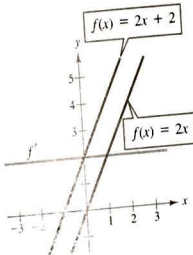
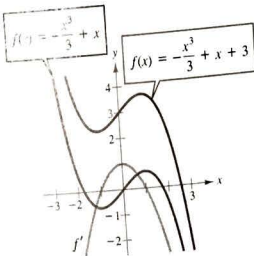


Chapter 5
Section 5.1

Given	Rewrite	Integrate	Simplify
1. $\int \sqrt[3]{x} dx$	$\int x^{1/3} dx$	$\frac{x^{4/3}}{4/3} + C$	$\frac{3}{4}x^{4/3} + C$
3. $\int \frac{1}{x\sqrt{x}} dx$	$\int x^{-3/2} dx$	$\frac{x^{-1/2}}{-1/2} + C$	$-\frac{2}{\sqrt{x}} + C$
5. $\int \frac{1}{2x^3} dx$	$\frac{1}{2} \int x^{-3} dx$	$\frac{1}{2} \left(\frac{x^{-2}}{-2} \right) + C$	$-\frac{1}{4x^2} + C$
7. $\frac{1}{4}x^4 + 2x + C$	9. $\frac{2}{5}x^{5/2} + x^2 + x + C$		
11. $\frac{3}{5}x^{5/3} + C$	13. $-\frac{1}{2x^2} + C$	15. $-\frac{1}{4x} + C$	
17. $\frac{2}{15}x^{1/2}(3x^2 + 5x + 15) + C$			
19. $x^3 + \frac{1}{2}x^2 - 2x + C$	21. $t - \frac{2}{t} + C$		
23. $\frac{2}{7}y^{7/2} + C$	25. $x + C$		



29.



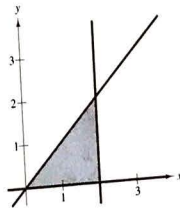
31. $y = x^2 - x + 1$ 33. $y = x^3 - x + 2$
 35. $f(x) = x^2 + x + 4$
 37. $f(x) = -4x^{1/2} + 3x = -4\sqrt{x} + 3x$
 39. $s(t) = -16t^2 + 1600, t = 10$ sec
 41. $v_0 \approx 187.617$ ft/sec
 43. (a) $\frac{1 + \sqrt{17}}{2} \approx 2.562$ sec
 (b) $-16\sqrt{17} \approx -65.970$ ft/sec
 45. (a) $\frac{154}{39} \approx 3.95$ ft/sec² (b) $\frac{1859}{3} \approx 619.67$ ft
 47. (a) 300 ft (b) 60 ft/sec ≈ 41 mi/hr

Section 5.2

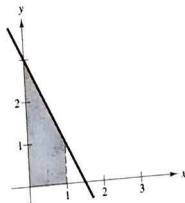
1. 35 3. $\frac{158}{85}$ 5. $4c$ 7. 238 9. $\sum_{i=1}^9 \frac{1}{3i}$
 11. $\sum_{j=1}^8 \left[2\left(\frac{j}{8}\right) + 3 \right]$ 13. $\frac{1}{6} \sum_{k=1}^6 \left[\left(\frac{k}{6}\right)^2 + 2 \right]$
 15. $\frac{2}{n} \sum_{i=1}^n \left[\left(\frac{2i}{n}\right)^3 - \left(\frac{2i}{n}\right) \right]$ 17. $\frac{3}{n} \sum_{i=1}^n \left[2\left(1 + \frac{3i}{n}\right)^2 \right]$
 19. 420 21. 2470 23. $\frac{1015}{n^3}$
 25. $\frac{8}{3}$ 27. $\frac{81}{4}$ 29. 9
 31. $\lim_{n \rightarrow \infty} \frac{1}{6} \left(\frac{2n^3 - 3n^2 + n}{n^3} \right) = \frac{1}{3}$
 33. $\lim_{n \rightarrow \infty} \left[8 \left(\frac{n^2 + n}{n^2} \right) \right] = 8$
 35. $\lim_{n \rightarrow \infty} 2 \left(\frac{10n^4 + 13n^3 + 4n^2}{n^4} \right) = 20$
 37. $S \approx 0.768$ 39. $S \approx 0.746$ 41. $S \approx 0.859$
 $s \approx 0.518$ $s \approx 0.646$ $s \approx 0.659$

43.

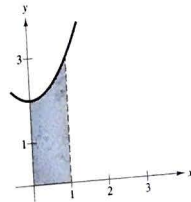
n	5	10	50	100
$s(n)$	1.6	1.8	1.96	1.98
$S(n)$	2.4	2.2	2.04	2.02



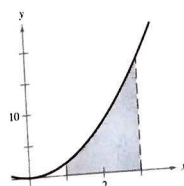
45. $A = 2$



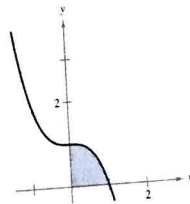
47. $A = \frac{7}{3}$



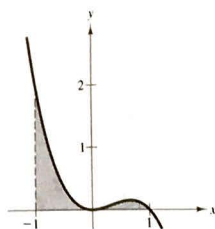
49. $A = \frac{52}{3}$



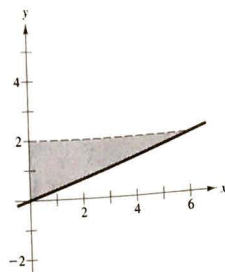
51. $A = \frac{3}{4}$



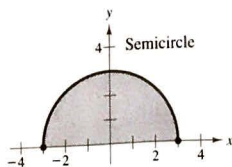
53. $A = \frac{2}{3}$



55. $A = 6$



19. $A = \frac{9\pi}{2}$



57. $\frac{69}{8}$ 59. 0.673

61.

n	4	8	12	16	20
Approximate area	5.3838	5.3523	5.3439	5.3403	5.3384

63. $N(5) \approx 167, N(10) \approx 250, N(25) \approx 400$

$$\lim_{t \rightarrow \infty} \frac{10(5 + 3t)}{1 + 0.04t} = 750$$

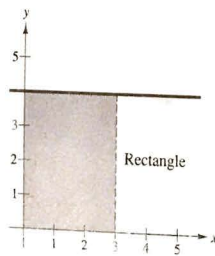
Section 5.3

1. $\int_0^5 3 \, dx$ 3. $\int_{-4}^4 (4 - |x|) \, dx$

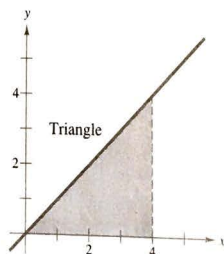
5. $\int_{-2}^2 (4 - x^2) \, dx$ 7. $\int_0^2 y^3 \, dy$

9. $\int_0^2 \sqrt{x+1} \, dx$

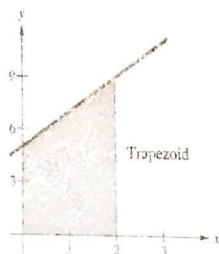
11. $A = 12$



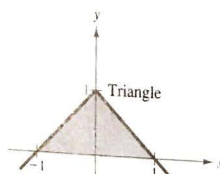
13. $A = 8$



15. $A = 14$



17. $A = 1$



21. (a) 13 (b) -10 (c) 0 (d) 30

23. (a) 8 (b) -12 (c) -4 (d) 30

25. 36 27. 0 29. $\frac{10}{3}$ 31. $\frac{4\sqrt{2}}{3}$

33. $\int_{-1}^5 (3x + 10) \, dx$

35.

n	4	8	12	16	20
$L(n)$	3.6830	3.9956	4.0707	4.1016	4.1177
$M(n)$	4.3082	4.2076	4.1838	4.1740	4.1690
$R(n)$	3.6830	3.9956	4.0707	4.1016	4.1177

37. Not integrable because there are an infinite number of discontinuities.

Section 5.4

1. 1 3. $-\frac{5}{2}$ 5. $-\frac{10}{3}$ 7. $\frac{1}{3}$ 9. $\frac{1}{2}$

11. 36 13. -4 15. $\frac{2}{3}$ 17. $-\frac{1}{18}$

19. $-\frac{27}{20}$ 21. 1 23. 4 25. $\frac{1}{6}$ 27. $\frac{8}{5}$

29. 6 31. 10 33. 6 35. $\sqrt[3]{2}$

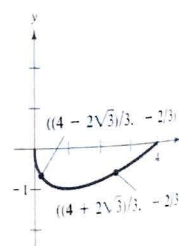
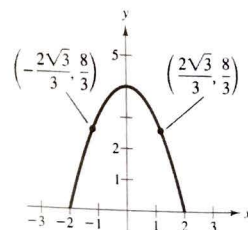
37. 1, 3

39. Average = $\frac{8}{3}$

$$x = \pm \frac{2\sqrt{3}}{3} \approx \pm 1.155$$

41. Average = $-\frac{2}{3}$

$$x = \left(1 + \frac{1}{\sqrt{3}}\right)^2$$



43. $\frac{1}{2}x^2 + 2x$ 45. $\frac{3}{4}x^{4/3} - 12$ 47. $1 - \frac{1}{x}$

49. $x^2 - 2x + 5$ 51. $\sqrt{x^4 + 1}$

53. 0.5318 liter 55. (a) 8 (b) $\frac{4}{3}$ (c) $20\frac{10}{3}$

Section 5.5

$\int f(g(x))g'(x) dx$ $u = g(x)$ $du = g'(x) dx$

1. $\int (5x^2 + 1)^2(10x) dx$ $5x^2 + 1$ $10x dx$

3. $\int \frac{x}{\sqrt{x^2 + 1}} dx$ $x^2 + 1$ $2x dx$

5. $\frac{(1 + 2x)^5}{5} + C$ 7. $\frac{2}{3}(9 - x^2)^{3/2} + C$

9. $\frac{(x^3 - 1)^5}{15} + C$ 11. $-\frac{15}{8}(1 - x^2)^{4/3} + C$

13. $-\frac{1}{3(1 + x^3)} + C$ 15. $-4\sqrt{16 - x^2} + C$

17. $-\frac{1}{2(x^2 + 2x - 3)} + C$ 19. $-\frac{1}{4}\left(1 + \frac{1}{t}\right)^4 + C$

21. $\sqrt{2x} + C$ 23. $\frac{2}{3}\sqrt{x}(x^2 + 5x + 35) + C$

25. $\frac{1}{4}t^4 - t^2 + C$ 27. $\frac{2}{5}y^{3/2}(15 - y) + C$

29. $2\left[\frac{1}{5}(x + 2)^{5/2} - \frac{2}{3}(x + 2)^{3/2}\right] + C$
 $= \frac{2}{15}(x + 2)^{3/2}(3x - 4) + C$

31. $-2\left[\frac{1}{3}(1 - x)^{3/2} - \frac{2}{5}(1 - x)^{5/2} + \frac{1}{7}(1 - x)^{7/2}\right] + C$
 $= -\frac{2}{105}(1 - x)^{3/2}(15x^2 + 12x + 8) + C$

33. $\frac{1}{4}\left[\frac{1}{5}(2x - 1)^{5/2} + \frac{2}{3}(2x - 1)^{3/2} - 3(2x - 1)^{1/2}\right] + C$
 $= \frac{\sqrt{2x - 1}}{15}(3x^2 + 2x - 13) + C$

35. $-x - 1 - 2\sqrt{x + 1} + C$
 or $-(x + 2\sqrt{x + 1}) + C_1$

37. $\frac{1}{2}\left[\frac{1}{3}(2x + 1)^{3/2} - (2x + 1)^{1/2}\right] + C$
 $= \frac{1}{3}\sqrt{2x + 1}(x - 1) + C$

39. 0 41. 2 43. $\frac{1}{2}$ 45. $\frac{4}{15}$ 47. $\frac{144}{5}$ (d) 8

49. $\frac{1209}{28}$ 51. (a) $\frac{8}{3}$ (b) $\frac{16}{3}$ (c) $-\frac{8}{3}$

53. (a) $\frac{3}{2}(\sqrt{16t + 9} - 3)$
 (b) $\frac{3}{2}(\sqrt{1609} - 3) \approx 55.67$ lb

Section 5.6

Exact	Trapezoidal	Simpson's
1. 2.6667	2.7500	2.6667
3. 4.0000	4.2500	4.0000
5. 4.0000	4.0625	4.0000
7. 12.6667	12.6640	12.6667
9. 0.1667	0.1676	0.1667

Trapezoidal	Simpson's
11. 1.683	1.622
13. 3.41	3.22
15. 0.342	0.372
17. 2.208	2.210
19. 2.352	2.438
21. 0.500	0.000

Trapezoidal Simpson's

23. 0.010 0.001
 25. $n = 366$ $n = 26$
 27. $n = 130$ $n = 12$

29. 3.14159 31. 89,250 ft²
 33. (a) 12.5175 (b) 12.5917

35.

n	$L(n)$	$M(n)$	$R(n)$	$T(n)$	$S(n)$
4	12.7771	15.3965	18.4340	15.6055	15.4845
8	14.0868	15.4480	16.9152	15.5010	15.4662
10	14.3569	15.4544	16.6197	15.4883	15.4658
12	14.5386	15.4578	16.4242	15.4814	15.4657
16	14.7674	15.4613	16.1816	15.4745	15.4657
20	14.9056	15.4628	16.0370	15.4713	15.4657

