x - 4)^3 + 6(3x^2 + 1)(2x - 4)^2$
3.5.28. $-2/(x - 1)^2$
3.5.29. $4x/(x^2 + 1)^2$
3.5.30. $(x^2 - 6x + 7)/(x - 3)^2$
3.5.31. $-5/(3x - 4)^2$
3.5.32. $60x^4 + 72x^3 + 18x^2 + 18x - 6$
3.5.33. $(5 - 4x)/((2x + 1)^2(x - 3)^2)$
3.5.34. $1/(2(2 + 3x)^2)$
3.5.35. $56x^6 + 72x^5 + 110x^4 + 100x^3 + 60x^2 + 28x + 6$
3.5.36. $y = 23x/96 - 29/96$
3.5.37. $y = 3 - 2x/3$
3.5.38. $y = 13x/2 - 23/2$
3.5.39. $y = 2x - 11$
3.5.40. $y = \frac{20 + 2\sqrt{5}}{5\sqrt{4 + \sqrt{5}}}x + \frac{3\sqrt{5}}{5\sqrt{4 + \sqrt{5}}}$
4.1.1. $2n\pi - \pi/2$, any integer n
4.1.2. $n\pi \pm \pi/6$, any integer n
4.1.3. $(\sqrt{2} + \sqrt{6})/4$
4.1.4. $-(1 + \sqrt{3})/(1 - \sqrt{3}) = 2 + \sqrt{3}$
4.1.11. $t = \pi/2$
4.3.1. 5
4.3.2. $7/2$
4.3.3. $3/4$
4.3.4. 1
4.3.5. $-\sqrt{2}/2$
4.3.6. 7
4.3.7. 2
4.4.1. $\sin(\sqrt{x})\cos(\sqrt{x})/\sqrt{x}$
4.4.2. $\frac{\sin x}{2\sqrt{x}} + \sqrt{x}\cos x$
4.4.3. $\frac{-\cos x}{\sin^2 x}$
4.4.4. $\frac{(2x + 1)\sin x - (x^2 + x)\cos x}{\sin^2 x}$
4.4.5. $\frac{-\sin x \cos x}{\sqrt{1 - \sin^2 x}}$
4.5.1. $\cos^2 x - \sin^2 x$
4.5.2. $-\sin x \cos(\cos x)$
4.5.3. $\frac{\tan x + x \sec^2 x}{2\sqrt{x} \tan x}$
4.5.4. $\frac{\sec^2 x(1 + \sin x) - \tan x \cos x}{(1 + \sin x)^2}$
4.5.5. $-\csc^2 x$
4.5.6. $-\csc x \cot x$
4.5.7. $3x^2 \sin(23x^2) + 46x^4 \cos(23x^2)$
4.5.8. 0
4.5.9. $-6 \cos(\cos(6x)) \sin(6x)$
4.5.10. $\frac{\sec \theta \tan \theta}{(1 + \sec \theta)^2} = \frac{\sin \theta}{(\cos \theta + 1)^2}$
4.5.11. $5t^4 \cos(6t) - 6t^5 \sin(6t)$
4.5.12. $3t^2(\sin(3t) + t \cos(3t))/\cos(2t) + 2t^3 \sin(3t) \sin(2t)/\cos^2(2t)$
4.5.13. $n\pi/2$, any integer n
4.5.14. $\pi/2 + n\pi$, any integer n
4.5.15. $y = \sqrt{3}x/2 + 3/4 - \sqrt{3}\pi/6$
4.5.16. $y = 8\sqrt{3}x + 4 - 8\sqrt{3}\pi/3$
4.5.17. $y = 3\sqrt{3}x/2 - \sqrt{3}\pi/4$

- 4.5.18. $\pi/6 + 2n\pi, 5\pi/6 + 2n\pi$, any integer n
- 4.6.1. $7 \log_{10}(x + 45) + \log_{10}(x - 2)$
- 4.6.2. $3 \log_2 x - \log_2(3x - 5 + (7/x))$
- 4.6.3. $\log_2(3x(x - 2)^{17}/(x^2 + 4x + 1)^2)$
- 4.6.4. 63^2
- 4.6.5. $\pm\sqrt{3}$
- 4.6.6. 9
- 4.7.1. $2 \ln(3)x3^{x^2}$
- 4.7.2. $\frac{\cos x - \sin x}{e^x}$
- 4.7.3. $2e^{2x}$
- 4.7.4. $e^x \cos(e^x)$
- 4.7.5. $\cos(x)e^{\sin x}$
- 4.7.6. $x^{\sin x} \left(\cos x \ln x + \frac{\sin x}{x} \right)$
- 4.7.7. $3x^2 e^x + x^3 e^x$
- 4.7.8. $1 + 2^x \ln(2)$
- 4.7.9. $-2x \ln(3)(1/3)^{x^2}$
- 4.7.10. $e^{4x}(4x - 1)/x^2$
- 4.7.11. $(3x^2 + 3)/(x^3 + 3x)$
- 4.7.12. $-\tan(x)$
- 4.7.13. $(1 - \ln(x^2))/(x^2 \sqrt{\ln(x^2)})$
- 4.7.14. $\sec(x)$
- 4.7.15. $x^{\cos(x)}(\cos(x)/x - \sin(x) \ln(x))$
- 4.7.16. $\ln x + 1$
- 4.7.17. $1/(\ln(3x))$
- 4.7.18. $\frac{1 + \ln(16/3)}{x(1 + \ln(4x))^2}$
- 4.7.19. $\frac{-22x^3 + 537x^2 + 276x}{13824(2x - 3)^9 \sqrt{x - 23}}$
- 4.7.20. e
- 4.7.21. $3e^{2/3}/(e + 2)$
- 4.8.1. x/y

- 4.8.2. $-(2x + y)/(x + 2y)$
- 4.8.3. $(2xy - 3x^2 - y^2)/(2xy - 3y^2 - x^2)$
- 4.8.4. $\sin(x) \sin(y)/(\cos(x) \cos(y))$
- 4.8.5. $-\sqrt{y}/\sqrt{x}$
