23. Use technology to verify sketch.

25. Use technology to verify sketch.

27. Critical points: $x = \frac{n\pi/2 - b}{a}$, where $n$ is an odd integer Points of inflection: $(n\pi - b)/a$, where $n$ is an integer.

29. $\frac{dy}{dx} = -x/y$, so the function is increasing in second and fourth quadrants, decreasing in the first and third quadrants.
$\frac{d^2y}{dx^2} = -1/y - x^2/y^3$, which is positive when $y < 0$ and is negative when $y > 0$. Hence the function is concave down in the first and second quadrants and concave up in the third and fourth quadrants.

# Chapter 4

### Section 4.1

1. T

3. (a) $5/(2\pi) \approx 0.796$cm/s
   (b) $1/(4\pi) \approx 0.0796$ cm/s
   (c) $1/(40\pi) \approx 0.00796$ cm/s

5. 63.14mph

7. Due to the height of the plane, the gun does not have to rotate very fast.
   (a) 0.0573 rad/s
   (b) 0.0725 rad/s
   (c) In the limit, rate goes to 0.0733 rad/s

9. (a) 0.04 ft/s
   (b) 0.458 ft/s
   (c) 3.35 ft/s
   (d) Not defined; as the distance approaches 24, the rates approaches $\infty$.

11. (a) 50.92 ft/min
    (b) 0.509 ft/min
    (c) 0.141 ft/min
    As the tank holds about 523.6ft$^3$, it will take about 52.36 minutes.

13. (a) The rope is 80ft long.
    (b) 1.71 ft/sec
    (c) 1.87 ft/sec
    (d) About 34 feet.

15. The cone is rising at a rate of 0.003ft/s.

### Section 4.2

1. $0/0, \infty/\infty, 0 \cdot \infty, \infty - \infty, 0^0, 1^\infty, \infty^0$

3. F

5. derivatives; limits

7. Answers will vary.

9. $5/8$

11. 3

13. $-5/3$

15. $-1$

17. $-\sqrt{2}/2$

19. 0

21. $a/b$

23. 1

25. $1/2$

27. 4

29. 0

31. $\infty$

33. 0

35. 2

37. $\ln 3 - \ln 2$

39. 0

41. $-2$

43. 0

45. 0

47. $\infty$

49. $\infty$

51. 0

53. $\infty$

55. 1

57. $8/27$

59. 1

61. 0

63. 1

65. $\infty$

67. 2

69. $1/2$

71. 1

73. 3

### Section 4.3

1. T

3. 2500; the two numbers are each 50.

5. There is no maximum sum; the fundamental equation has only 1 critical value that corresponds to a minimum.

7. Area = 1/4, with sides of length $1/\sqrt{2}$.

9. The radius should be about 3.84cm and the height should be $2r = 7.67$cm. No, this is not the size of the standard can.

11. The height and width should be 18 and the length should be 36, giving a volume of $11,664$in$^3$.

13. $5 - 10/\sqrt{39} \approx 3.4$ miles should be run underground, giving a minimum cost of $374,899.96.

15. The dog should run about 19 feet along the shore before starting to swim.

17. The largest area is 2 formed by a square with sides of length $\sqrt{2}$.

### Section 4.4

1. T

3. F

5. Answers will vary.

7. Use $y = x^2$; $dy = 2x \cdot dx$ with $x = 6$ and $dx = -0.07$. Thus $dy = -0.84$; knowing $6^2 = 36$, we have $5.93^2 \approx 35.16$.

9. Use $y = x^3$; $dy = 3x^2 \cdot dx$ with $x = 7$ and $dx = -0.2$. Thus $dy = -29.4$; knowing $7^3 = 343$, we have $6.8^3 \approx 313.6$.

11. Use $y = \sqrt{x}$; $dy = 1/(2\sqrt{x}) \cdot dx$ with $x = 25$ and $dx = -1$. Thus $dy = -0.1$; knowing $\sqrt{25} = 5$, we have $\sqrt{24} \approx 4.9$.

13. Use $y = \sqrt[3]{x}$; $dy = 1/(3\sqrt[3]{x^2}) \cdot dx$ with $x = 8$ and $dx = 0.5$. Thus $dy = 1/24 \approx 1/25 = 0.04$; knowing $\sqrt[3]{8} = 2$, we have $\sqrt[3]{8.5} \approx 2.04$.