37. 10,233.58 ft · lb

Review Exercises for Chapter 5

1. $x^{2/3} + C$ 3. $\frac{2}{3}x^3 + \frac{1}{2}x^2 - x + C$
 5. $\frac{2\sqrt{x}}{15}(15 + 10x + 3x^2) + C$
 7. $\frac{2}{3}\sqrt{x^3 + 3} + C$ 9. $\frac{1}{7}x^7 + \frac{3}{5}x^5 + x^3 + x + C$
 11. $\frac{1}{8}(x^2 + 1)^4 + C$ 13. $-\frac{1}{4(x^2 + 1)^2} + C$
 15. $2\left[\frac{1}{7}(x + 5)^{7/2} - 2(x + 5)^{5/2} + \frac{25}{3}(x + 5)^{3/2}\right] + C$
 $= \frac{2(x + 5)^{3/2}}{21}(3x^2 - 12x + 40) + C$

17. $\frac{1}{2}x^2 - \frac{1}{x} + C$

19. (a) $\sum_{i=1}^{10} (2i - 1)$ (b) $\sum_{i=1}^n i^3$ (c) $\sum_{i=1}^{10} (4i + 2)$

21. 16 23. 0 25. 2 27. $\frac{422}{5}$

29. $\frac{28\pi}{15}$ 31. $y = 2 - x^2$ 33. 240 ft/sec

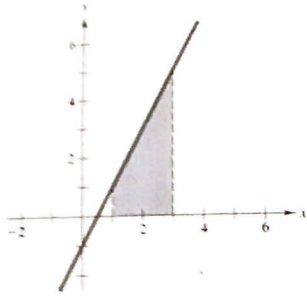
35. (a) 3 sec (b) 144 ft (c) $\frac{3}{2}$ sec (d) 108 ft
 37. (a) $S = \frac{5mb^2}{8}, s = \frac{3mb^2}{8}$

(b) $S(n) = \frac{mb^2(n + 1)}{2n}$

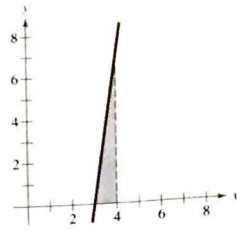
$s(n) = \frac{mb^2(n - 1)}{2n}$

- (c) $\frac{1}{2}mb^2$ (d) $\frac{1}{2}mb^2$

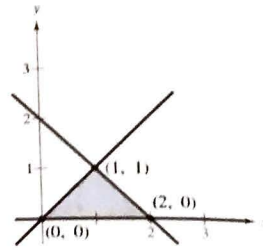
39. 6



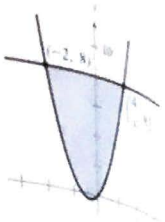
41. $\frac{10}{3}$



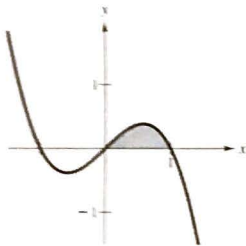
13. $A = 1$



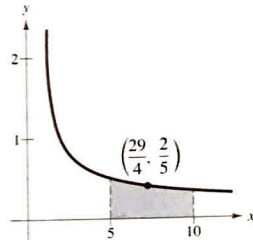
15. $A = \frac{500}{27}$



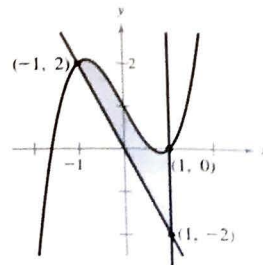
43. $\frac{1}{4}$



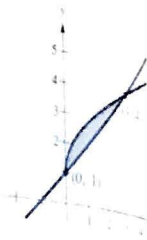
45. Average = $\frac{2}{5}$, $x = \frac{29}{4}$



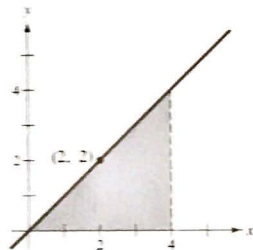
17. $A = 2$



19. $A = \frac{3}{2}$

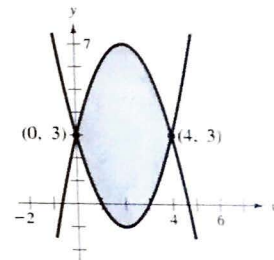


47. Average = 2, $x = 2$

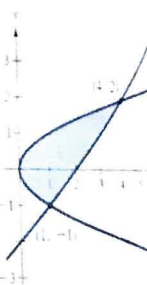


49. 0.254

21. $A = \frac{64}{3}$



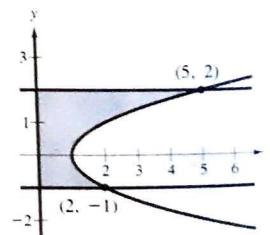
23. $A = \frac{9}{2}$



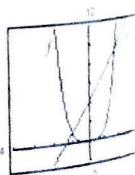
51. (a) $\frac{20,650}{M}$ (b) $\frac{43,150}{M}$

53. (a) $0.025 = 2.5\%$ (b) $0.736 = 73.6\%$

25. $A = 6$



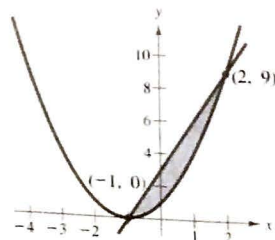
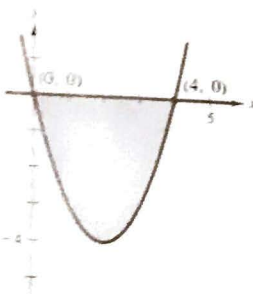
27. $A = 10.6115$



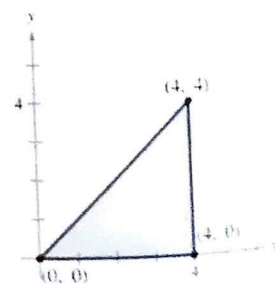
Chapter 6

Section 6.1

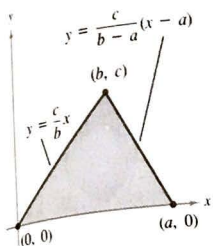
1. $A = 36$ 3. $A = 9$ 5. $A = \frac{13}{3}$ 7. d
 9. $A = \frac{32}{3}$ 11. $A = \frac{9}{2}$



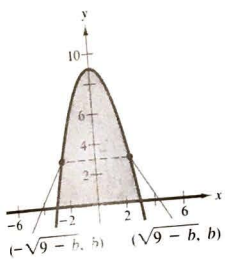
29. $A = 8$



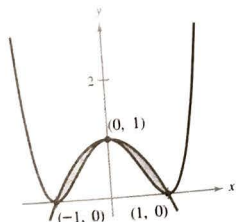
31. $A = \frac{1}{2}ac$



33. $b = 9\left(1 - \frac{1}{\sqrt[3]{4}}\right) \approx 3.330$

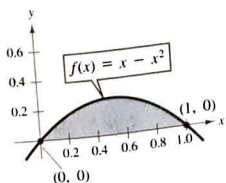


35. $x^4 - 2x^2 + 1 \leq 1 - x^2$ on $[-1, 1]$
 $A = \int_{-1}^1 [(1 - x^2) - (x^4 - 2x^2 + 1)] dx = \frac{4}{15}$



37. $A = \int_{-2}^1 [x^3 - (3x - 2)] dx = \frac{27}{4}$

39. 1.760 41. $\frac{1}{6}$



43. \$1.625 billion 45. Consumer surplus = 1600
 Producer surplus = 400
 47. Consumer surplus = 50,000 49. 4.773
 Producer surplus = 25,497

Section 6.2

1. $\frac{\pi}{3}$ 3. $\frac{16\pi}{3}$ 5. $\frac{15\pi}{2}$ 7. $\frac{2\pi}{35}$ 9. 8π
 11. $\frac{\pi}{4}$
 13. (a) 8π (b) $\frac{128\pi}{5}$ (c) $\frac{256\pi}{15}$ (d) $\frac{192\pi}{5}$
 15. (a) $\frac{32\pi}{3}$ (b) $\frac{64\pi}{3}$ 17. $\frac{128\pi}{15}$ 19. $\frac{3\pi}{4}$
 21. 18π 23. $\frac{363\pi}{64}$ 25. $\frac{208\pi}{3}$
 27. $\frac{384\pi}{5}$ 29. $\frac{512\pi}{15}$ 31. 60π 33. 18π
 37. $\pi r^2 h \left(1 - \frac{h}{H} + \frac{h^2}{3H^2}\right)$
 41. $\frac{\pi}{30}$ 43. 9.293
 45. (a) $\frac{128}{3}$ (b) $\frac{32\sqrt{3}}{3}$ (c) $\frac{16\pi}{3}$ (d) $\frac{32}{3}$
 47. (a) $\frac{1}{10}$ (b) $\frac{\pi}{80}$ (c) $\frac{\sqrt{3}}{40}$ (d) $\frac{3}{80}$ (e) $\frac{\pi}{20}$
 49. $\frac{2r^3}{3}$ 51. 122.92

Section 6.3

1. $\frac{16\pi}{3}$ 3. $\frac{8\pi}{3}$ 5. $\frac{128\pi}{5}$ 7. 8π 9. $\frac{16\pi}{3}$
 11. 16π 13. 64π 15. $\frac{8\pi}{3}$ 17. $\frac{192\pi}{5}$ 19. $\frac{\pi}{2}$
 21. (a) $\frac{128\pi}{7}$ (b) $\frac{64\pi}{5}$ (c) $\frac{96\pi}{5}$ (d) $\frac{320\pi}{7}$
 23. (a) $\frac{\pi a^3}{15}$ (b) $\frac{\pi a^3}{15}$ (c) $\frac{4\pi a^3}{15}$
 25. Diameter = $2\sqrt{4 - 2\sqrt{3}} \approx 1.464$
 29. 2.97 (Shell), 3.01 (Disc)
 31. 122,313 ft³ 33. $4\pi^2$ 35. 186.055

Section 6.4

1. 13 3. $\frac{2}{3}(\sqrt{8} - 1) \approx 1.219$ 5. $\frac{33}{16}$
 7. $\frac{779}{240}$ 9. $s = \int_{-2}^1 \sqrt{2 + 4x + 4x^2} dx$
 11. $s = \int_0^2 \sqrt{1 + 4x^2} dx$ 13. $\int_1^2 \frac{\sqrt{y^6 + 4}}{y^3} dy$
 15. 2.1517 17. 8.6101 19. $\frac{2}{3}$
 21. $3 \arcsin \frac{2}{3} \approx 2.1892$
 23. $\frac{\pi}{9}(82\sqrt{82} - 1) \approx 258.85$ 25. $\frac{47\pi}{16}$

27. $\frac{\pi}{27}(145\sqrt{145} - 10\sqrt{10}) \approx 199.48$
 29. $\pi r\sqrt{r^2 + h^2}$
 31. $6\pi(3 - \sqrt{5}) \approx 14.40$
 33. Surface area = $\frac{\pi}{27} \text{ft}^2 \approx 16.8 \text{in.}^2$ 37. 50.86
 Amount of glass = $\frac{\pi}{27} \left(\frac{0.015}{12}\right)$
 $\approx 0.00015 \text{ft}^3$
 $\approx 0.25 \text{in.}^3$

Section 6.5

1. 1000 ft · lb 3. 300 ft · lb
 5. 30.625 in · lb $\approx 2.55 \text{ft} \cdot \text{lb}$
 7. 360 in · lb = 30 ft · lb
 9. 180 in · lb = 15 ft · lb
 11. (a) 2496 ft · lb (b) 9984 ft · lb
 13. 431,308.8 π ft · lb 15. 20,217.6 π ft · lb
 17. 2995.2 π ft · lb 19. 2457 π ft · lb
 21. (a) 761.905 mi · ton $\approx 8,046,000,000 \text{ft} \cdot \text{lb}$
 (b) 1,454.545 mi · ton $\approx 15,360,000,000 \text{ft} \cdot \text{lb}$
 23. (a) $2.93 \times 10^4 \text{mi} \cdot \text{tons} \approx 3.10 \times 10^{11} \text{ft} \cdot \text{lb}$
 (b) $3.38 \times 10^4 \text{mi} \cdot \text{tons} \approx 3.57 \times 10^{11} \text{ft} \cdot \text{lb}$
 25. $\frac{3k}{4}$ 27. 337.5 ft · lb 29. 300 ft · lb
 31. 168.75 ft · lb 33. 7987.5 ft · lb
 35. $2000 \ln \frac{3}{2} \approx 810.93 \text{ft} \cdot \text{lb}$ 37. 10,202.6 ft · lb

Section 6.6

1. 936 lb 3. 748.8 lb 5. 1123.2 lb
 7. 748.8 lb 9. 1064.96 lb 11. 748.8 lb
 13. 15,163.2 lb 15. 2814 lb 17. 3376.8 lb
 19. 94.5 lb 23. 960 lb
 25. 9,984 lb (on the wall at the shallow end)
 39,936 lb (on the wall at the deep end)
 46,592 lb (on the side walls)
 27. 6483 lb

