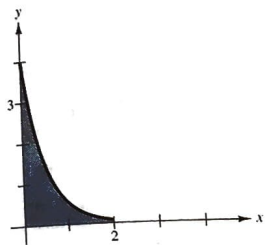


41.  $\ln |\ln |3x|| + C$     43.  $\frac{x^2}{2} + 3 \ln |x| + C$   
 45.  $\frac{1}{3} \ln |x^3 - 1| + C$     47.  $2\sqrt{\ln x} + C$   
 49.  $-\frac{1}{6}e^{-3x^2} + C$     51.  $\frac{e^{4x} - 3e^{2x} - 3}{3e^x} + C$   
 53.  $\ln |e^x - 1| + C$     55.  $-e^{-x^2/2} + C$   
 57.  $3 + \ln 4$     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.  $\infty$     89. 1    91.  $1000e^{0.09} \approx 1094.17$

## 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)  $270^\circ$     (b)  $210^\circ$     (c)  $-105^\circ$     (d)  $20^\circ$

9.

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

11.  $171.89^\circ$

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)  $\sin 60^\circ = \frac{\sqrt{3}}{2}$

$\cos 60^\circ = \frac{1}{2}$

$\tan 60^\circ = \sqrt{3}$

(c)  $\sin \frac{\pi}{4} = \frac{\sqrt{2}}{2}$

$\cos \frac{\pi}{4} = \frac{\sqrt{2}}{2}$

$\tan \frac{\pi}{4} = 1$

25. (a)  $\sin 225^\circ = -\frac{\sqrt{2}}{2}$

$\cos 225^\circ = -\frac{\sqrt{2}}{2}$

$\tan 225^\circ = 1$

(c)  $\sin 300^\circ = -\frac{\sqrt{3}}{2}$

$\cos 300^\circ = \frac{1}{2}$

$\tan 300^\circ = -\sqrt{3}$

(b)  $\sin \frac{2\pi}{3} = \frac{\sqrt{3}}{2}$

$\cos \frac{2\pi}{3} = -\frac{1}{2}$

$\tan \frac{2\pi}{3} = -\sqrt{3}$

(d)  $\sin \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$

$\cos \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$

$\tan \frac{5\pi}{4} = 1$

(b)  $\sin(-225^\circ) = \frac{\sqrt{2}}{2}$

$\cos(-225^\circ) = -\frac{\sqrt{2}}{2}$

$\tan(-225^\circ) = -1$

(d)  $\sin 330^\circ = -\frac{1}{2}$

$\cos 330^\circ = \frac{\sqrt{3}}{2}$

$\tan 330^\circ = -\frac{\sqrt{3}}{3}$

27. (a) 0.1736

(b) 5.759

31. (a)  $\theta = \frac{\pi}{4}, \frac{7\pi}{4}$

(b)  $\theta = \frac{3\pi}{4}, \frac{5\pi}{4}$

35.  $\theta = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \frac{7\pi}{4}$

39.  $\theta = \frac{\pi}{3}, \frac{5\pi}{3}$     41.  $\theta = 0, \frac{\pi}{2}, \pi$

29. (a) 0.3640

(b) 0.3640

33. (a)  $\theta = \frac{\pi}{4}, \frac{5\pi}{4}$

(b)  $\theta = \frac{5\pi}{6}, \frac{11\pi}{6}$

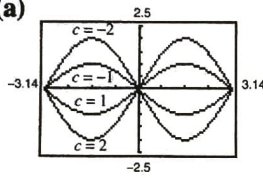
37.  $\theta = 0, \frac{\pi}{4}, \pi, \frac{5\pi}{4}$

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

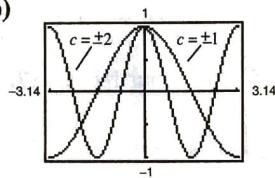
1. Period:  $\pi$     Amplitude: 2  
 3. Period: 4    Amplitude:  $\frac{5}{2}$   
 5. Period:  $6\pi$     Amplitude: 2  
 7. Period:  $\frac{\pi}{5}$     Amplitude: 2  
 9. Period:  $\frac{1}{2}$     Amplitude: 3

11. (a)



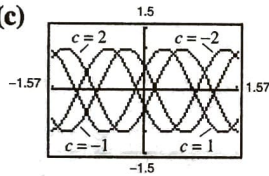
Change in amplitude

(b)



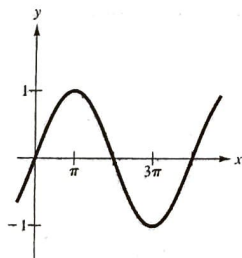
Change in period

(c)

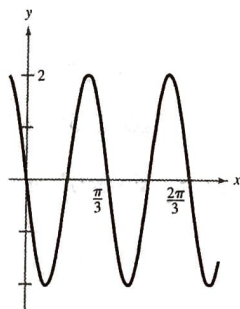


Horizontal translation

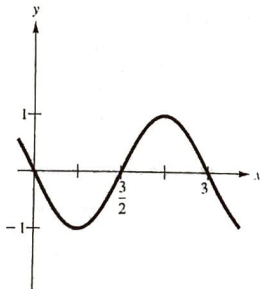
13.