- 4.8.6. $(y \sec^2(x/y) - y^2)/(x \sec^2(x/y) + y^2)$
- 4.8.7. $(y - \cos(x + y))/(\cos(x + y) - x)$
- 4.8.8. $-y^2/x^2$
- 4.8.9. 1
- 4.8.12. $y = 2x \pm 6$
- 4.8.13. $y = x/2 \pm 3$
- 4.8.14. $(\sqrt{3}, 2\sqrt{3}), (-\sqrt{3}, -2\sqrt{3}),$
 $(2\sqrt{3}, \sqrt{3}), (-2\sqrt{3}, -\sqrt{3})$
- 4.8.15. $y = 7x/\sqrt{3} - 8/\sqrt{3}$
- 4.8.16. $y = (-y_1^{1/3}x + y_1^{1/3}x_1 + x_1^{1/3}y_1)/x_1^{1/3}$
- 4.8.17. $(y - y_1) = \frac{(x_1 - 2x_1^3 - 2x_1y_1^2)}{(y_1 + 2y_1^3 + 2y_1x_1^2)}(x - x_1)$
- 4.9.3. $\frac{-1}{1 + x^2}$
- 4.9.5. $\frac{2x}{\sqrt{1 - x^4}}$
- 4.9.6. $\frac{e^x}{1 + e^{2x}}$
- 4.9.7. $-3x^2 \cos(x^3)/\sqrt{1 - \sin^2(x^3)}$
- 4.9.8. $\frac{2}{(\arcsin x)\sqrt{1 - x^2}}$
- 4.9.9. $-e^x/\sqrt{1 - e^{2x}}$
- 4.9.10. 0
- 4.9.11. $\frac{(1 + \ln x)x^x}{\ln 5(1 + x^{2x}) \arctan(x^x)}$
- 4.10.1. 0
- 4.10.2. ∞
- 4.10.3. 1

- 4.10.4. 0
- 4.10.5. 0
- 4.10.6. 1
- 4.10.7. $1/6$
- 4.10.8. $-\infty$
- 4.10.9. $1/16$
- 4.10.10. $1/3$
- 4.10.11. 0
- 4.10.12. $3/2$
- 4.10.13. $-1/4$
- 4.10.14. -3
- 4.10.15. $1/2$
- 4.10.16. 0
- 4.10.17. -1
- 4.10.18. $-1/2$
- 4.10.19. 5
- 4.10.20. ∞
- 4.10.21. ∞
- 4.10.22. $2/7$
- 4.10.23. 2
- 4.10.24. $-\infty$
- 4.10.25. 1
- 4.10.26. 1
- 4.10.27. 2
- 4.10.28. 1
- 4.10.29. 0
- 4.10.30. $1/2$
- 4.10.31. 2
- 4.10.32. 0
- 4.10.33. ∞
- 4.10.34. $1/2$
- 4.10.35. 0
- 4.10.36. $1/2$
- 4.10.37. 5
- 4.10.38. $2\sqrt{2}$
- 4.10.39. $-1/2$
- 4.10.40. 2
- 4.10.41. 0
- 4.10.42. ∞
- 4.10.43. 0
- 4.10.44. $3/2$
- 4.10.45. ∞
- 4.10.46. 5
- 4.10.47. $-1/2$
- 4.10.48. does not exist
- 4.10.49. ∞
- 4.10.50. $y = 1$ and $y = -1$
- 4.11.2. $\infty, \infty, 1, 0$
- 5.1.1. min at $x = 1/2$
- 5.1.2. min at $x = -1$, max at $x = 1$
- 5.1.3. max at $x = 2$, min at $x = 4$
- 5.1.4. min at $x = \pm 1$, max at $x = 0$.
- 5.1.5. min at $x = 1$
- 5.1.6. none
- 5.1.7. none
- 5.1.8. min at $x = 7\pi/12 + k\pi$, max at $x = -\pi/12 + k\pi$, for integer k .
- 5.1.9. none
- 5.1.10. local max at $x = 5$
- 5.1.11. local min at $x = 49$
- 5.1.12. local min at $x = 0$
- 5.1.13. Local min of 1 at every point of $[0, 1]$, local max of 1 at every point of $(0, 1)$.

- 5.1.16. one
- 5.2.1. min at $x = 1/2$
- 5.2.2. min at $x = -1$, max at $x = 1$
- 5.2.3. max at $x = 2$, min at $x = 4$
- 5.2.4. min at $x = \pm 1$, max at $x = 0$.
- 5.2.5. min at $x = 1$
- 5.2.6. none
- 5.2.7. none
- 5.2.8. min at $x = 7\pi/12 + k\pi$, max at $x = -\pi/12 + k\pi$, for integer k .
- 5.2.9. none
- 5.2.10. max at $x = 0$, min at $x = \pm 11$
- 5.2.11. min at $x = -3/2$, neither at $x = 0$
- 5.2.13. min at $n\pi$, max at $\pi/2 + n\pi$
- 5.2.14. min at $2n\pi$, max at $(2n + 1)\pi$
- 5.2.15. min at $\pi/2 + 2n\pi$, max at $3\pi/2 + 2n\pi$
- 5.3.1. min at $x = 1/2$
- 5.3.2. min at $x = -1$, max at $x = 1$
- 5.3.3. max at $x = 2$, min at $x = 4$
- 5.3.4. min at $x = \pm 1$, max at $x = 0$.
- 5.3.5. min at $x = 1$
- 5.3.6. none
- 5.3.7. none
- 5.3.8. min at $x = 7\pi/12 + n\pi$, max at $x = -\pi/12 + n\pi$, for integer n .