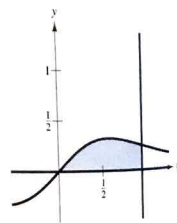
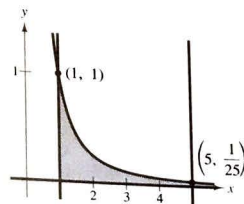
Section 6.7

1. $\bar{x} = -\frac{6}{7}$ 3. $\bar{x} = 12$ 5. $\bar{x} = 17$
 7. $(\bar{x}, \bar{y}) = \left(-\frac{7}{8}, -\frac{7}{16}\right)$
 9. $(\bar{x}, \bar{y}) = \left(\frac{4 + 3\pi}{4 + \pi}, 0\right)$ 11. $(\bar{x}, \bar{y}) = \left(0, \frac{135}{34}\right)$

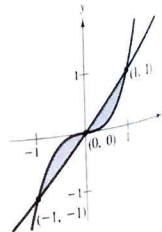
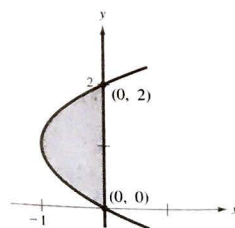
13. $(\bar{x}, \bar{y}) = \left(0, \frac{2 + 3\pi}{2 + \pi}\right)$
 15. $M_x = 4\rho, M_y = \frac{64\rho}{5}, (\bar{x}, \bar{y}) = \left(\frac{12}{5}, \frac{3}{4}\right)$
 17. $M_x = \frac{\rho}{12}, M_y = \frac{\rho}{15}, (\bar{x}, \bar{y}) = \left(\frac{2}{5}, \frac{1}{2}\right)$
 19. $M_x = \frac{99\rho}{5}, M_y = \frac{27\rho}{4}, (\bar{x}, \bar{y}) = \left(\frac{3}{2}, \frac{22}{5}\right)$
 21. $M_x = 0, M_y = \frac{256\rho}{15}, (\bar{x}, \bar{y}) = \left(\frac{8}{5}, 0\right)$
 23. $M_x = \frac{27\rho}{4}, M_y = -\frac{27\rho}{10}, (\bar{x}, \bar{y}) = \left(-\frac{3}{5}, \frac{3}{2}\right)$
 25. $M_x = \frac{192\rho}{7}, M_y = 96\rho, (\bar{x}, \bar{y}) = \left(5, \frac{10}{7}\right)$
 27. $(\bar{x}, \bar{y}) = \left(0, \frac{4}{3\pi}\right)$ 29. $(\bar{x}, \bar{y}) = \left(\frac{1}{2}, \frac{2}{5}\right)$
 31. $(\bar{x}, \bar{y}) = \left(\frac{12}{7}, \frac{26}{7}\right)$ 33. $(\bar{x}, \bar{y}) = \left(\frac{b}{3}, \frac{c}{3}\right)$
 35. $(\bar{x}, \bar{y}) = \left(\frac{(a+2b)c}{3(a+b)}, \frac{a^2 + ab + b^2}{3(a+b)}\right)$
 37. $\bar{y} = 16.5 \text{ft}$
 39. $V = 160\pi^2 \approx 1579.14$
 41. $V = \frac{128\pi}{3}$

Review Exercises for Chapter 6

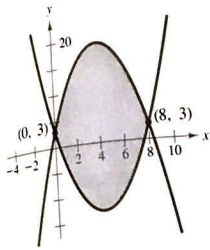
1. $A = \frac{4}{5}$ 3. $A = \frac{1}{4}$



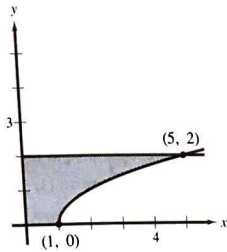
5. $A = \frac{4}{3}$ 7. $A = \frac{1}{2}$



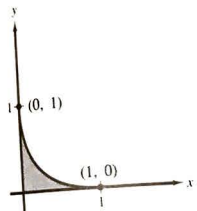
9. $A = \frac{512}{3}$



11. $A = \frac{14}{3}$



13. $A = \frac{1}{6}$



15. (a) $\frac{64\pi}{3}$

(b) $\frac{128\pi}{3}$

(c) $\frac{64\pi}{3}$

(d) $\frac{160\pi}{3}$

17. (a) 64π (b) 48π 19. $\frac{\pi}{2}$

21. (a) $\frac{512\pi}{15}$ (b) 64π

23. $50 \text{ in} \cdot \text{lb} \approx 4.167 \text{ ft} \cdot \text{lb}$ 25. $104,000\pi \text{ ft} \cdot \text{lb} \approx 163.4 \text{ ft} \cdot \text{ton}$ 27. $250 \text{ ft} \cdot \text{lb}$

29. $72,800 \text{ lb}$ (on side walls)
 $62,400 \text{ lb}$ (on wall at deep end)
 $15,600 \text{ lb}$ (on wall at shallow end)

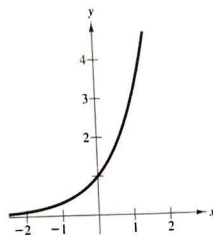
31. $4992\pi \text{ lb}$ 33. $(\bar{x}, \bar{y}) = \left(\frac{a}{5}, \frac{a}{5}\right)$

35. $(\bar{x}, \bar{y}) = \left(0, \frac{2a^2}{5}\right)$

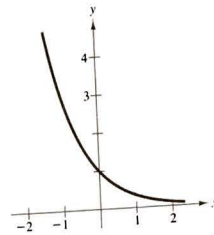
37. $s = \int_0^{\sqrt{3}} \frac{4}{\sqrt{4-x^2}} dx$ 39. 15π

41. $\frac{4}{15}$ 43. $\frac{32\pi}{105}$ 45. $\frac{8}{15}(1 + 6\sqrt{3}) \approx 6.076$

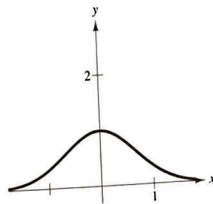
19.



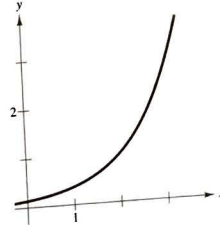
21.



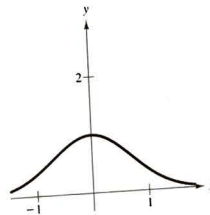
23.



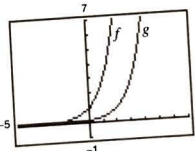
25.



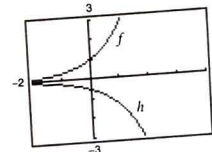
27.



29. (a)

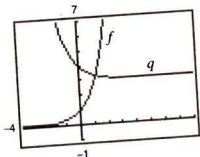


(b)



Translation two units to the right

(c)



Reflection in the y-axis and a translation three units upward

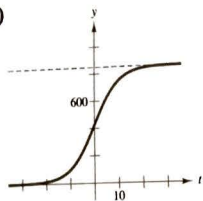
31. c 32. d 33. a 34. b
 35. (a) \$2593.74 (b) \$2653.30 (c) \$2707.04
 (d) \$2717.91 (e) \$2718.28
 37. (a) \$88,692.04 (b) \$30,119.42
 (c) \$9071.80 (d) \$247.88
 39. (a) 0.154 (b) 0.487 (c) 0.811

Chapter 7

Section 7.1

1. (a) 125 (b) 9 (c) $\frac{1}{9}$ (d) $\frac{1}{3}$
 3. (a) 5^5 (b) $\frac{1}{5}$ (c) $\frac{1}{5}$ (d) 2^2
 5. (a) e^6 (b) e^{12} (c) $\frac{1}{e^6}$ (d) e^2
 7. $x = 4$ 9. $x = -2$ 11. $x = 2$
 13. $x = 16$ 15. $x = -\frac{5}{2}$
 17. $2.7182805 < e$

41. (a) 850 (b)



43. (a) 0.731 (b) 0.83

Section 7.2

1. 3 3. 1 5. -2

7. $2e^{2x}$ 9. $2(x-1)e^{-2x+x^2}$ 11. $-\frac{e^{1/x}}{x^2}$

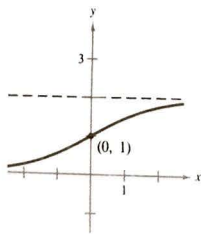
13. $\frac{e^{\sqrt{x}}}{2\sqrt{x}}$ 15. $e^{3x}(3x+4)$ 17. $\frac{e^{x^2}(2x^2-1)}{x^2}$

19. $3(e^{-x} + e^x)^2(e^x - e^{-x})$ 21. $\frac{-2(e^x - e^{-x})}{(e^x + e^{-x})^2}$

23. xe^x 25. $\frac{10 - e^y}{xe^y + 3}$ 27. $6(3e^{3x} + 2e^{-2x})$

29. $32(x+1)e^{4x}$

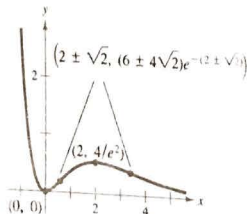
31. Point of inflection: (0, 1)



33. Relative minimum: (0, 0)

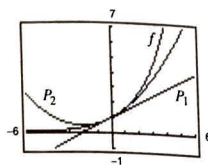
Relative maximum: (2, $4e^{-2}$)

Points of inflection: $(2 \pm \sqrt{2}, (6 \pm 4\sqrt{2})e^{-(2 \pm \sqrt{2})})$



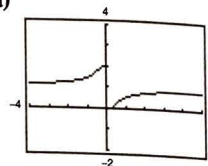
35. $y = x + 1$ 37. $A = \sqrt{2}e^{-1/2}$

39.



The values of f , P_1 , P_2 , and their first derivatives agree at $x = 0$. The values of the second derivatives of f and P_2 agree at $x = 0$.

41. (a)



(b) When x increases without bound, $1/x$ approaches 0, and $e^{1/x}$ approaches 1. Therefore, $f(x)$ approaches $2/(1+1) = 1$. Thus, $f(x)$ has a horizontal asymptote at $y = 1$. As x approaches 0 from the right, $1/x$ approaches ∞ , $e^{1/x}$ approaches ∞ , and $f(x)$ approaches 0. As x approaches 0 from the left, $1/x$ approaches $-\infty$, $e^{1/x}$ approaches 0, and $f(x)$ approaches 2. The limit does not exist, because the left limit does not equal the right limit. Therefore, $x = 0$ is a nonremovable discontinuity.

43. $\frac{e^2 - 1}{2e^2}$ 45. $\frac{e}{3}(e^2 - 1)$ 47. $\frac{1}{1 + e^{-x}} + C$

49. $\frac{1}{2a}e^{ax^2} + C$ 51. $\frac{e}{3}(e^2 - 1)$

53. $-\frac{1}{3}(1 + e^{-x})^3 + C$ 55. $-\frac{2}{3}(1 - e^x)^{3/2} + C$

57. $2\sqrt{e^x - e^{-x}} + C$ 59. $-\frac{5}{2}e^{-2x} + e^{-x} + C$

61. 4 63. $f(x) = \frac{1}{2}(e^x + e^{-x})$

65. $e^5 - 1 \approx 147.41$ 67. $1 - e^{-1} \approx 0.632$

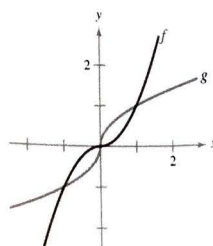
69. $\frac{\pi}{2}(e^2 - 1)$ 73. (a) 0.212 (b) 0.035

75. 0.3413 77. (a) Midpoint Rule: 92.1898
Trapezoidal Rule: 93.8371
Simpson's Rule: 92.7385

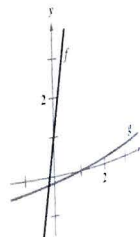
(b) Midpoint Rule: 1.1906
Trapezoidal Rule: 1.1827
Simpson's Rule: 1.1880

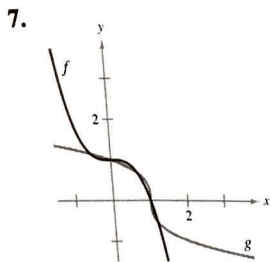
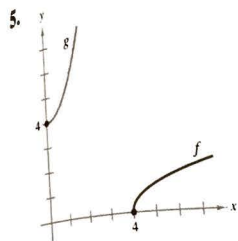
Section 7.3

1.

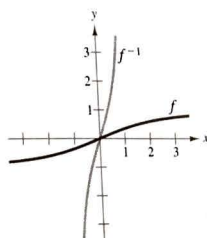


3.