15. Use $y = \cos x$; $dy = -\sin x \cdot dx$ with $x = \pi/2 \approx 1.57$ and $dx \approx -0.07$. Thus $dy = 0.07$; knowing $\cos \pi/2 = 0$, we have $\cos 1.5 \approx 0.07$.

17. $dy = (2x + 3)dx$

19. $dy = \frac{-2}{4x^3}dx$

21. $dy = \left(2xe^{3x} + 3x^2e^{3x}\right)dx$

23. $dy = \frac{2(\tan x+1)-2x\sec^2 x}{(\tan x+1)^2}dx$

25. $dy = (e^x \sin x + e^x \cos x)dx$

27. $dy = \frac{1}{(x+2)^2}dx$

29. $dy = (\ln x)dx$

31. (a) $\pm 12.8$ feet
    (b) $\pm 32$ feet

33. $\pm 48 \text{in}^2$, or $1/3\text{ft}^2$

35. (a) 298.8 feet
    (b) $\pm 17.3$ ft
    (c) $\pm 5.8\%$

37. The isosceles triangle setup works the best with the smallest percent error.

### Section 4.5

1. F

3. $x_0 = 1.5$, $x_1 = 1.5709148$, $x_2 = 1.5707963$, $x_3 = 1.5707963$, $x_4 = 1.5707963$, $x_5 = 1.5707963$

5. $x_0 = 0$, $x_1 = 2$, $x_2 = 1.2$, $x_3 = 1.0117647$, $x_4 = 1.0000458$, $x_5 = 1$

7. $x_0 = 2$, $x_1 = 0.6137056389$, $x_2 = 0.9133412072$, $x_3 = 0.9961317034$, $x_4 = 0.9999925085$, $x_5 = 1$

9. roots are: $x = -3.714$, $x = -0.857$, $x = 1$ and $x = 1.571$

11. roots are: $x = -2.165$, $x = 0$, $x = 0.525$ and $x = 1.813$

13. $x = -0.637$, $x = 1.410$

15. $x = \pm 4.493$, $x = 0$

17. The approximations alternate between $x = 1$, $x = 2$ and $x = 3$.

# Chapter 5

### Section 5.1

1. Answers will vary.

3. Answers will vary.

5. Answers will vary.

7. velocity

9. $1/9x^9 + C$

11. $t + C$

13. $-1/(3t) + C$

15. $2\sqrt{x} + C$

17. $-\cos\theta + C$

19. $5e^{\theta} + C$

21. $\frac{5^t}{2\ln 5} + C$

23. $t^6/6 + t^4/4 - 3t^2 + C$

25. $e^{\pi}x + C$

27. $\frac{x^2}{2} + 3x + \ln|x| + C$

29. (a) $x > 0$
    (b) $1/x$
    (c) $x < 0$
    (d) $1/x$
    (e) $\ln|x| + C$. Explanations will vary.

31. $-\cos x + 3$

33. $x^4 - x^3 + 7$

35. $\tan x + 4$

37. $4\tan^{-1} x + \pi + 12$

39. $\frac{7x^3}{6} - \frac{9x}{2} + \frac{40}{3}$

41. $\theta - \sin(\theta) - \pi + 4$

43. $3x - 2$

45. $dy = (2xe^x \cos x + x^2e^x \cos x - x^2e^x \sin x)dx$

### Section 5.2

1. Answers will vary.

3. 0

5. (a) 3
   (b) 4
   (c) 3
   (d) 0
   (e) $-4$
   (f) 9

7. (a) 4
   (b) 2
   (c) 4
   (d) 2
   (e) 1
   (f) 2

9. (a) $\pi$
   (b) $\pi$
   (c) $2\pi$
   (d) $10\pi$

11. (a) $4/\pi$
    (b) $-4/\pi$
    (c) 0
    (d) $2/\pi$

13. (a) $40/3$
    (b) $26/3$
    (c) $8/3$
    (d) $38/3$

15. (a) 3ft/s
    (b) 9.5ft
    (c) 9.5ft

17. (a) 96ft/s
    (b) 6 seconds
    (c) 6 seconds
    (d) Never; the maximum height is 208ft.