- 5.3.9. max at $x = 63/64$
- 5.3.10. max at $x = 7$
- 5.3.11. max at $-5^{-1/4}$, min at $5^{-1/4}$
- 5.3.12. none
- 5.3.13. max at -1 , min at 1
- 5.3.14. min at $2^{-1/3}$
- 5.3.15. none
- 5.3.16. min at $n\pi$
- 5.3.17. max at $n\pi$, min at $\pi/2 + n\pi$
- 5.3.18. max at $\pi/2 + 2n\pi$, min at $3\pi/2 + 2n\pi$
- 5.4.1. concave up everywhere
- 5.4.2. concave up when $x < 0$, concave down when $x > 0$
- 5.4.3. concave down when $x < 3$, concave up when $x > 3$
- 5.4.4. concave up when $x < -1/\sqrt{3}$ or $x > 1/\sqrt{3}$, concave down when $-1/\sqrt{3} < x < 1/\sqrt{3}$
- 5.4.5. concave up when $x < 0$ or $x > 2/3$, concave down when $0 < x < 2/3$
- 5.4.6. concave up when $x < 0$, concave down when $x > 0$
- 5.4.7. concave up when $x < -1$ or $x > 1$, concave down when $-1 < x < 0$ or $0 < x < 1$
- 5.4.8. concave down on $((8n-1)\pi/4, (8n+3)\pi/4)$, concave up on $((8n+3)\pi/4, (8n+7)\pi/4)$, for integer n
- 5.4.9. concave down everywhere
- 5.4.10. concave up on $(-\infty, (21 - \sqrt{497})/4)$ and $(21 + \sqrt{497})/4, \infty)$
- 5.4.11. concave up on $(0, \infty)$
- 5.4.12. concave down on $(2n\pi/3, (2n+1)\pi/3)$
- 5.4.13. concave up on $(0, \infty)$
- 5.4.14. concave up on $(-\infty, -1)$ and $(0, \infty)$
- 5.4.15. concave down everywhere
- 5.4.16. concave up everywhere
- 5.4.17. concave up on $(\pi/4 + n\pi, 3\pi/4 + n\pi)$
- 5.4.18. inflection points at $n\pi$, $\pm \arcsin(\sqrt{2/3}) + n\pi$

- 5.4.19. up/incre: $(3, \infty)$, up/decr: $(-\infty, 0)$, $(2, 3)$, down/decr: $(0, 2)$
- 6.1.1. max at $(2, 5)$, min at $(0, 1)$
- 6.1.2. 25×25
- 6.1.3. $P/4 \times P/4$
- 6.1.4. $w = l = 2 \cdot 5^{2/3}$, $h = 5^{2/3}$, $h/w = 1/2$
- 6.1.5. $\sqrt[3]{100} \times \sqrt[3]{100} \times 2\sqrt[3]{100}$, $h/s = 2$
- 6.1.6. $w = l = 2^{1/3}V^{1/3}$, $h = V^{1/3}/2^{2/3}$, $h/w = 1/2$
- 6.1.7. 1250 square feet
- 6.1.8. $l^2/8$ square feet
- 6.1.9. \$5000
- 6.1.10. 100
- 6.1.11. r^2
- 6.1.12. $h/r = 2$
- 6.1.13. $h/r = 2$
- 6.1.14. $r = 5$ cm, $h = 40/\pi$ cm, $h/r = 8/\pi$
- 6.1.15. $8/\pi$
- 6.1.16. $4/27$
- 6.1.17. Go direct from D to A .
- 6.1.18. (a) 2, (b) $7/2$
- 6.1.19. $\left(\frac{\sqrt{3}}{6}\right) \times \left(\frac{\sqrt{3}}{6} + \frac{1}{2}\right) \times \left(\frac{1}{4} - \frac{\sqrt{3}}{12}\right)$
- 6.1.20. (a) $a/6$, (b) $(a + b - \sqrt{a^2 - ab + b^2})/6$
- 6.1.21. 1.5 meters wide by 1.25 meters tall
- 6.1.22. If $k \leq 2/\pi$ the ratio is $(2 - k\pi)/4$; if $k \geq 2/\pi$, the ratio is zero: the window should be semicircular with no rectangular part.
- 6.1.23. a/b
- 6.1.24. $w = 2r/\sqrt{3}$, $h = 2\sqrt{2}r/\sqrt{3}$
- 6.1.25. $1/\sqrt{3} \approx 58\%$
- 6.1.26. $18 \times 18 \times 36$
- 6.1.27. $r = 5/(2\pi)^{1/3} \approx 2.7$ cm,
 $h = 5 \cdot 2^{5/3}/\pi^{1/3} = 4r \approx 10.8$ cm
- 6.1.28. $h = \frac{750}{\pi} \left(\frac{2\pi^2}{750^2}\right)^{1/3}$, $r = \left(\frac{750^2}{2\pi^2}\right)^{1/6}$
- 6.1.29. $h/r = \sqrt{2}$
- 6.1.30. The ratio of the volume of the cone to the volume of the sphere is $1033/4096 + 33\sqrt{17}/4096 \approx 0.2854$, so the cone occupies approximately 28.54% of the sphere.
- 6.1.31. P should be at distance $c\sqrt[3]{a}/(\sqrt[3]{a} + \sqrt[3]{b})$ from charge A .
- 6.1.32. $1/2$
- 6.1.33. \$7000
- 6.1.34. There is a critical point when $\sin \theta_1/v_1 = \sin \theta_2/v_2$, and the second derivative is positive, so there is a minimum at the critical point.