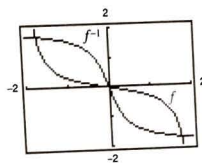
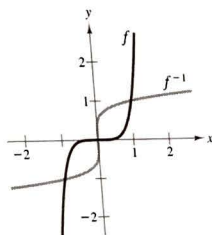
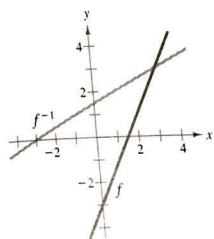
21. $f^{-1}(x) = \frac{\sqrt{7x}}{\sqrt{1-x^2}}, -1 < x < 1$



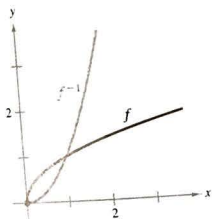
9. $f^{-1}(x) = \frac{x+3}{2}$

11. $f^{-1}(x) = x^{1/5}$

23. $f^{-1}(x) = \begin{cases} \frac{1 - \sqrt{1 + 16x^2}}{2x}, & \text{if } x \neq 0 \\ 0, & \text{if } x = 0 \end{cases}$

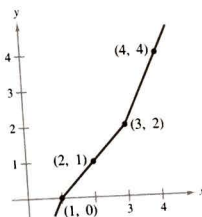


13. $f^{-1}(x) = x^2, x \geq 0$

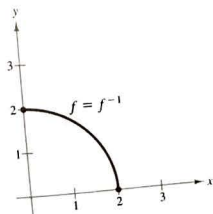


25.

x	1	2	3	4
$f^{-1}(x)$	0	1	2	4

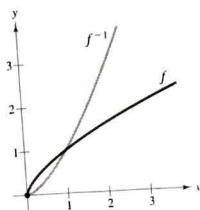
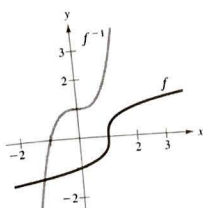


15. $f^{-1}(x) = \sqrt{4-x^2}, 0 \leq x \leq 2$

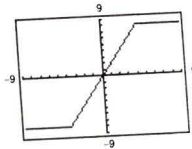
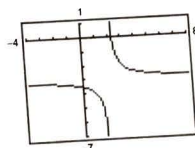


17. $f^{-1}(x) = x^3 + 1$

19. $f^{-1}(x) = x^{3/2}, x \geq 0$



27. 32 29. 600 31. Inverse exists.
 33. Inverse does not exist. 35. Inverse exists.
 37. Inverse exists. 39. Inverse exists.
 41. One-to-one 43. Not one-to-one



45. $f'(x) = 2(x-4) > 0$ on $(4, \infty)$

47. $f'(x) = -\frac{8}{x^3} < 0$ on $(0, \infty)$

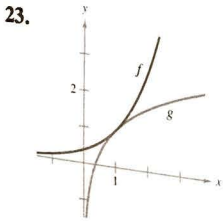
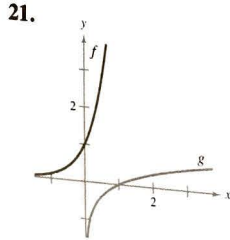
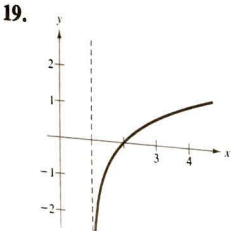
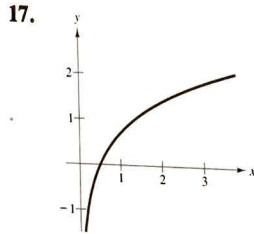
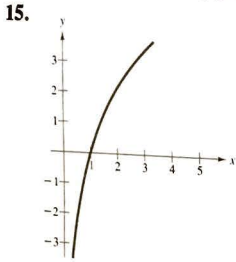
49. $f'(\frac{1}{2}) = \frac{3}{4}, (f^{-1})'(\frac{1}{8}) = \frac{4}{3}$

51. $f'(5) = \frac{1}{2}, (f^{-1})'(1) = 2$

53. Not continuous at $x = 0$

Section 7.4

1. (a) $\log_2 8 = 3$ (b) $\log_3 \frac{1}{3} = -1$
 3. (a) $10^{-2} = 0.01$ (b) $(\frac{1}{2})^{-3} = 8$
 5. (a) $e^{0.6931\dots} = 2$ (b) $e^{2.128\dots} = 8.4$
 7. (a) $x = 3$ (b) $x = -1$
 9. (a) $x = \frac{1}{3}$ (b) $x = \frac{1}{16}$
 11. (a) $x = \frac{1}{9}$ (b) $x = 3$
 13. (a) $x = -1, 2$ (b) $x = \frac{1}{3}$



25. x^2 27. $5x + 2$ 29. \sqrt{x}
 31. (a) 1.7917 (b) -0.4055
 (c) 4.3944 (d) 0.5493
 33. $\ln 2 - \ln 3$ 35. $\ln x + \ln y - \ln z$
 37. $\frac{3}{2} \ln 2$ 39. $3[\ln(x+1) + \ln(x-1)] - 3 \ln x$
 41. $\ln z + 2 \ln(z-1)$ 43. $\ln \frac{x-2}{x+2}$
 45. $\ln \sqrt[3]{\frac{x(x+3)^2}{x^2-1}}$ 47. $\ln \frac{9}{\sqrt{x^2+1}}$
 49. $x = 4$ 51. $x = 1$
 53. $x = \ln 4 - 1 \approx 0.386$
 55. $x = \frac{\ln 5 - \ln 6}{0.11} \approx -1.657$
 57. $x = \frac{\ln 15}{\ln 25} \approx 0.841$ 59. $t = \frac{\ln 2}{\ln 1.07} \approx 10.245$

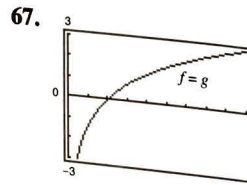
61. (a) $t \approx 6.642$ years (b) $t \approx 6.330$ years
 (c) $t \approx 6.302$ years (d) $t \approx 6.301$ years

63.

r	2%	4%	6%	8%	10%	12%
t (years)	54.93	27.47	18.31	13.73	10.99	9.16

65.

x	y	$\frac{\ln x}{\ln y}$	$\ln \frac{x}{y}$	$\ln x - \ln y$
1	2	0	-0.6931	-0.6931
3	4	0.7925	-0.2877	-0.2877
10	5	1.4307	0.6931	0.6931
4	0.5	-2.000	2.0794	2.0794



69. (a) 1.771 (b) 0.712
 (c) -3.322 (d) -0.431

Section 7.5

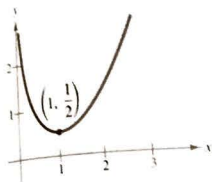
1. 3 3. 2 5. $\frac{2}{x}$ 7. $\frac{2(x^3-1)}{x(x^3-4)}$
 9. $\frac{4(\ln x)^3}{x}$ 11. $\frac{2x^2-1}{x(x^2-1)}$ 13. $\frac{1-x^2}{x(x^2+1)}$
 15. $\frac{1-2 \ln x}{x^3}$ 17. $\frac{2}{x \ln x^2} = \frac{1}{x \ln x}$
 19. $\frac{1}{1-x^2}$ 21. $\frac{-4}{x(x^2+4)}$ 23. $\frac{\sqrt{x^2+1}}{x^2}$
 25. $(\ln 4)4^x$ 27. $(\ln 5)5^{x-2}$
 29. $x^{2x}(x \ln 2 + 2)$ 31. $\frac{1}{x(\ln 3)}$
 33. $\frac{x-2}{(\ln 2)x(x-1)}$ 35. $\frac{x}{(\ln 5)(x^2-1)}$
 37. $\frac{2x}{x^2-1}$ 39. $\frac{2x^2-1}{\sqrt{x^2-1}}$
 41. $\frac{3x^3-15x^2+8x}{2(x-1)^3\sqrt{3x-2}}$
 43. $\frac{(2x^2+2x-1)\sqrt{x-1}}{(x+1)^{3/2}}$
 45. $2(1-\ln x)x^{(2x)-2}$
 47. $(x-2)^{x+1} \left[\frac{x+1}{x-2} + \ln(x-2) \right]$

49. $xy'' + y' = x\left(\frac{-2}{x^2}\right) + \frac{2}{x} = 0$

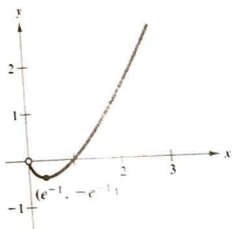
51. $\frac{2xy}{3 - 2y^2}$

53. $5x - y - 2 = 0$

55. Relative minimum: $(1, \frac{1}{2})$

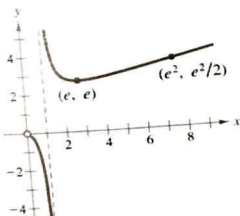


57. Relative minimum: $(e^{-1}, -e^{-1})$



59. Relative minimum: (e, e)

Point of inflection: $(e^2, \frac{e^2}{2})$



61. 0.567

63. (a) 0 (b) $L'(x) = \frac{1}{x}$, $L'(1) = 1$ (c) 2.718

65. (a) 0 (b) $-\sqrt{3}$

Section 7.6

1. $\ln|x+1| + C$ 3. $-\frac{1}{2}\ln|3-2x| + C$

5. $\ln\sqrt{x^2+1} + C$ 7. $\frac{x^2}{2} - 4\ln|x| + C$

9. $\frac{1}{4}$ 11. $\frac{7}{3}$ 13. $-\ln 3$

15. $2\sqrt{x+1} + C$

17. $\frac{1}{3}\ln|x^3+3x^2+9x| + C$

19. $3\ln|1+x^{1/3}| + C$

21. $2[\sqrt{x} - \ln(1+\sqrt{x})] + C$

23. $x + 6\sqrt{x} + 18\ln|\sqrt{x}-3| + C$

25. $-\frac{2}{3}\ln|1-x\sqrt{x}| + C$

27. $\ln|x-1| + \frac{1}{2(x-1)^2} + C$ 29. $\frac{3^x}{\ln 3} + C$

31. $\frac{7}{\ln 4}$ 33. $-\frac{1}{2\ln 5}5^{x^2} + C$

35. $x - \ln(e^x + 1) + C_1$ or $-\ln(1 + e^{-x}) + C_2$

37. $\frac{15}{2} + 8\ln 2 \approx 13.045$ square units

39. $\pi \ln 4$ 41. $\frac{\pi}{4}(32\ln 4 - 3)$ 43. $\frac{26}{\ln 3}$

45. $2000 \ln \frac{3}{2} \approx 810.93$ ft · lb

47. $P(t) = 1000(12\ln|1 + 0.25t| + 1)$
 $P(3) \approx 7715$

49. $\frac{10}{\ln 2} \ln \frac{4}{3} \approx 4.15$ min

Section 7.7

1. $y = \frac{1}{2}e^{0.4605t}$ 3. $y = 0.6687e^{0.4024t}$

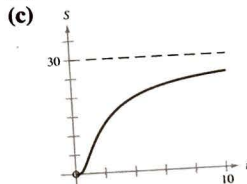
5. Time to double: 5.78 years
Amount after 10 years: \$3320.12
Amount after 25 years: \$20,085.54

7. Annual rate: 8.94%
Amount after 10 years: \$1833.67
Amount after 25 years: \$7009.86

9. Annual rate: 9.50%
Time to double: 7.30 years
Amount after 25 years: \$5375.51

11. (a) $N = 30(1 - e^{-0.0502t})$ (b) 36 days

13. (a) $S = 30e^{-1.7918/t}$ (b) 20,965 units



15. 900 17. 6015

19. Amount after 1000 years: 6.52 grams
Amount after 10,000 years: 0.14 gram

21. Initial quantity: 6.70 grams
Amount after 1000 years: 5.94 grams

23. Initial quantity: 2.16 grams
Amount after 10,000 years: 1.63 grams

25. 95.81% 27. 15,683 years 29. 22.35°

31. 11.75° 33. 527.06 mm Hg

Section 7.8

1. $\frac{1}{3}$ 3. $\frac{5}{3}$ 5. 3 7. 0 9. 2

11. $n = 1; 0$, $n = 2; \frac{1}{2}$, $n \geq 3; \infty$ 13. 0

15. $\frac{3}{2}$ 17. ∞ 19. 0 21. $-\frac{3}{2}$ 23. 1

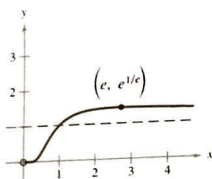
25. 0 27. 1 29. 1

31. (a) $f(x) = x^2 - 25$, $g(x) = x - 5$
 (b) $f(x) = (x - 5)^2$, $g(x) = x^2 - 25$
 (c) $f(x) = x^2 - 25$, $g(x) = (x - 5)^3$
 33. 0 35. 0 37. 0
 39. Limit is not of the form $0/0$ or ∞/∞ .

