50. (a) $\pi/6$ (b) $(-\sqrt{3}/2, -\frac{1}{2})$
51. (a) $\pi/3$ (b) $(-\frac{1}{2}, -\sqrt{3}/2)$
52. (a) $\pi/4$ (b) $(\sqrt{2}/2, -\sqrt{2}/2)$ **53.** $(0.5, 0.8)$
54. $(-0.8, 0.6)$ **55.** $(0.5, -0.9)$ **56.** $(-0.6, -0.9)$

SECTION 5.2 ■ PAGE 384

1. $y, x, y/x$ **2.** 1, 1 **3.** $t = \pi/4$, $\sin t = \sqrt{2}/2$, $\cos t = \sqrt{2}/2$;
$t = \pi/2$, $\sin t = 1$, $\cos t = 0$; $t = 3\pi/4$,
$\sin t = \sqrt{2}/2$, $\cos t = -\sqrt{2}/2$;
$t = \pi$, $\sin t = 0$, $\cos t = -1$; $t = 5\pi/4$,
$\sin t = -\sqrt{2}/2$, $\cos t = -\sqrt{2}/2$; $t = 3\pi/2$, $\sin t = -1$,
$\cos t = 0$; $t = 7\pi/4$, $\sin t = -\sqrt{2}/2$, $\cos t = \sqrt{2}/2$;
$t = 2\pi$, $\sin t = 0$, $\cos t = 1$
4. $t = \pi/6$, $\sin t = \frac{1}{2}$, $\cos t = \sqrt{3}/2$;
$t = \pi/3$, $\sin t = \sqrt{3}/2$, $\cos t = \frac{1}{2}$;
$t = \pi/2$, $\sin t = 1$, $\cos t = 0$;
$t = 2\pi/3$, $\sin t = \sqrt{3}/2$, $\cos t = -\frac{1}{2}$;
$t = 5\pi/6$, $\sin t = \frac{1}{2}$, $\cos t = -\sqrt{3}/2$;
$t = \pi$, $\sin t = 0$, $\cos t = -1$;
$t = 7\pi/6$, $\sin t = -\frac{1}{2}$, $\cos t = -\sqrt{3}/2$;
$t = 4\pi/3$, $\sin t = -\sqrt{3}/2$, $\cos t = -\frac{1}{2}$;
$t = 3\pi/2$, $\sin t = -1$, $\cos t = 0$;
$t = 5\pi/3$, $\sin t = -\sqrt{3}/2$, $\cos t = \frac{1}{2}$;
$t = 11\pi/6$, $\sin t = -\frac{1}{2}$, $\cos t = \sqrt{3}/2$;
$t = 2\pi$, $\sin t = 0$, $\cos t = 1$
5. (a) $\sqrt{3}/2$ (b) $-1/2$ (c) $-\sqrt{3}$
6. (a) $1/2$ (b) $-\sqrt{3}/2$ (c) $-\sqrt{3}/3$
7. (a) $-1/2$ (b) $-1/2$ (c) $-1/2$
8. (a) $1/2$ (b) $1/2$ (c) $1/2$
9. (a) $-\sqrt{2}/2$ (b) $-\sqrt{2}/2$ (c) $\sqrt{2}/2$
10. (a) $\sqrt{2}/2$ (b) $-\sqrt{2}/2$ (c) $-\sqrt{2}/2$
11. (a) $\sqrt{3}/2$ (b) $2\sqrt{3}/3$ (c) $\sqrt{3}/3$
12. (a) $1/2$ (b) 2 (c) $-\sqrt{3}$ **13.** (a) -1 (b) 0 (c) 0
14. (a) 1 (b) 0 (c) 0 **15.** (a) 2 (b) $-2\sqrt{3}/3$ (c) 2
16. (a) $-\sqrt{3}/2$ (b) $-2\sqrt{3}/3$ (c) -2
17. (a) $-\sqrt{3}/3$ (b) $\sqrt{3}/3$ (c) $-\sqrt{3}/3$
18. (a) $-\sqrt{3}/3$ (b) $-\sqrt{3}/3$ (c) $-\sqrt{3}/3$
19. (a) $\sqrt{2}/2$ (b) $-\sqrt{2}$ (c) -1
20. (a) $-\sqrt{2}/2$ (b) $-\sqrt{2}$ (c) 1
21. (a) -1 (b) 1 (c) -1 **22.** (a) -1 (b) -1 (c) 1
23. (a) 0 (b) 1 (c) 0 **24.** (a) 1 (b) 0 (c) 0
25. $\sin 0 = 0$, $\cos 0 = 1$, $\tan 0 = 0$, $\sec 0 = 1$,
others undefined
26. $\sin \pi/2 = 1$, $\cos \pi/2 = 0$, $\cot \pi/2 = 0$, $\csc \pi/2 = 1$,
others undefined
27. $\sin \pi = 0$, $\cos \pi = -1$, $\tan \pi = 0$, $\sec \pi = -1$,
others undefined
28. $\sin 3\pi/2 = -1$, $\cos 3\pi/2 = 0$, $\cot 3\pi/2 = 0$,
$\csc 3\pi/2 = -1$, others undefined
29. $\frac{4}{5}, \frac{3}{5}, \frac{4}{3}$ **30.** $\frac{4}{5}, -\frac{3}{5}, -\frac{4}{3}$ **31.** $-\sqrt{11}/4, \sqrt{5}/4, -\sqrt{55}/5$
32. $-2\sqrt{2}/3, -1/3, 2\sqrt{2}$ **33.** $\sqrt{13}/7, -6/7, -\sqrt{13}/6$
34. $\frac{9}{41}, \frac{40}{41}, \frac{9}{40}$ **35.** $-\frac{12}{13}, -\frac{5}{13}, \frac{12}{5}$ **36.** $2\sqrt{5}/5, \sqrt{5}/5, 2$
37. $\frac{21}{29}, -\frac{20}{29}, -\frac{21}{20}$ **38.** $-\frac{7}{25}, \frac{24}{25}, -\frac{7}{24}$ **39.** (a) 0.8 (b) 0.84147
40. (a) 0.7 (b) 0.69671 **41.** (a) 0.9 (b) 0.93204
42. (a) 0.3 (b) 0.28366 **43.** (a) 1 (b) 1.02964
44. (a) -3.6 (b) -3.60210 **45.** (a) -0.6 (b) -0.57482
46. (a) 0.9 (b) 0.88345 **47.** Negative **48.** Negative
49. Negative **50.** Positive **51.** II **52.** III **53.** II **54.** II
55. $\sin t = \sqrt{1 - \cos^2 t}$ **56.** $\cos t = \sqrt{1 - \sin^2 t}$