- 6.2.1. $1/(16\pi)$ cm/s
- 6.2.2. $3/(1000\pi)$ meters/second
- 6.2.3. $1/4$ m/s
- 6.2.4. $6/25$ m/s
- 6.2.5. 80π mi/min
- 6.2.6. $3\sqrt{5}$ ft/s
- 6.2.7. $20/(3\pi)$ cm/s
- 6.2.8. $13/20$ ft/s
- 6.2.9. $5\sqrt{10}/2$ m/s
- 6.2.10. $75/64$ m/min

- 6.2.11.** $145\pi/72$ m/s
6.2.12. $25\pi/144$ m/min
6.2.13. $\pi\sqrt{2}/36$ ft³/s
6.2.14. tip: 6 ft/s, length: 5/2 ft/s
6.2.15. tip: 20/11 m/s, length: 9/11 m/s
6.2.16. $380/\sqrt{3} - 150 \approx 69.4$ mph
6.2.17. $500/\sqrt{3} - 200 \approx 88.7$ km/hr
6.2.18. 18 m/s
6.2.19. $136\sqrt{475}/19 \approx 156$ km/hr
6.2.20. -50 m/s
6.2.21. 68 m/s
6.2.22. $3800/\sqrt{329} \approx 210$ km/hr
6.2.23. $820/\sqrt{329} + 150\sqrt{57}/\sqrt{47} \approx 210$ km/hr
6.2.24. 4000/49 m/s
6.2.25. (a) $x = a \cos \theta - a \sin \theta \cot(\theta + \beta) = a \sin \beta / \sin(\theta + \beta)$, (c) $\dot{x} \approx 3.79$ cm/s
6.3.1. $x_3 = 1.475773162$
6.3.2. 2.15
6.3.3. 3.36
6.3.4. 2.19 or 1.26
6.4.1. $\Delta y = 65/16$, $dy = 2$
6.4.2. $\Delta y = \sqrt{11/10} - 1$, $dy = 0.05$
6.4.3. $\Delta y = \sin(\pi/50)$, $dy = \pi/50$
6.4.4. $dV = 8\pi/25$
6.5.1. $c = 1/2$
6.5.2. $c = \sqrt{18} - 2$
6.5.6. $x^3/3 + 47x^2/2 - 5x + k$
6.5.7. $\arctan x + k$
6.5.8. $x^4/4 - \ln x + k$
6.5.9. $-\cos(2x)/2 + k$
7.1.1. 10
7.1.2. $35/3$
7.1.3. x^2
7.1.4. $2x^2$
7.1.5. $2x^2 - 8$
7.1.6. $2b^2 - 2a^2$
7.1.7. 4 rectangles: $41/4 = 10.25$,
8 rectangles: $183/16 = 11.4375$
7.1.8. 23/4
7.2.1. $(16/3)x^{3/2} + C$
7.2.2. $t^3 + t + C$
7.2.3. $8\sqrt{x} + C$
7.2.4. $-2/z + C$
7.2.5. $7 \ln s + C$
7.2.6. $(5x + 1)^3/15 + C$
7.2.7. $(x - 6)^3/3 + C$
7.2.8. $2x^{5/2}/5 + C$
7.2.9. $-4/\sqrt{x} + C$
7.2.10. $4t - t^2 + C$, $t < 2$; $t^2 - 4t + 8 + C$,
 $t \geq 2$
7.2.11. 87/2
7.2.12. 2
7.2.13. $\ln(10)$
7.2.14. $e^5 - 1$
7.2.15. $3^4/4$
7.2.16. $2^6/6 - 1/6$
7.2.17. $x^2 - 3x$
7.2.18. $2x(x^4 - 3x^2)$
7.2.19. e^{x^2}
7.2.20. $2xe^{x^4}$
7.2.21. $\tan(x^2)$
7.2.22. $2x \tan(x^4)$

- 7.3.1.** It rises until $t = 100/49$, then falls.
The position of the object at time t is $s(t) = -4.9t^2 + 20t + k$. The net distance traveled is $-45/2$, that is, it ends up 45/2 meters below where it started. The total distance traveled is 6205/98 meters.
7.3.2. $\int_0^{2\pi} \sin t \, dt = 0$
7.3.3. net: 2π , total: $2\pi/3 + 4\sqrt{3}$
7.3.4. 8
7.3.5. 17/3
7.3.6. $A = 18$, $B = 44/3$, $C = 10/3$
8.1.1. $-(1 - t)^{10}/10 + C$
8.1.2. $x^5/5 + 2x^3/3 + x + C$
8.1.3. $(x^2 + 1)^{101}/202 + C$
8.1.4. $-3(1 - 5t)^{2/3}/10 + C$
8.1.5. $(\sin^4 x)/4 + C$
8.1.6. $-(100 - x^2)^{3/2}/3 + C$
8.1.7. $-2\sqrt{1 - x^3}/3 + C$
8.1.8. $\sin(\sin \pi t)/\pi + C$
8.1.9. $1/(2 \cos^2 x) = (1/2) \sec^2 x + C$
8.1.10. $-\ln |\cos x| + C$
8.1.11. 0
8.1.12. $\tan^2(x)/2 + C$
8.1.13. 1/4
8.1.14. $-\cos(\tan x) + C$
8.1.15. 1/10
8.1.16. $\sqrt{3}/4$