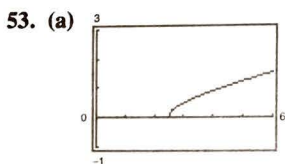
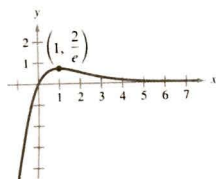
41.

x	10	10^2	10^4	10^6	10^8	10^{10}
$\frac{(\ln x)^4}{x}$	2.811	4.498	0.720	0.036	0.001	0.000

45. (a) 0 (b) ∞ 47. $v = 32t + v_0$
 49. Horizontal asymptote: $y = 1$
 Relative maximum: $(e, e^{1/e})$

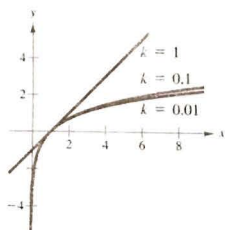


51. Horizontal asymptote: $y = 0$
 Relative maximum: $(1, 2/e)$



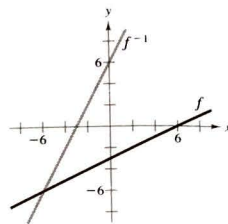
(b) $\frac{1}{2}$

55. $\lim_{k \rightarrow 0^+} \frac{x^k - 1}{k} = \ln x$

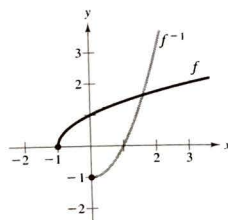


Review Exercises for Chapter 7

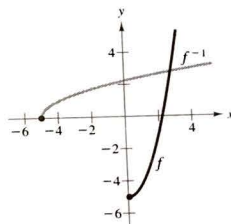
1. $f^{-1}(x) = 2x + 6$



3. $f^{-1}(x) = x^2 - 1, x \geq 0$



5. $f^{-1}(x) = \sqrt{x + 5}$



7. $f^{-1}(x) = \sqrt{\frac{x}{2}} + 4, x \geq 4$ 9. $x = 3$

11. $x = 5 \pm \sqrt{7}$ 13. $\frac{1}{2x}$

15. $\frac{1 + 2 \ln x}{2\sqrt{\ln x}}$ 17. $\frac{-y}{x(2y + \ln x)}$

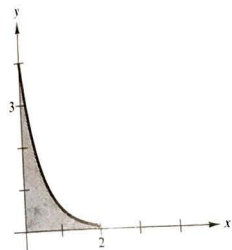
19. $y(1 + \ln x)$ 21. $\frac{x}{(a + bx)^2}$ 23. $\frac{1}{x(a + bx)}$

25. $-2x$ 27. $xe^x(x + 2)$ 29. $\frac{e^{2x} - e^{-2x}}{\sqrt{e^{2x} + e^{-2x}}}$

31. $3x^{-1} \ln 3$ 33. $\frac{y - ye^x - e^y}{e^x + xe^y - x}$ 35. ax^{a-1}

37. $x^x(1 + \ln x)$ 39. $\frac{1}{7} \ln |7x - 2| + C$

41. $\ln |\ln |3x|| + C$ 43. $\frac{x^2}{2} + 3 \ln |x| + C$
 45. $\frac{1}{3} \ln |x^3 - 1| + C$ 47. $2\sqrt{\ln x} + C$
 49. $-\frac{1}{6}e^{-3x^2} + C$ 51. $\frac{e^{4x} - 3e^{2x} - 3}{3e^x} + C$
 53. $\ln |e^x - 1| + C$ 55. $-e^{-x^2/2} + C$
 57. $3 + \ln 4$ 59. $\ln \frac{5}{3}$
 61. $2[1 - e^{-4}] \approx 1.963$



63. Average $= \frac{2}{5} \ln \frac{3}{2} \approx 0.162$,
 $x = 1 + \frac{5}{2 \ln(3/2)} \approx 7.166$
 65. $\frac{1}{2}(1 - e^{-16}) \approx 0.500$
 67. (a) \$525.64 (b) \$824.36 (c) \$74,206.58
 69. \$3499.38
 71. (a) 27.73 years (b) 43.94 years
 73. (a) -24.26% (b) -14.72%
 75. (a) 0.3935 (b) 0.7769 (c) 0.2492
 (d) 0.9502
 77. (a) 0.60 (b) 0.85
 81. $v(t) = \frac{1}{k}[32 - (20k + 32)e^{kt}]$
 83. $s(t) = \frac{32}{k}t - \frac{32}{k^2}(1 - e^{kt}) + s_0$ 85. 0
 87. ∞ 89. 1 91. $1000e^{0.09} \approx 1094.17$

9.

r	8 ft	15 in.	85 cm	24 in.	$\frac{12,963}{\pi}$ mi
s	12 ft	24 in.	63.75π cm	96 in.	8642 mi
θ	1.5	1.6	$\frac{3\pi}{4}$	4	$\frac{2\pi}{3}$

11. 171.89°
 13. (a) $\sin \theta = \frac{4}{5}$, $\csc \theta = \frac{5}{4}$
 $\cos \theta = \frac{3}{5}$, $\sec \theta = \frac{5}{3}$
 $\tan \theta = \frac{4}{3}$, $\cot \theta = \frac{3}{4}$
 (b) $\sin \theta = -\frac{15}{17}$, $\csc \theta = -\frac{17}{15}$
 $\cos \theta = \frac{8}{17}$, $\sec \theta = \frac{17}{8}$
 $\tan \theta = -\frac{15}{8}$, $\cot \theta = -\frac{8}{15}$
 15. Quadrant III 17. 2 19. $\frac{4}{3}$ 21. $\frac{17}{15}$
 23. (a) $\sin 60^\circ = \frac{\sqrt{3}}{2}$ (b) $\sin \frac{2\pi}{3} = \frac{\sqrt{3}}{2}$
 $\cos 60^\circ = \frac{1}{2}$ $\cos \frac{2\pi}{3} = -\frac{1}{2}$
 $\tan 60^\circ = \sqrt{3}$ $\tan \frac{2\pi}{3} = -\sqrt{3}$
 (c) $\sin \frac{\pi}{4} = \frac{\sqrt{2}}{2}$ (d) $\sin \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$
 $\cos \frac{\pi}{4} = \frac{\sqrt{2}}{2}$ $\cos \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$
 $\tan \frac{\pi}{4} = 1$ $\tan \frac{5\pi}{4} = 1$
 25. (a) $\sin 225^\circ = -\frac{\sqrt{2}}{2}$ (b) $\sin(-225^\circ) = \frac{\sqrt{2}}{2}$
 $\cos 225^\circ = -\frac{\sqrt{2}}{2}$ $\cos(-225^\circ) = -\frac{\sqrt{2}}{2}$
 $\tan 225^\circ = 1$ $\tan(-225^\circ) = -1$
 (c) $\sin 300^\circ = -\frac{\sqrt{3}}{2}$ (d) $\sin 330^\circ = -\frac{1}{2}$
 $\cos 300^\circ = \frac{1}{2}$ $\cos 330^\circ = \frac{\sqrt{3}}{2}$
 $\tan 300^\circ = -\sqrt{3}$ $\tan 330^\circ = -\frac{\sqrt{3}}{3}$
 27. (a) 0.1736 29. (a) 0.3640
 (b) 5.759 (b) 0.3640
 31. (a) $\theta = \frac{\pi}{4}, \frac{7\pi}{4}$ 33. (a) $\theta = \frac{\pi}{4}, \frac{5\pi}{4}$
 (b) $\theta = \frac{3\pi}{4}, \frac{5\pi}{4}$ (b) $\theta = \frac{5\pi}{6}, \frac{11\pi}{6}$
 35. $\theta = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$ 37. $\theta = 0, \frac{\pi}{4}, \pi, \frac{5\pi}{4}$
 39. $\theta = \frac{\pi}{3}, \frac{5\pi}{3}$ 41. $\theta = 0, \frac{\pi}{2}, \pi$

Chapter 8

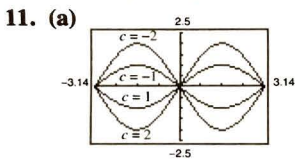
Section 8.1

1. (a) $396^\circ, -324^\circ$ (b) $240^\circ, -480^\circ$
 3. (a) $\frac{19\pi}{9}, -\frac{17\pi}{9}$ (b) $\frac{10\pi}{3}, -\frac{2\pi}{3}$
 5. (a) $\frac{\pi}{6}$ (b) $\frac{5\pi}{6}$ (c) $\frac{7\pi}{4}$ (d) $\frac{2\pi}{3}$
 7. (a) 270° (b) 210° (c) -105° (d) 20°

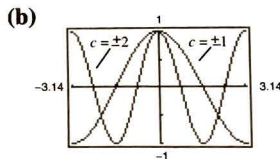
43. $y = \frac{100\sqrt{3}}{3}$ 45. $x = \frac{25\sqrt{3}}{3}$ 47. 2.63 in.
 49. 6839.307 ft

Section 8.2

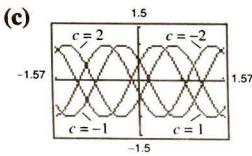
1. Period: π Amplitude: 2
 3. Period: 4 Amplitude: $\frac{5}{2}$
 5. Period: 6π Amplitude: 2
 7. Period: $\frac{\pi}{5}$ Amplitude: 2
 9. Period: $\frac{1}{2}$ Amplitude: 3



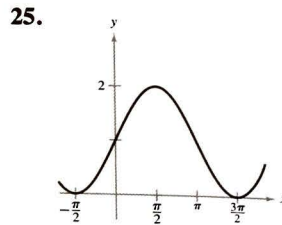
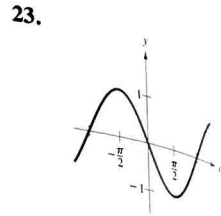
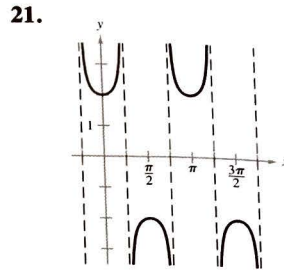
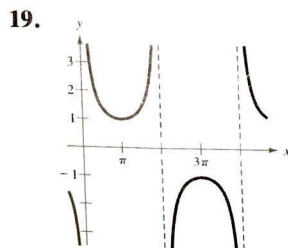
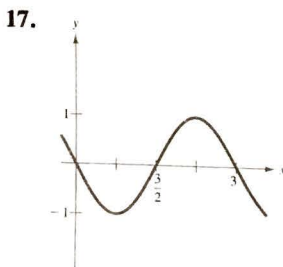
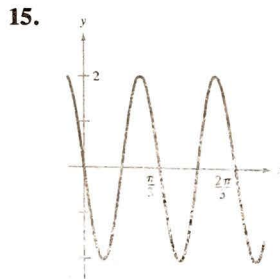
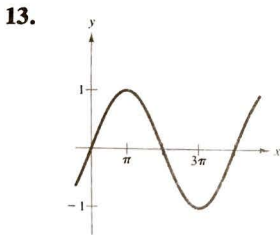
Change in amplitude



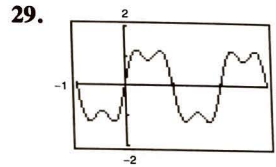
Change in period



Horizontal translation



27. $y = 3 \cos\left(\frac{x}{2} - \frac{\pi}{2}\right)$



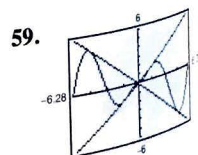
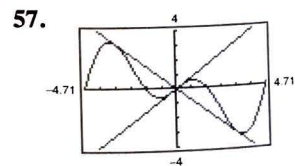
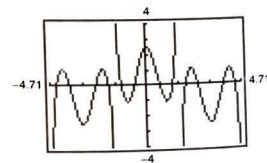
$f(x) = \frac{4}{\pi} \left(\sin \pi x + \frac{1}{3} \sin 3\pi x + \frac{1}{5} \sin 5\pi x + \dots \right)$

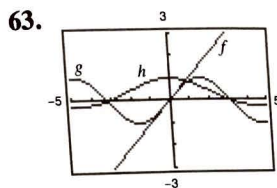
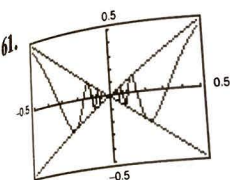
31. $\frac{1}{5}$ 33. 0 35. 0 37. 1 39. 1
 41. $\frac{2}{3}$ 43. 0 45. Limit does not exist.
 47. ∞ 49. Continuous for all real x

51. Nonremovable discontinuities at integer multiples of $\pi/2$

53. Continuous for all real x

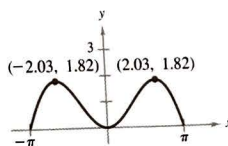
55. $\lim_{x \rightarrow 0} f(x) = \frac{5}{2}$





The magnitudes of $f(x)$ and $g(x)$ are approximately equal when x is "close to" 0. Therefore, their ratio is approximately 1.