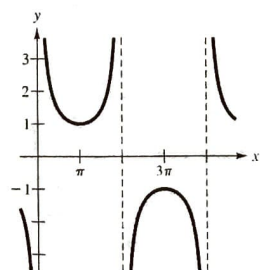
15.



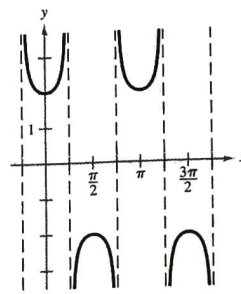
17.



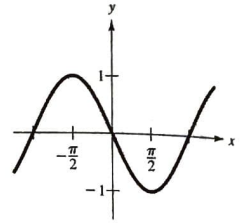
19.



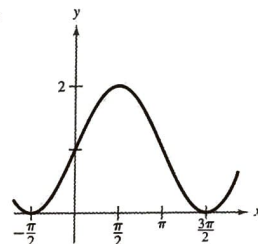
21.



23.

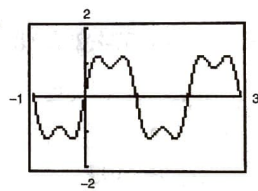


25.



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

29.



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

31.  $\frac{1}{5}$     33. 0    35. 0    37. 1    39. 1

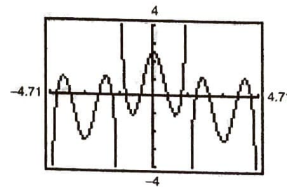
41.  $\frac{2}{3}$     43. 0    45. Limit does not exist.

47.  $\infty$     49. Continuous for all real  $x$

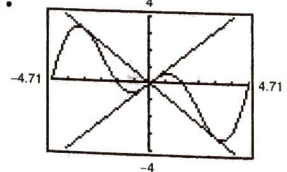
51. Nonremovable discontinuities at integer multiples of  $\pi/2$

53. Continuous for all real  $x$

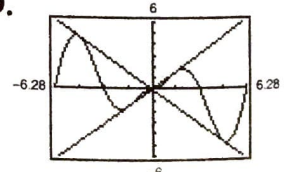
55.  $\lim_{x \rightarrow 0} f(x) = \frac{5}{2}$

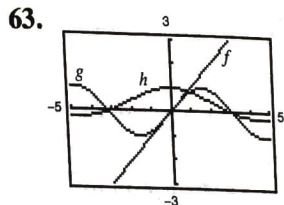
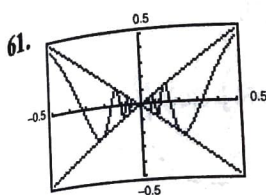


57.



59.





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

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

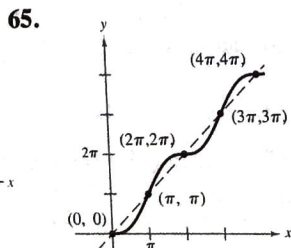
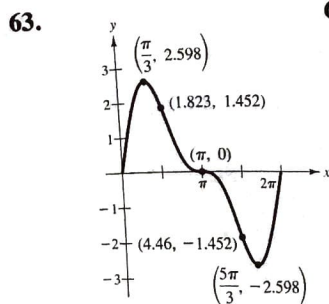
**Section 8.3**

- 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.  $\pi \cos \frac{\pi x}{4}$
- 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.  $\sec x \csc x$

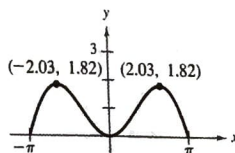
45.  $\frac{\cos x}{2 \sin 2y}$ , undefined    47.  $-\frac{x^2}{x^2 + 1}, 0$

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



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

**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.  $\frac{1}{5} \tan^5 x + C$

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.  $2\pi$     53.  $\pi$     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.  $\frac{1}{2} \sin^2 x + C_1 = -\frac{1}{2} \cos^2 x + C_2$