8.1.17. $(27/8)(x^2 - 7)^{8/9} + C$
8.1.18. $-(3^7 + 1)/14$
8.1.19. 0
8.1.20. $f(x)^2/2 + C$
8.2.1. $x/2 - \sin(2x)/4 + C$
8.2.2. $-\cos x + (\cos^3 x)/3 + C$
8.2.3. $3x/8 - (\sin 2x)/4 + (\sin 4x)/32 + C$
8.2.4. $(\cos^5 x)/5 - (\cos^3 x)/3 + C$
8.2.5. $\sin x - (\sin^3 x)/3 + C$
8.2.6. $x/8 - (\sin 4x)/32 + C$
8.2.7. $(\sin^3 x)/3 - (\sin^5 x)/5 + C$
8.2.8. $-2(\cos x)^{5/2}/5 + C$
8.2.9. $\tan x - \cot x + C$
8.2.10. $(\sec^3 x)/3 - \sec x + C$
8.3.1. $-\ln |\csc x + \cot x| + C$
8.3.2. $-\csc x \cot x/2 - (1/2) \ln |\csc x + \cot x| + C$
8.3.3. $x\sqrt{x^2 - 1}/2 - \ln|x + \sqrt{x^2 - 1}|/2 + C$
8.3.4. $x\sqrt{9 + 4x^2}/2 + (9/4) \ln|2x + \sqrt{9 + 4x^2}| + C$
8.3.5. $-(1 - x^2)^{3/2}/3 + C$
8.3.6. $\arcsin(x)/8 - \sin(4 \arcsin x)/32 + C$
8.3.7. $\ln|x + \sqrt{1 + x^2}| + C$
8.3.8. $(x + 1)\sqrt{x^2 + 2x}/2 - \ln|x + 1 + \sqrt{x^2 + 2x}|/2 + C$
8.3.9. $-\arctan x - 1/x + C$
8.3.10. $2 \arcsin(x/2) - x\sqrt{4 - x^2}/2 + C$
8.3.11. $\arcsin(\sqrt{x}) - \sqrt{x}\sqrt{1 - x} + C$
8.3.12. $(2x^2 + 1)\sqrt{4x^2 - 1}/24 + C$
8.4.1. $\cos x + x \sin x + C$
8.4.2. $x^2 \sin x - 2 \sin x + 2x \cos x + C$
8.4.3. $(x - 1)e^x + C$
8.4.4. $(1/2)e^{x^2} + C$
8.4.5. $(x/2) - \sin(2x)/4 + C = (x/2) - (\sin x \cos x)/2 + C$

- 8.4.6. $x \ln x - x + C$
- 8.4.7. $(x^2 \arctan x + \arctan x - x)/2 + C$
- 8.4.8. $-x^3 \cos x + 3x^2 \sin x + 6x \cos x - 6 \sin x + C$
- 8.4.9. $x^3 \sin x + 3x^2 \cos x - 6x \sin x - 6 \cos x + C$
- 8.4.10. $x^2/4 - (\cos^2 x)/4 - (x \sin x \cos x)/2 + C$
- 8.4.11. $x/4 - (x \cos^2 x)/2 + (\cos x \sin x)/4 + C$
- 8.4.12. $x \arctan(\sqrt{x}) + \arctan(\sqrt{x}) - \sqrt{x} + C$
- 8.4.13. $2 \sin(\sqrt{x}) - 2\sqrt{x} \cos(\sqrt{x}) + C$
- 8.4.14. $\sec x \csc x - 2 \cot x + C$
- 8.5.1. $-\ln|x-2|/4 + \ln|x+2|/4 + C$
- 8.5.2. $-x^3/3 - 4x - 4 \ln|x-2| + 4 \ln|x+2| + C$
- 8.5.3. $-1/(x+5) + C$
- 8.5.4. $-x - \ln|x-2| + \ln|x+2| + C$
- 8.5.5. $-4x + x^3/3 + 8 \arctan(x/2) + C$
- 8.5.6. $(1/2) \arctan(x/2 + 5/2) + C$
- 8.5.7. $x^2/2 - 2 \ln(4+x^2) + C$
- 8.5.8. $(1/4) \ln|x+3| - (1/4) \ln|x+7| + C$
- 8.5.9. $(1/5) \ln|2x-3| - (1/5) \ln|1+x| + C$
- 8.5.10. $(1/3) \ln|x| - (1/3) \ln|x+3| + C$
- 8.6.1. T, S: 4 ± 0
- 8.6.2. T: 9.28125 ± 0.28125 ; S: 9 ± 0
- 8.6.3. T: 60.75 ± 1 ; S: 60 ± 0
- 8.6.4. T: 1.1167 ± 0.0833 ; S: 1.1000 ± 0.0167
- 8.6.5. T: 0.3235 ± 0.0026 ; S: 0.3217 ± 0.000065
- 8.6.6. T: 0.6478 ± 0.0052 ; S: 0.6438 ± 0.000033
- 8.6.7. T: 2.8833 ± 0.0834 ; S: 2.9000 ± 0.0167
- 8.6.8. T: 1.1170 ± 0.0077 ; S: 1.1114 ± 0.0002
- 8.6.9. T: 1.097 ± 0.0147 ; S: 1.089 ± 0.0003
- 8.6.10. T: 3.63 ± 0.087 ; S: 3.62 ± 0.032
- 8.7.1. $\frac{(t+4)^4}{4} + C$
- 8.7.2. $\frac{(t^2-9)^{5/2}}{5} + C$
- 8.7.3. $\frac{(e^t+16)^2}{4} + C$
- 8.7.4. $\cos t - \frac{2}{3} \cos^3 t + C$
- 8.7.5. $\frac{\tan^2 t}{2} + C$