67. $-2.03, 0, 2.03$



69. (a) $y = \frac{1}{4}$ in. $v = 4$ in./sec
 (c) Period: $\frac{\pi}{6}$ Frequency: $\frac{6}{\pi}$

71. $\theta = \arctan k, F = \frac{kW}{\sqrt{k^2 + 1}}$

73. $\theta = \frac{2\pi}{3}(3 - \sqrt{6}) \approx 66^\circ$

75. (a) $\frac{1}{2}$ rad/min (b) $\frac{3}{2}$ rad/min
 (c) 1.87 rad/min

77. (a) 0 ft/sec (b) 10π ft/sec
 (c) $10\sqrt{3}\pi$ ft/sec

79. $rg \sec^2 \theta \frac{d\theta}{dt} = 2v \frac{dv}{dt}$

81. (a) 12 sec (b) $(0, \sqrt{5})$
 (c) $\frac{\sqrt{6}\pi}{24} \approx 0.32$ ft/sec

65. $\frac{3}{4}$

Section 8.3

1. $2x + \frac{1}{2} \sin x$

3. $-\frac{1}{x^2} - 3 \cos x$ 5. $\frac{2}{\sqrt{x}} - 3 \sin x$

7. $t(t \cos t + 2 \sin t)$ 9. $-\frac{t \sin t + \cos t}{t^2}$

11. $-1 + \sec^2 x = \tan^2 x$

13. $-5x \csc x \cot x + 5 \csc x = 5 \csc x(1 - x \cot x)$

15. $\csc \theta \cot \theta - \cos \theta = \cos \theta \cot^2 \theta$

17. $t^2 \cos t + 2t \sin t - 2t \sin t + 2 \cos t - 2 \cos t = t^2 \cos t$

19. $\pi \cos 2\pi x$ 21. $\frac{-2 \csc x \cot x}{(1 - \csc x)^2}$

23. $-3 \sin 3x$ 25. $12 \sec^2 4x$ 27. $\pi \cos \frac{\pi x}{x}$

29. $\frac{1}{4} \sin 2x$ 31. $\frac{1}{2} \sin 4x$ 33. $\frac{1}{2} \cot x \sqrt{\sin x}$

35. $6 \sec^3 2x \tan 2x$ 37. $\csc x$ 39. $2e^x \cos x$

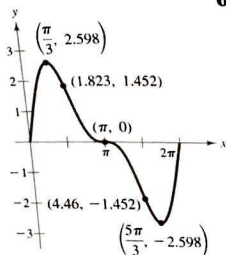
41. $\sec^2 x e^{\tan x}$ 43. $\sec x \csc x$

45. $\frac{\cos x}{2 \sin 2y}$, undefined 47. $-\frac{x^2}{x^2 + 1}, 0$

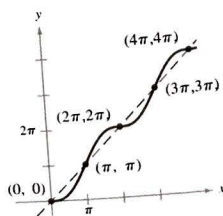
49. $\frac{\cot y}{x}, \frac{1}{2\sqrt{3}}$ 53. (a) 1 (b) 2 55. $\frac{2}{3}$

57. -2 59. $\frac{1}{2}$ 61. 1

63.



65.



Section 8.4

1. $-2 \cos x + 3 \sin x + C$ 3. $t + \csc t + C$

5. $\tan \theta + \cos \theta + C$ 7. $-\frac{1}{2} \cos 2x + C$

9. $\frac{1}{2} \sin x^2 + C$ 11. $2 \tan\left(\frac{x}{2}\right) + C$

13. $\frac{1}{2} \tan^2 x + C$ or $\frac{1}{2} \sec^2 x + C_1$

15. $-\cot x - x + C$ 17. $\frac{1}{3} \tan^3 x + C$

19. $\frac{1}{\pi} \ln |\sin \pi x| + C$

21. $-\frac{1}{2} \ln |\csc 2x + \cot 2x| + C$

23. $\ln |\tan x| + C$ 25. $\ln |\sec x - 1| + C$

27. $\ln |1 + \sin t| + C$ 29. $\ln |\theta - \sin \theta| + C$

31. $\sin e^x + C$ 33. $\ln |\cos e^{-x}| + C$

35. $x - \frac{1}{4} \cos 4x + C$

37. $\frac{3\sqrt{3}}{4}$ 39. $2(\sqrt{3} - 1)$ 41. $\frac{1}{2}$

43. $-1 + \sec 1$ 45. 2 47. 4

49. $2 \left[\frac{2\pi}{3} - \ln(2 + \sqrt{3}) \right] \approx 1.5549$

51. 2π 53. π 55. 3.829

57. (a) 102.352 thousand units

(b) 102.352 thousand units

(c) 74.5 thousand units

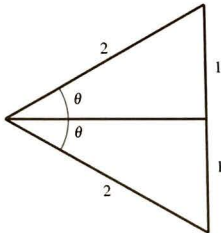
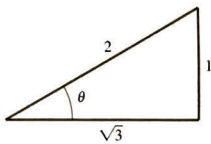
59. (a) 1.273 amps (b) 1.382 amps (c) 0 amp

61. $\frac{1}{2} \sin^2 x + C_1 = -\frac{1}{2} \cos^2 x + C_2$

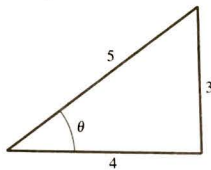
67. (a) 0.957 (b) 0.978
 69. (a) 0.334 (b) 0.305
 71. (a) 0.194 (b) 0.186
 73. 3.4624

Section 8.5

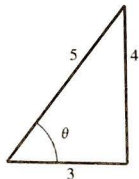
1. $\frac{\pi}{6}$ 3. $\frac{\pi}{3}$ 5. $\frac{\pi}{6}$ 7. $\frac{\pi}{4}$
 9. $\arccos\left(\frac{1}{1.269}\right) \approx 0.663$
 11. (a) $\frac{1}{2}$ (b) $\cos 2\theta = 1 - 2\sin^2 \theta = \frac{1}{2}$



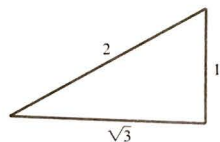
13. (a) $\frac{3}{5}$



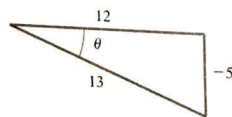
- (b) $\frac{5}{3}$



15. (a) $\cot[\arcsin(-\frac{1}{2})] = -\cot[\arcsin(\frac{1}{2})] = -\sqrt{3}$

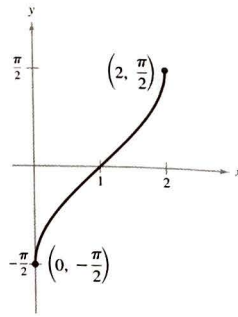


- (b) $-\frac{13}{5}$

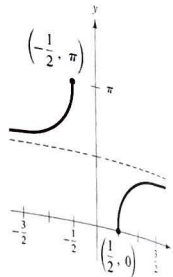


17. x 19. $\sqrt{1-4x^2}$ 21. $\frac{\sqrt{x^2-1}}{x}$
 23. $\frac{\sqrt{x^2-9}}{3}$ 25. $\frac{\sqrt{x^2+2}}{x}$
 27. $\arcsin\left(\frac{9}{\sqrt{x^2+81}}\right)$

31.



33.



35. $x = \frac{1}{3}[\sin(\frac{1}{2}) + \pi] \approx 1.207$ 37. $x = \frac{1}{3}$
 39. $\frac{2}{\sqrt{1-4x^2}}$ 41. $\frac{2}{\sqrt{2x-x^2}}$ 43. $-\frac{3}{\sqrt{4-x^2}}$
 45. $\frac{5}{1+25x^2}$ 47. $\frac{1}{|x|\sqrt{x^2-1}}$ 49. 0
 51. $-\frac{t}{\sqrt{1-t^2}}$ 53. $\frac{1}{2+3t^2}$ 55. $\frac{1}{1-x^4}$
 57. $\arcsin x$ 59. (0, 0)
 61. Relative maximum: (1.272, -0.606)
 Relative minimum: (-1.272, 3.747)
 63. (0.7862, 0.6662) 65. $\frac{\sqrt{3}}{40}$ rad/sec

Section 8.6

1. $\frac{\pi}{18}$ 3. $\frac{\pi}{6}$ 5. $\operatorname{arcsec}|2x| + C$
 7. $\frac{1}{2}x^2 - \frac{1}{2}\ln(x^2+1) + C$ 9. $\arcsin(x+1) + C$
 11. $\frac{1}{2}\arcsin t^2 + C$ 13. $\frac{1}{2}(\arctan x)^2 + C$
 15. $\frac{\pi^2}{32} \approx 0.308$ 17. $\frac{\sqrt{3}-2}{2} \approx -0.134$
 19. $\arcsin e^x + C$ 21. $\frac{1}{3}\arctan\left(\frac{x-3}{3}\right) + C$
 23. $2\arctan\sqrt{x} + C$ 25. $\frac{\pi}{4}$ 27. $\frac{\pi}{2}$
 29. $\ln|x^2+6x+13| - 3\arctan\left(\frac{x+3}{2}\right) + C$
 31. $\arcsin\left(\frac{x+2}{2}\right) + C$
 33. $-\sqrt{-x^2-4x} + C$ 35. $4 - 2\sqrt{3} + \frac{\pi}{6} \approx 1.059$
 37. $\frac{1}{2}\arctan(x^2+1) + C$
 39. $\frac{1}{4}\arcsin(4x-2) + C$
 41. $2(\sqrt{x-1} - \arctan\sqrt{x-1}) + C$
 43. $2\sqrt{e^t-3} - 2\sqrt{3}\arctan\left(\frac{\sqrt{e^t-3}}{\sqrt{3}}\right) + C$

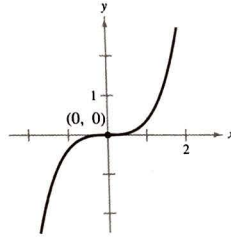
45. $\frac{\pi}{4}$ 47. $\frac{\pi}{8}$

49. $\sqrt{\frac{32}{k}} \tan \left[\arctan \left(500\sqrt{\frac{k}{32}} \right) - \sqrt{32kt} \right]$

51. (b) 3.14159 53. (a) $\arcsin x + C$
 (b) $-\sqrt{1-x^2} + C$
 (c) Does not fit Basic Formulas

55. (a) $\frac{2}{3}(x-1)^{3/2} + C$
 (b) $\frac{2}{15}(x-1)^{3/2}(3x+2) + C$
 (c) $\frac{2}{3}\sqrt{x-1}(x+2) + C$

63. Point of inflection: (0, 0)



65. $y''' - y' = a \cosh x - a \cosh x = 0$
 67. $-\frac{\sqrt{a^2 - x^2}}{x}$ 69. $\frac{52}{31}$ kg 71. $2a \sinh \frac{b}{a}$

Section 8.7

1. (a) 10.018 3. (a) $\frac{4}{3}$ 5. (a) 1.317
 (b) -0.964 (b) $\frac{13}{12}$ (b) 0.962
7. $\left(\frac{e^x - e^{-x}}{e^x + e^{-x}} \right)^2 + \left(\frac{2}{e^x + e^{-x}} \right)^2 = 1$
9. $\left(\frac{e^x - e^{-x}}{2} \right) \left(\frac{e^y + e^{-y}}{2} \right) + \left(\frac{e^x + e^{-x}}{2} \right) \left(\frac{e^y - e^{-y}}{2} \right)$
 $= \frac{e^{(x+y)} - e^{-(x+y)}}{2} = \sinh(x+y)$
11. $\left(\frac{e^x - e^{-x}}{2} \right) \left[3 + 4 \left(\frac{e^x - e^{-x}}{2} \right)^2 \right]$
 $= \frac{e^{3x} - e^{-3x}}{2} = \sinh(3x)$
13. $-2x \cosh(1-x^2)$ 15. $\coth x$
 17. $\operatorname{csch} x$ 19. $\sinh^2 x$ 21. $\operatorname{sech} x$
23. $\frac{y}{x} [\cosh x + x(\sinh x) \ln x]$ 25. $-2e^{-2x}$
27. $\frac{3}{\sqrt{9x^2 - 1}}$ 29. $|\sec x|$ 31. $2 \sec 2x$
33. $2 \sinh^{-1}(2x)$ 35. $-\frac{1}{2} \cosh(1-2x) + C$
 37. $\frac{1}{3} \cosh^3(x-1) + C$ 39. $\ln |\sinh x| + C$
41. $-\coth \frac{x^2}{2} + C$ 43. $\operatorname{csch} \frac{1}{x} + C$
45. $\frac{1}{5} \ln 3$ 47. $\frac{\pi}{4}$ 49. $\frac{1}{2} \arctan x^2 + C$
51. $-\operatorname{csch}^{-1}(e^x) + C = -\ln \left(\frac{1 + \sqrt{1 + e^{2x}}}{e^x} \right) + C$
53. $2 \sinh^{-1} \sqrt{x} + C = 2 \ln(\sqrt{x} + \sqrt{1+x}) + C$
55. $-\ln \left[\frac{1 + \sqrt{(x-1)^2 + 1}}{|x-1|} \right] + C$
57. $\frac{1}{2\sqrt{6}} \ln \left| \frac{\sqrt{2(x+1)} + \sqrt{3}}{\sqrt{2(x+1)} - \sqrt{3}} \right| + C$
59. $\frac{1}{4} \arcsin \left(\frac{4x-1}{9} \right) + C$
61. $-\frac{x^2}{2} - 4x - \frac{10}{3} \ln \left| \frac{x-5}{x+1} \right| + C$