- 8.7.6. $\ln|t^2+t+3| + C$
- 8.7.7. $\frac{1}{8} \ln|1-4/t^2| + C$
- 8.7.8. $\frac{1}{25} \tan(\arcsin(t/5)) + C = \frac{t}{25\sqrt{25-t^2}} + C$
- 8.7.9. $\frac{2}{3} \sqrt{\sin 3t} + C$
- 8.7.10. $t \tan t + \ln|\cos t| + C$
- 8.7.11. $2\sqrt{e^t+1} + C$
- 8.7.12. $\frac{3t}{8} + \frac{\sin 2t}{4} + \frac{\sin 4t}{32} + C$
- 8.7.13. $\frac{\ln|t|}{3} - \frac{\ln|t+3|}{3} + C$
- 8.7.14. $\frac{-1}{\sin \arctan t} + C = -\sqrt{1+t^2}/t + C$
- 8.7.15. $\frac{-1}{2(1+\tan t)^2} + C$
- 8.7.16. $\frac{(t^2+1)^{5/2}}{5} - \frac{(t^2+1)^{3/2}}{3} + C$
- 8.7.17. $\frac{e^t \sin t - e^t \cos t}{2} + C$
- 8.7.18. $\frac{(t^{3/2}+47)^4}{6} + C$

- 8.7.19. $\frac{2}{3(2-t^2)^{3/2}} - \frac{1}{(2-t^2)^{1/2}} + C$
- 8.7.20. $\frac{\ln|\sin(\arctan(2t/3))|}{9} + C = \frac{\ln(4t^2) - \ln(9+4t^2)}{18} + C$
- 8.7.21. $\frac{(\arctan(2t))^2}{4} + C$
- 8.7.22. $\frac{3 \ln|t+3|}{4} + \frac{\ln|t-1|}{4} + C$
- 8.7.23. $\frac{\cos^7 t}{7} - \frac{\cos^5 t}{5} + C$
- 8.7.24. $\frac{-1}{t-3} + C$
- 8.7.25. $\frac{-1}{\ln t} + C$
- 8.7.26. $\frac{t^2(\ln t)^2}{2} - \frac{t^2 \ln t}{2} + \frac{t^2}{4} + C$
- 8.7.27. $(t^3 - 3t^2 + 6t - 6)e^t + C$
- 8.7.28. $\frac{5+\sqrt{5}}{10} \ln(2t+1-\sqrt{5}) + \frac{5-\sqrt{5}}{10} \ln(2t+1+\sqrt{5}) + C$
- 9.1.1. $8\sqrt{2}/15$
- 9.1.2. $1/12$
- 9.1.3. $9/2$
- 9.1.4. $4/3$
- 9.1.5. $2/3 - 2/\pi$
- 9.1.6. $3/\pi - 3\sqrt{3}/(2\pi) - 1/8$
- 9.1.7. $1/3$
- 9.1.8. $10\sqrt{5}/3 - 6$
- 9.1.9. $500/3$
- 9.1.10. 2
- 9.1.11. $1/5$
- 9.1.12. $1/6$
- 9.2.1. $1/\pi, 5/\pi$
- 9.2.2. $0, 245$
- 9.2.3. $20, 28$
- 9.2.4. $(3-\pi)/(2\pi), (18-12\sqrt{3}+\pi)/(4\pi)$
- 9.2.5. $10/49$ meters, $20/49$ seconds
- 9.2.6. $45/98$ meters, $30/49$ seconds
- 9.2.7. $25000/49$ meters, $1000/49$ seconds
- 9.2.8. $s(t) = \cos t, v(t) = -\sin t$, maximum distance is 1 , maximum speed is 1
- 9.2.9. $s(t) = -\sin(\pi t)/\pi^2 + t/\pi, v(t) = -\cos(\pi t)/\pi + 1/\pi$, maximum speed is $2/\pi$
- 9.2.10. $s(t) = t^2/2 - \sin(\pi t)/\pi^2 + t/\pi, v(t) = t - \cos(\pi t)/\pi + 1/\pi$
- 9.2.11. $s(t) = t^2/2 + \sin(\pi t)/\pi^2 - t/\pi, v(t) = t + \cos(\pi t)/\pi - 1/\pi$
- 9.3.5. $8\pi/3$
- 9.3.6. $\pi/30$
- 9.3.7. $\pi(\pi/2 - 1)$
- 9.3.8. (a) $114\pi/5$ (b) $74\pi/5$ (c) 20π (d) 4π
- 9.3.9. $16\pi, 24\pi$
- 9.3.11. $\pi h^2(3r-h)/3$
- 9.3.13. 2π
- 9.4.1. $2/\pi; 2/\pi; 0$
- 9.4.2. $4/3$
- 9.4.3. $1/A$
- 9.4.4. $\pi/4$
- 9.4.5. $-1/3, 1$
- 9.4.6. $-4\sqrt{1224}$ ft/s; $-8\sqrt{1224}$ ft/s
- 9.5.1. $\approx 5, 305, 028, 516$ N-m
- 9.5.2. $\approx 4, 457, 854, 041$ N-m
- 9.5.3. $367, 500\pi$ N-m

- 9.5.4.** $49000\pi + 196000/3$ N-m
9.5.5. 2450π N-m
9.5.6. 0.05 N-m
9.5.7. $6/5$ N-m
9.5.8. 3920 N-m
9.5.9. 23520 N-m
9.5.10. 12740 N-m
9.6.1. $15/2$
9.6.2. 5
9.6.3. $16/5$
9.6.5. $\bar{x} = 45/28, \bar{y} = 93/70$
9.6.6. $\bar{x} = 0, \bar{y} = 4/(3\pi)$
9.6.7. $\bar{x} = 1/2, \bar{y} = 2/5$
9.6.8. $\bar{x} = 0, \bar{y} = 8/5$
9.6.9. $\bar{x} = 4/7, \bar{y} = 2/5$
9.6.10. $\bar{x} = \bar{y} = 1/5$
9.6.11. $\bar{x} = 0, \bar{y} = 28/(9\pi)$
9.6.12. $\bar{x} = \bar{y} = 28/(9\pi)$
9.6.13. $\bar{x} = 0, \bar{y} = 244/(27\pi) \approx 2.88$
9.7.1. ∞
9.7.2. $1/2$
9.7.3. diverges
9.7.4. diverges
9.7.5. 1
9.7.6. diverges
9.7.7. 2
9.7.8. diverges
9.7.9. $\pi/6$
9.7.10. diverges, 0
9.7.11. diverges, 0
9.7.12. diverges, no CPV
9.7.13. π
9.7.14. 80 mph: 90.8 to 95.3 N-m
 90 mph: 114.9 to 120.6 N-m
 100.9 mph: 144.5 to 151.6 N-m
9.8.2. $\mu = 1/c, \sigma = 1/c$
9.8.3. $\mu = (a+b)/2, \sigma = \frac{(b-a)}{2\sqrt{3}}$
9.8.4. $7/2$
9.8.5. $21/2$
9.8.9. $r = 6$
9.9.1. $(22\sqrt{22} - 8)/27$
9.9.2. $\ln(2) + 3/8$
9.9.3. $a + a^3/3$
9.9.4. $\ln((\sqrt{2} + 1)/\sqrt{3})$
9.9.6. $3/4$
9.9.7. ≈ 3.82
9.9.8. ≈ 1.01
9.9.9. $\sqrt{1+e^2} - \sqrt{2} + 1 - \ln(\sqrt{1+e^2} + 1) + \ln(\sqrt{2} + 1)$
9.10.1. $8\pi\sqrt{3} - \frac{16\pi\sqrt{2}}{3}$
9.10.3. $\frac{730\pi\sqrt{730}}{27} - \frac{10\pi\sqrt{10}}{27}$
9.10.4. $\pi + 2\pi e + \frac{1}{4}\pi e^2 - \frac{\pi}{4e^2} - \frac{2\pi}{e}$
9.10.6. $8\pi^2$
9.10.7. $2\pi + \frac{8\pi^2}{3\sqrt{3}}$
9.10.8. $a > b: \frac{2\pi b^2 + 2\pi a^2 b}{\sqrt{a^2 - b^2}} \arcsin(\sqrt{a^2 - b^2}/a),$
 $a < b: \frac{2\pi b^2 + 2\pi a^2 b}{\sqrt{b^2 - a^2}} \ln\left(\frac{b}{a} + \frac{\sqrt{b^2 - a^2}}{a}\right)$
10.1.2. $\theta = \arctan(3)$

- 10.1.3.** $r = -4 \csc \theta$
10.1.4. $r^3 \cos \theta \sin^2 \theta = 1$
10.1.5. $r = \sqrt{5}$
10.1.6. $r^2 = \sin \theta \sec^3 \theta$
10.1.7. $r \sin \theta = \sin(r \cos \theta)$
10.1.8. $r = 2/(\sin \theta - 5 \cos \theta)$
10.1.9. $r = 2 \sec \theta$
10.1.10. $0 = r^2 \cos^2 \theta - r \sin \theta + 1$
10.1.11. $0 = 3r^2 \cos^2 \theta - 2r \cos \theta - r \sin \theta$
10.1.12. $r = \sin \theta$
10.1.21. $(x^2 + y^2)^2 = 4x^2 y - (x^2 + y^2)y$
10.1.22. $(x^2 + y^2)^{3/2} = y^2$
10.1.23. $x^2 + y^2 = x^2 y^2$
10.1.24. $x^4 + x^2 y^2 = y^2$
10.2.1. $(\theta \cos \theta + \sin \theta)/(-\theta \sin \theta + \cos \theta),$
 $(\theta^2 + 2)/(-\theta \sin \theta + \cos \theta)^3$
10.2.2. $\frac{\cos \theta + 2 \sin \theta \cos \theta}{\cos^2 \theta - \sin^2 \theta - \sin \theta},$
 $\frac{3(1 + \sin \theta)}{(\cos^2 \theta - \sin^2 \theta - \sin \theta)^3}$
10.2.3. $(\sin^2 \theta - \cos^2 \theta)/(2 \sin \theta \cos \theta),$
 $-1/(4 \sin^3 \theta \cos^3 \theta)$
10.2.4. $\frac{2 \sin \theta \cos \theta}{\cos^2 \theta - \sin^2 \theta}, \frac{2}{(\cos^2 \theta - \sin^2 \theta)^3}$
10.2.5. undefined
10.2.6. $\frac{2 \sin \theta - 3 \sin^3 \theta}{3 \cos^3 \theta - 2 \cos \theta},$
 $\frac{3 \cos^4 \theta - 3 \cos^2 \theta + 2}{2 \cos^3 \theta (3 \cos^2 \theta - 2)^3}$