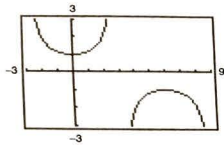
Review Exercises for Chapter 8

1. $\frac{x \cos x - 2 \sin x}{x^3}$ 3. $-x \sec^2 x - \tan x$
5. $\cos 4x + 1$ 7. $\frac{1}{2}(1 - \cos 2x) = \sin^2 x$
9. $-\frac{3}{\sqrt{x}} \csc^3 \sqrt{x} \cot \sqrt{x}$ 11. $-\frac{\sec^2 \sqrt{1-x}}{2\sqrt{1-x}}$
13. $(1-x^2)^{-3/2}$ 15. $\frac{x}{|x|\sqrt{x^2-1}} + \operatorname{arcsec} x$
17. $(\arcsin x)^2$ 19. $\frac{1}{2} + x \arctan x$
21. $\frac{1}{\cos y} = \frac{1}{\sqrt{1-(x-2)^2}}$
23. $-\frac{e^y + 2x \sin x^2}{xe^y}$
25. $2 \csc^2 x \cot x$
27. $\frac{-x^2 \cos x + 2x \sin x + 2 \cos x}{x^3}$
29. $\frac{8x}{(1-4x^2)^{3/2}}$ 31. $\arctan(\sin x) + C$
33. $\frac{1}{4}(\arctan 2x)^2 + C$ 35. $\frac{\tan^{n+1} x}{n+1} + C$
37. $-\frac{1}{2} \ln(1 + e^{-2x}) + C$
39. $\frac{1}{2} \arctan(e^{2x}) + C$ 41. $-\frac{1}{2} \ln |\cos x^2| + C$
43. $\frac{1}{2} \arcsin x^2 + C$ 45. $\frac{1}{2} \ln(16 + x^2) + C$
47. $\frac{1}{4} \left[\arctan \frac{x}{2} \right]^2 + C$
49. $4 \arcsin \frac{x}{2} + \sqrt{4-x^2} + C$
53. $2\pi x + 4y = \pi^2$ 55. 1.122
57. $3(3^{2/3} + 2^{2/3})^{3/2}$ ft ≈ 21.07 ft
59. $\frac{32}{L} \sqrt{A^2 + B^2}$ 61. $x = \frac{3\pi}{4}, \frac{7\pi}{4}$
63. (a) $C \approx \$9.17$
 (b) $C \approx \$3.14$ Savings $\approx \$6.03$

65. $\frac{\pi^2}{4}$ 67. $2x \sinh(x^2 + 1)$ 69. $\frac{2}{4 - x^2}$

71. $-\cosh \frac{1}{x} + C$ 73. $\frac{1}{2} \sinh^{-1}(2x) + C$

77. $\lim_{x \rightarrow 3^+} f(x) = -\infty$



Chapter 9

Section 9.1

1. $\frac{1}{15}(3x - 2)^5 + C$ 3. $-\frac{1}{5}(-2x + 5)^{5/2} + C$
 5. $\frac{1}{2}v^2 - \frac{1}{6(3v - 1)^2} + C$
 7. $-\frac{1}{3} \ln |-t^3 + 9t + 1| + C$
 9. $\frac{1}{2}x^2 + x + \ln |x - 1| + C$
 11. $\frac{1}{3} \ln \left| \frac{3x - 1}{3x + 1} \right| + C$ 13. $-\frac{1}{2} \cos t^2 + C$
 15. $e^{\sin x} + C$ 17. $-e^{-t} + 2t + e^t + C$
 19. $\frac{1}{3} \sec 3x + C$ 21. $2 \ln(1 + e^x) + C$
 23. $-\cot x - \csc x + C$
 25. $\ln(t^2 + 4) - \frac{1}{2} \arctan \frac{t}{2} + C$
 27. $3 \arctan t + C$ 29. $\frac{1}{2} \operatorname{arcsec} \frac{|x|}{2} + C$
 31. $-\frac{1}{2} \arcsin(2t - 1) + C$ 33. $-\frac{1}{\pi} \csc(\pi x) + C$
 35. $\frac{1}{2} \arcsin t^2 + C$ 37. $\frac{1}{2} \arctan \frac{\tan x}{2} + C$
 39. $\frac{1}{2} \ln \left| \cos \frac{2}{t} \right| + C$
 41. $\frac{x}{15}(12x^4 + 20x^2 + 15) + C$
 43. $\frac{1}{2}x^2 + 3x + 3 \ln |x| - \frac{1}{x} + C$
 45. $\frac{1}{2}e^{2x} + 2e^x + x + C$ 47. $3 \arcsin \frac{x - 3}{3} + C$
 49. $\frac{1}{4} \arctan \frac{2x + 1}{8} + C$ 51. $\frac{1}{2}(1 - e^{-1}) \approx 0.316$
 53. $\frac{1}{2}$ 55. 4 57. $\frac{1}{2} \ln 2$
 59. $\frac{1}{2} \left(\operatorname{arcsec} 4 - \frac{\pi}{3} \right) \approx 0.135$ 61. $\frac{4}{3}$
 63. $a = \frac{1}{2}$ 65. $b = \sqrt{\ln \left(\frac{3\pi}{3\pi - 4} \right)} \approx 0.743$
 67. $\frac{2}{\arcsin(4/5)} \approx 2.157$ 69. 1.0320

Section 9.2

1. $\frac{e^{2x}}{4}(2x - 1) + C$ 3. $\frac{1}{2}e^{x^2} + C$
 5. $-\frac{1}{4e^{2x}}(2x + 1) + C$
 7. $e^x(x^3 - 3x^2 + 6x - 6) + C$
 9. $\frac{x^4}{16}(4 \ln x - 1) + C$
 11. $\frac{1}{4}[2(t^2 - 1) \ln |t + 1| - t^2 + 2t] + C$
 13. $x(\ln x)^2 - 2x \ln x + 2x + C$
 15. $\frac{(\ln x)^3}{3} + C$ 17. $\frac{e^{2x}}{4(2x + 1)} + C$
 19. $(x - 1)^2 e^x + C$ 21. $\frac{2(x - 1)^{3/2}}{15}(3x + 2) + C$
 23. $\frac{2}{3}x^2(2 + 3x)^{1/2} - \frac{8}{27}x(2 + 3x)^{3/2} + \frac{16}{405}(2 + 3x)^{5/2}$
 $= \frac{2}{405}(27x^2 - 24x + 32)\sqrt{2 + 3x} + C$
 25. $x \sin x + \cos x + C$
 27. $x \tan x + \ln |\cos x| + C$
 29. $x \arcsin 2x + \frac{1}{2}\sqrt{1 - 4x^2} + C$
 31. $x \arctan x - \frac{1}{2} \ln(1 + x^2) + C$
 33. $\frac{1}{5}e^{2x}(2 \sin x - \cos x) + C$
 35. $-\frac{\pi}{2}$ 37. $\frac{e[\sin(1) - \cos(1)] + 1}{2} \approx 0.909$
 39. $\frac{\pi}{2} - 1$ 41. $\frac{e^{2x}}{4}(2x^2 - 2x + 1) + C$
 43. $(3x^2 - 6) \sin x - (x^3 - 6x) \cos x + C$
 45. $x \tan x + \ln |\cos x| + C$
 47. $\frac{2}{5}(2x - 3)^{3/2}(x + 1) + C$
 49. $n = 0: x(\ln x - 1) + C$
 $n = 1: \frac{x^2}{4}(2 \ln x - 1) + C$
 $n = 2: \frac{x^3}{9}(3 \ln x - 1) + C$
 $n = 3: \frac{x^4}{16}(4 \ln x - 1) + C$
 $n = 4: \frac{x^5}{25}(5 \ln x - 1) + C$
 $\int x^n \ln x \, dx = \frac{x^{n+1}}{(n+1)^2}[(n+1) \ln x - 1] + C$
 57. $\frac{x^4}{16}(4 \ln x - 1) + C$
 59. $\frac{e^{2x}}{13}(2 \cos 3x + 3 \sin 3x) + C$
 61. $1 - \frac{5}{e^4} \approx 0.908$ 63. $\frac{\pi}{1 + \pi^2} \left(\frac{1}{e} + 1 \right) \approx 0.395$
 65. (a) 1 (b) $\pi(e - 2) \approx 2.257$
 (c) $\frac{(e^2 + 1)\pi}{2} \approx 13.177$
 (d) $\left(\frac{e^2 + 1}{4}, \frac{e - 2}{2} \right) \approx (2.097, 0.359)$
 67. (a) $3.2(\ln 2) - 0.2 \approx 2.018$
 (b) $12.8(\ln 4) - 7.2(\ln 3) - 1.8 \approx 8.035$

69. \$771,721.44 73. $\frac{8h}{(n\pi)^2} \sin\left(\frac{n\pi}{2}\right)$

 75. 125.5 mi
 77. No. The solution is correct.
 79. 0.246

Section 9.3

1. $-\frac{1}{4} \cos^4 x + C$ 3. $\frac{1}{12} \sin^6 2x + C$
 5. $-\frac{1}{3} \cos^3 x + \frac{2}{5} \cos^5 x - \frac{1}{7} \cos^7 x + C$
 7. $\frac{1}{12}(6x + \sin 6x) + C$
 9. $\frac{1}{32\pi}(12\pi x - 8 \sin 2\pi x + \sin 4\pi x) + C$
 11. $\frac{1}{32}(4x - \sin 4x) + C$
 13. $\frac{1}{8}(2x^2 - 2x \sin 2x - \cos 2x) + C$
 15. $\frac{1}{3} \ln |\sec 3x + \tan 3x| + C$
 17. $\frac{1}{15} \tan 5x(3 + \tan^2 5x) + C$
 19. $\frac{1}{2\pi}(\sec \pi x \tan \pi x + \ln |\sec \pi x + \tan \pi x|) + C$
 21. $-\frac{\tan^2(1-x)}{2} - \ln |\cos(1-x)| + C$
 23. $\tan^4\left(\frac{x}{4}\right) - 2 \tan^2\left(\frac{x}{4}\right) - 4 \ln \left|\cos \frac{x}{4}\right| + C$
 25. $\frac{1}{2} \tan^2 x + C$ 27. $\frac{\tan^3 x}{3} + C$
 29. $\frac{1}{5\pi} \sec^5 \pi x + C$ 31. $\frac{\sec^6 4x}{24} + C$
 33. $\frac{1}{3} \sec^3 x + C$ 35. $\frac{1}{9} \sec^3 3x - \frac{1}{3} \sec 3x + C$
 37. $\frac{1}{4}[\ln |\csc^2(2x)| - \cot^2(2x)] + C$
 39. $-\cot \theta - \frac{1}{3} \cot^3 \theta + C$
 41. $\ln |\csc t - \cot t| + \cos t + C$
 43. $-\frac{1}{10}(\cos 5x + 5 \cos x) + C$
 45. $\frac{1}{8}(2 \sin 2\theta - \sin 4\theta) + C$
 47. $\ln |\csc x - \cot x| + \cos x + C$
 49. $t - 2 \tan t + C$ 51. π 53. $\frac{1}{2}(1 - \ln 2)$
 55. $\ln 2$ 57. $\frac{3\sqrt{2}}{10}$ 59. $\frac{4}{3}$
 61. $\frac{\tan^6 3x}{18} + \frac{\tan^4 3x}{12} + C_1 = \frac{\sec^6 3x}{18} - \frac{\sec^4 3x}{12} + C_2$
 63. $\frac{1}{2}$ 65. $2\pi\left(1 - \frac{\pi}{4}\right) \approx 1.348$
 67. (a) $\frac{\pi^2}{2}$ (b) $(\bar{x}, \bar{y}) = \left(\frac{\pi}{2}, \frac{\pi}{8}\right)$
 79. $-\frac{1}{15} \cos x(3 \sin^4 x + 4 \sin^2 x + 8) + C$
 81. $\frac{1}{6} \cos^5 x \sin x + \frac{5}{24} \cos^3 x \sin x + \frac{5}{16} \cos x \sin x + \frac{5}{16} x + C$
 83. $\frac{1}{8\pi}(-2 \cos^3 \pi x \sin \pi x + \cos \pi x \sin \pi x + \pi x) + C$
 87. 8.586

Section 9.4

1. $\frac{x}{25\sqrt{25-x^2}} + C$
 3. $5 \ln \left| \frac{5 - \sqrt{25-x^2}}{x} \right| + \sqrt{25-x^2} + C$
 5. $\ln |x + \sqrt{x^2-4}| + C$
 7. $\frac{1}{15}(x^2-4)^{3/2}(3x^2+8) + C$ 9. $\frac{1}{3}(1+x^2)^{3/2} + C$
 11. $\frac{1}{2}\left(\arctan x + \frac{x}{1+x^2}\right) + C$ 13. $\sqrt{x^2+9} + C$
 15. 2π 17. $\ln |x + \sqrt{x^2-9}| + C$
 19. $\sqrt{3} - \frac{\pi}{3} \approx 0.685$ 21. $-\frac{(1-x^2)^{3/2}}{3x^3} + C$
 23. $-\frac{1}{3} \ln \left| \frac{\sqrt{4x^2+9}+3}{2x} \right| + C$
 25. $-\frac{1}{\sqrt{x^2+3}} + C$ 27. $\frac{1}{3}(1+e^{2x})^{3/2} + C$
 29. $\frac{1}{3}(x^2+2x+2)^{3/2} + C$
 31. $\sqrt{x^2+4x+8} - 2 \ln |\sqrt{x^2+4x+8} + (x+2)| + C$
 33. $\frac{1}{2}(\arcsin e^x + e^x \sqrt{1-e^{2x}}) + C$
 35. $\frac{1}{4}\left(\frac{x}{x^2+2} + \frac{1}{\sqrt{2}} \arctan \frac{x}{\sqrt{2}}\right) + C$
 37. $\frac{1}{6}(3x\sqrt{9x^2+4} + 4 \ln |3x + \sqrt{9x^2+4}|) + C$
 39. $x \operatorname{arcsec} 2x - \frac{1}{2} \ln |2x + \sqrt{4x^2-1}| + C$
 41. $\frac{1}{2}(x-15)\sqrt{x^2+10x+9} + 33 \ln |\sqrt{x^2+10x+9} + (x+5)| + C$
 43. $\frac{1}{2}(x\sqrt{x^2-1} + \ln |x + \sqrt{x^2-1}|) + C$
 45. $9(2-\sqrt{2})$ 47. $1 - \frac{\sqrt{3}\pi}{6} \approx 0.093$
 49. 187.2π lb 51. πr² 53. 6π²
 55. $\ln \left[\frac{5(\sqrt{2}+1)}{\sqrt{26}+1} \right] + \sqrt{26} - \sqrt{2} \approx 4.367$
 57. $100\sqrt{2} + 50 \ln \left(\frac{\sqrt{2}+1}{\sqrt{2}-1} \right) \approx 229.559$
 59. $\frac{\pi}{32}[102\sqrt{2} - \ln(3+2\sqrt{2})] \approx 13.989$
 61. 121.3 lb 63. $(\bar{x}, \bar{y}) \approx (5.30, 1.43)$