10.3.1. 1
10.3.2. $9\pi/2$
10.3.3. $\sqrt{3}/3$
10.3.4. $\pi/12 + \sqrt{3}/16$
10.3.5. πa^2
10.3.6. $41\pi/2$
10.3.7. $2 - \pi/2$
10.3.8. $\pi/12$
10.3.9. $3\pi/16$
10.3.10. $\pi/4 - 3\sqrt{3}/8$
10.3.11. $\pi/2 + 3\sqrt{3}/8$
10.3.12. $1/2$
10.3.13. $3/2 - \pi/4$
10.3.14. $\pi/3 + \sqrt{3}/2$
10.3.15. $\pi/3 - \sqrt{3}/4$
10.3.16. $4\pi^3/3$
10.3.17. π^2
10.3.18. $5\pi/24 - \sqrt{3}/4$
10.3.19. $7\pi/12 - \sqrt{3}$
10.3.20. $4\pi - \sqrt{15}/2 - 7 \arccos(1/4)$
10.3.21. $3\pi^3$
10.4.6. $x = t - \frac{\sin(t)}{2}, y = 1 - \frac{\cos(t)}{2}$
10.4.7. $x = 4 \cos t - \cos(4t),$
 $y = 4 \sin t - \sin(4t)$
10.4.8. $x = 2 \cos t + \cos(2t),$
 $y = 2 \sin t - \sin(2t)$
10.4.9. $x = \cos t + t \sin t,$
 $y = \sin t - t \cos t$
10.5.1. There is a horizontal tangent at all multiples of π .
10.5.2. $9\pi/4$
10.5.3. $\int_0^{2\pi} \frac{1}{2} \sqrt{5 - 4 \cos t} dt$
10.5.4. Four points:
 $\left(\frac{-3 - 3\sqrt{5}}{4}, \pm 5\sqrt{\frac{5 - \sqrt{5}}{8}}\right),$
 $\left(\frac{-3 + 3\sqrt{5}}{4}, \pm 5\sqrt{\frac{5 + \sqrt{5}}{8}}\right)$

- 10.5.5.** $11\pi/3$
10.5.6. $32/3$
10.5.7. 2π
10.5.8. $16/3$
10.5.9. $(\pi/2, 1)$
10.5.10. $5\pi^3/6$
10.5.11. $2\pi^2$
10.5.12. $(2\pi\sqrt{4\pi^2+1} + \ln(2\pi + \sqrt{4\pi^2+1}))/2$
11.1.1. 1
11.1.3. 0
11.1.4. 1
11.1.5. 1
11.1.6. 0
11.2.1. $\lim_{n \rightarrow \infty} n^2/(2n^2+1) = 1/2$
11.2.2. $\lim_{n \rightarrow \infty} 5/(2^{1/n} + 14) = 1/3$
11.2.3. $\sum_{n=1}^{\infty} \frac{1}{n}$ diverges, so $\sum_{n=1}^{\infty} 3\frac{1}{n}$ diverges
11.2.4. $-3/2$
11.2.5. 11
11.2.6. 20
11.2.7. $3/4$
11.2.8. $3/2$
11.2.9. $3/10$
11.3.1. diverges
11.3.2. diverges
11.3.3. converges
11.3.4. converges
11.3.5. converges
11.3.6. converges
11.3.7. diverges
11.3.8. converges
11.3.9. $N = 5$
11.3.10. $N = 10$
11.3.11. $N = 1687$
11.3.12. any integer greater than e^{200}
11.4.1. converges
11.4.2. converges
11.4.3. diverges
11.4.4. converges
11.4.5. 0.90
11.4.6. 0.95
11.5.1. converges
11.5.2. converges
11.5.3. converges
11.5.4. diverges
11.5.5. diverges
11.5.6. diverges
11.5.7. converges
11.5.8. diverges
11.5.9. converges
11.5.10. diverges
11.6.1. converges absolutely
11.6.2. diverges
11.6.3. converges conditionally
11.6.4. converges absolutely
11.6.5. converges conditionally
11.6.6. converges absolutely
11.6.7. diverges
11.6.8. converges conditionally
11.7.5. converges
11.7.6. converges

- 11.7.7.** converges
11.7.8. diverges
11.8.1. $R = 1, I = (-1, 1)$
11.8.2. $R = \infty, I = (-\infty, \infty)$
11.8.3. $R = e, I = (-e, e)$
11.8.4. $R = e, I = (2 - e, 2 + e)$
11.8.5. $R = 0$, converges only when $x = 2$
11.8.6. $R = 1, I = [-6, -4]$
11.9.1. the alternating harmonic series
11.9.2. $\sum_{n=0}^{\infty} (n+1)x^n$
11.9.3. $\sum_{n=0}^{\infty} (n+1)(n+2)x^n$
11.9.4. $\sum_{n=0}^{\infty} \frac{(n+1)(n+2)}{2} x^n, R = 1$
11.9.5. $C + \sum_{n=0}^{\infty} \frac{-1}{(n+1)(n+2)} x^{n+2}$
11.10.1. $\sum_{n=0}^{\infty} (-1)^n x^{2n}/(2n)!, R = \infty$
11.10.2. $\sum_{n=0}^{\infty} x^n/n!, R = \infty$
11.10.3. $\sum_{n=0}^{\infty} (-1)^n \frac{(x-5)^n}{5^{n+1}}, R = 5$
11.10.4. $\sum_{n=1}^{\infty} (-1)^{n-1} \frac{(x-1)^n}{n}, R = 1$
11.10.5. $\ln(2) + \sum_{n=1}^{\infty} (-1)^{n-1} \frac{(x-2)^n}{n2^n}, R = 2$
11.10.6. $\sum_{n=0}^{\infty} (-1)^n (n+1)(x-1)^n, R = 1$
11.10.7. $1 + \sum_{n=1}^{\infty} \frac{1 \cdot 3 \cdot 5 \cdots (2n-1)}{n!2^n} x^n = 1 + \sum_{n=1}^{\infty} \frac{(2n-1)!}{2^{2n-1}(n-1)!n!} x^n, R = 1$
11.10.8. $x + x^3/3$
11.10.9. $\sum_{n=0}^{\infty} (-1)^n x^{4n+1}/(2n)!$
11.10.10. $\sum_{n=0}^{\infty} (-1)^n x^{n+1}/n!$
11.11.1. $1 - \frac{x^2}{2} + \frac{x^4}{24} - \frac{x^6}{720} + \cdots + \frac{x^{12}}{12!}$
11.11.2. 1000; 8
11.11.3. $x + \frac{x^3}{3} + \frac{2x^5}{15}$, error ± 1.32 .
11.12.1. diverges
11.12.2. converges
11.12.3. converges
11.12.4. diverges
11.12.5. diverges
11.12.6. diverges
11.12.7. converges
11.12.8. converges
11.12.9. converges
11.12.10. converges
11.12.11. converges
11.12.12. converges
11.12.13. converges
11.12.14. converges
11.12.15. converges
11.12.16. converges
11.12.17. diverges
11.12.18. $(-\infty, \infty)$
11.12.19. $(-3, 3)$
11.12.20. $(-3, 3)$
11.12.21. $(-1, 1)$

- 11.12.22.** radius is 0—it converges only when $x = 0$
- 11.12.23.** $(-\sqrt{3}, \sqrt{3})$
- 11.12.24.** $(-\infty, \infty)$
- 11.12.25.** $\sum_{n=0}^{\infty} \frac{(\ln(2))^n}{n!} x^n$
- 11.12.26.** $\sum_{n=0}^{\infty} \frac{(-1)^n}{n+1} x^{n+1}$
- 11.12.27.** $\sum_{n=0}^{\infty} \frac{2}{2n+1} x^{2n+1}$
- 11.12.28.** $1 + x/2 + \sum_{n=2}^{\infty} (-1)^{n+1} \frac{1 \cdot 3 \cdot 5 \cdots (2n-3)}{2^n n!} x^n$
- 11.12.29.** $\sum_{n=0}^{\infty} (-1)^n x^{2n}$
- 11.12.30.** $\sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1} x^{2n+1}$
- 11.12.31.** $\pi = \sum_{n=0}^{\infty} (-1)^n \frac{4}{2n+1}$