Section 9.5

1. $\frac{1}{2} \ln \left| \frac{x-1}{x+1} \right| + C$ 3. $\ln \left| \frac{x-1}{x+2} \right| + C$
 5. $\frac{3}{2} \ln |2x-1| - 2 \ln |x+1| + C$
 7. $5 \ln |x-2| - \ln |x+2| - 3 \ln |x| + C$
 9. $x^2 + \frac{3}{2} \ln |x-4| - \frac{1}{2} \ln |x+2| + C$
 11. $\frac{1}{x} + \ln |x^4 + x^3| + C$
 13. $\frac{1}{2}x^2 + 3x + 6 \ln |x-1| - \frac{4}{x-1} - \frac{1}{2(x-1)^2} + C$

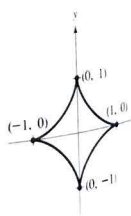
15. $3 \ln |x - 3| - \frac{9}{x - 3} + C$
 17. $\ln \left| \frac{x^2 + 1}{x} \right| + C$
 19. $\frac{1}{6} \left[\ln \left| \frac{x - 2}{x + 2} \right| + \sqrt{2} \arctan \left(\frac{x}{\sqrt{2}} \right) \right] + C$
 21. $\frac{1}{16} \ln \left| \frac{4x^2 - 1}{4x^2 + 1} \right| + C$
 23. $\frac{\sqrt{2}}{2} \arctan \frac{x}{\sqrt{2}} - \frac{1}{2(x^2 + 2)} + C$
 25. $\ln |x + 1| + \sqrt{2} \arctan \left(\frac{x - 1}{\sqrt{2}} \right) + C$
 27. $4 \ln |x - 2| + \ln (x^2 + 4) + \frac{1}{2} \arctan \frac{x}{2} + C$
 29. $\ln |x - 2| + \frac{1}{2} \ln |x^2 + x + 1| - \sqrt{3} \arctan \left(\frac{2x + 1}{\sqrt{3}} \right) + C$
 31. $\ln 2$ 33. $\frac{1}{2} \ln \left(\frac{8}{5} \right) - \frac{\pi}{4} + \arctan (2) \approx 0.557$
 35. $\ln 2 + \arctan 2 - \arctan 3$
 37. $\ln \left| \frac{\cos x}{\cos x - 1} \right| + C$ 39. $\ln \left| \frac{-1 + \sin x}{2 + \sin x} \right| + C$
 41. $\frac{1}{5} \ln \left| \frac{e^x - 1}{e^x + 4} \right| + C$ 47. $6 - \frac{7}{4} \ln 7 \approx 2.595$
 49. $2\pi \left[\arctan 3 - \frac{3}{10} \right] \approx 5.963$
 51. $x = \frac{n[e^{(n+1)kt} - 1]}{n + e^{(n+1)kt}}$
 53. (a) As $t \rightarrow \infty$, $x(t) \rightarrow y_0$ 55. 14.666
 (b) $y_0 > z_0$: As $t \rightarrow \infty$, $x(t) \rightarrow z_0$
 $y_0 = z_0$: As $t \rightarrow \infty$, $x(t) \rightarrow y_0 = z_0$

Section 9.6

1. $-\frac{1}{2}x(2 - x) + \ln |1 + x| + C$
 3. $-\frac{\sqrt{1 - x^2}}{x} + C$ 5. $\frac{1}{9}x^3(-1 + 3 \ln x) + C$
 7. $\frac{\sqrt{x^2 - 4}}{4x} + C$ 9. $\frac{1}{2}e^{x^2} + C$
 11. $\frac{2}{9} \left(\ln |1 - 3x| + \frac{1}{1 - 3x} \right) + C$
 13. $e^x \arccos (e^x) - \sqrt{1 - e^{2x}} + C$
 15. $\frac{1}{16}x^4(4 \ln |x| - 1) + C$
 17. $\frac{1}{27} \left(3x - \frac{25}{3x - 5} + 10 \ln |3x - 5| \right) + C$
 19. $\frac{1}{2}(x^2 + \cot x^2 + \csc x^2) + C$
 21. $\arctan (\sin x) + C$ 23. $x - \frac{1}{2} \ln (1 + e^{2x}) + C$
 25. $\frac{\sqrt{2}}{2} \arctan \left(\frac{1 + \sin \theta}{\sqrt{2}} \right) + C$
 27. $-\frac{\sqrt{2 + 9x^2}}{2x} + C$

29. $\frac{1}{2}(e^x \sqrt{e^{2x} + 1} + \ln |e^x + \sqrt{e^{2x} + 1}|) + C$
 31. $\frac{1}{16}(6x - 3 \sin 2x \cos 2x - 2 \sin^3 2x \cos 2x) + C$
 33. $-2(\cot \sqrt{x} + \csc \sqrt{x}) + C$
 35. $(t^4 - 12t^2 + 24) \sin t + (4t^3 - 24t) \cos t + C$
 37. $\frac{1}{2}[(x^2 + 1) \operatorname{arcsec} (x^2 + 1) - \ln |(x^2 + 1) + \sqrt{x^4 + 2x^2 + 1}|] + C$
 39. $\frac{1}{4}(2 \ln |x| - 3 \ln |3 + 2 \ln |x||) + C$
 41. $\sqrt{2 - 2x - x^2} - \sqrt{3} \ln \left| \frac{\sqrt{3} + \sqrt{2 - 2x - x^2}}{x + 1} \right| + C$
 43. $\frac{1}{2} \arctan (x^2 - 3) + C$
 45. $\frac{1}{2} \ln |(x^2 - 3) + \sqrt{x^4 - 6x^2 + 5}| + C$
 47. $-\frac{1}{3}\sqrt{4 - x^2}(x^2 + 8) + C$ 49. $-\frac{2\sqrt{1 - x}}{\sqrt{x}} + C$
 51. $\frac{2}{1 + e^x} - \frac{1}{2(1 + e^x)^2} + \ln |1 + e^x| + C$
 59. $\frac{1}{\sqrt{5}} \ln \left| \frac{2 \tan (\theta/2) - 3 - \sqrt{5}}{2 \tan (\theta/2) - 3 + \sqrt{5}} \right| + C$
 61. $\ln 2$ 63. $\frac{1}{2} \ln (3 - 2 \cos \theta) + C$
 65. $2 \sin \sqrt{\theta} + C$ 67. $-\csc \theta + C$
 69. 1919.145 ft · lb

Section 9.7

1. 4 3. 6 5. 1 7. Diverges 9. 2
 11. 1 13. $\frac{1}{2}$ 15. π 17. $\frac{\pi}{4}$
 19. Diverges 21. Diverges 23. 6
 25. $-\frac{1}{4}$ 27. Diverges 29. $\ln (2 + \sqrt{3})$
 31. 0 33. $p > 1$ 37. Diverges
 39. Converges 41. Converges 43. Diverges
 45. Converges 47. $\frac{1}{s}$ 49. $\frac{2}{s^3}$ 51. $\frac{s}{s^2 + a^2}$
 53. $\frac{s}{s^2 - a^2}$
 55. (a) 1 57. 
 (b) $\frac{\pi}{3}$
 (c) Diverges
 59. (a) $\Gamma(1) = 1, \Gamma(2) = 1, \Gamma(3) = 2$
 (c) $\Gamma(n) = (n - 1)!$
 61. (b) 43.53% (c) 7
 63. (a) \$743,997.58
 (b) \$795,584.54
 (c) \$858,333.33
 65. $\frac{k(\sqrt{a^2 + 1} - 1)}{a^2 \sqrt{a^2 + 1}}$

Review Exercises for Chapter 9

1. $x + \frac{9}{8} \ln|x-3| - \frac{25}{8} \ln|x+5| + C$
3. $\tan \theta + \sec \theta + C$
5. $\frac{e^{2x}}{13}(2 \sin 3x - 3 \cos 3x) + C$
7. $-\frac{1}{x}(1 + \ln 2x) + C$
9. $\frac{1}{2} \left(4 \arcsin \frac{x}{2} + x\sqrt{4-x^2} \right) + C$
11. $\frac{3\sqrt{4-x^2}}{x} + C$
13. $\frac{2}{3} \left[\tan^3 \left(\frac{x}{2} \right) + 3 \tan \left(\frac{x}{2} \right) \right] + C$
15. $\frac{3}{2} \ln \left| \frac{x-3}{x+3} \right| + C$
17. $\frac{1}{4} [6 \ln|x-1| - \ln(x^2+1) + 6 \arctan x] + C$
19. $\frac{3}{2} \ln(x^2+1) - \frac{1}{2(x^2+1)} + C$
21. $16 \arcsin \frac{x}{4} + C$
23. $\frac{1}{2} \arctan \frac{e^x}{2} + C$
25. $\frac{1}{2} \ln|x^2+4x+8| - \arctan \left(\frac{x+2}{2} \right) + C$
27. $\frac{1}{8}(\sin 2\theta - 2\theta \cos 2\theta) + C$
29. $\frac{1}{2}(2\theta - \cos 2\theta) + C$
31. $\frac{4}{3}[x^{3/4} - 3x^{1/4}] + 3 \arctan(x^{1/4}) + C$
33. $2\sqrt{1-\cos x} + C$
35. $x \ln|x^2+x| - 2x + \ln|x+1| + C$
37. $\sin x \ln(\sin x) - \sin x + C$
39. $x - \frac{1}{2(x^2+1)} + C$
41. $-\frac{\sqrt{4+x^2}}{4x} + C$
43. $\frac{1}{3}\sqrt{4+x^2}(x^2-8) + C$
45. (a) $e-1 \approx 1.72$ (b) 1
(c) $\frac{1}{2}(e-1) \approx 0.86$ (d) 1.46 (Simpson's Rule)
47. 3.82
49. $(\bar{x}, \bar{y}) = \left(0, \frac{4}{3\pi} \right)$
51. $0.015846 < \int_2^\infty \frac{1}{x^5-1} dx < 0.015851$

15. $\frac{(-1)^{n-1}}{2^{n-2}}$
17. $\frac{n+1}{n}$
19. $\frac{n}{(n+1)(n+2)}$
21. $\frac{2^n n!}{(2n)!}$
23. $(-1)^{n(n-1)/2}$
25. Converges to 1
27. Diverges
29. Converges to $\frac{3}{2}$
31. Diverges
33. Converges to 0
35. Diverges
37. Converges to 0
39. Diverges
41. Converges to 3
43. Converges to e^k
45. Converges to 0
47. Monotonic
49. Not monotonic
51. Not monotonic
53. Monotonic
55. Not monotonic
57. 5
59. $\frac{1}{3}$
61. (a) No
(b)

Month	1	2	3
Amount	\$9086.25	\$9173.33	\$9261.24

Month	4	5
Amount	\$9349.99	\$9439.60

Month	6	7	8
Amount	\$9530.06	\$9621.39	\$9713.59

Month	9	10
Amount	\$9806.68	\$9900.66

63. (a) $\$2,500,000,000(0.8)^n$
(b)

Year	1	2
Budget	\$2,000,000,000	\$1,600,000,000

Year	3	4
Budget	\$1,280,000,000	\$1,024,000,000

- (c) Converges to 0
65. $S_6 = 240, S_7 = 440, S_8 = 810,$
 $S_9 = 1490, S_{10} = 2740$
67. 1, 1.4142, 1.4422, 1.4142, 1.3797, 1.3480
Converges to 1
71. (a) 1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144
(b) 1, 2, 1.5, 1.6667, 1.6, 1.6250, 1.6154, 1.6190,
1.6176, 1.6182
(d) $\rho = \frac{1 + \sqrt{5}}{2} \approx 1.6180$

Chapter 10

Section 10.1

1. 2, 4, 8, 16, 32
3. $-\frac{1}{2}, \frac{1}{4}, -\frac{1}{8}, \frac{1}{16}, -\frac{1}{32}$
5. $3, \frac{9}{2}, \frac{27}{6}, \frac{81}{24}, \frac{243}{120}$
7. $-1, -\frac{1}{4}, \frac{1}{9}, \frac{1}{16}, -\frac{1}{25}$
9. $3n - 2$
11. $n^2 - 2$
13. $\frac{n+1}{n+2}$