57. $\tan t = (\sin t)/\sqrt{1 - \sin^2 t}$ **58.** $\tan t = -\dfrac{\sqrt{1 - \cos^2 t}}{\cos t}$

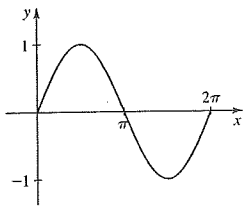
59. $\sec t = -\sqrt{1 + \tan^2 t}$ **60.** $\csc t = -\sqrt{1 + \cot^2 t}$

61. $\tan t = \sqrt{\sec^2 t - 1}$ **62.** $\sin t = -\dfrac{\sqrt{\sec^2 t - 1}}{\sec t}$

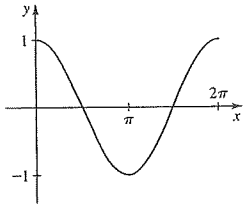
63. $\tan^2 t = (\sin^2 t)/(1 - \sin^2 t)$ **64.** $\sec^2 t \sin^2 t = \dfrac{1 - \cos^2 t}{\cos^2 t}$
65. $\cos t = -\frac{4}{5}$, $\tan t = -\frac{3}{4}$, $\csc t = \frac{5}{3}$, $\sec t = -\frac{5}{4}$, $\cot t = -\frac{4}{3}$
66. $\sin t = -\frac{3}{5}$, $\tan t = \frac{3}{4}$, $\csc t = -\frac{5}{3}$, $\sec t = -\frac{5}{4}$, $\cot t = \frac{4}{3}$
67. $\sin t = -2\sqrt{2}/3$, $\cos t = \frac{1}{3}$, $\tan t = -2\sqrt{2}$,
$\csc t = -\frac{3}{4}\sqrt{2}$, $\cot t = -\sqrt{2}/4$
68. $\sin t = -\sqrt{17}/17$, $\cos t = -4\sqrt{17}/17$,
$\csc t = -\sqrt{17}$, $\sec t = -\sqrt{17}/4$, $\cot t = 4$
69. $\sin t = -\frac{3}{5}$, $\cos t = \frac{4}{5}$, $\csc t = -\frac{5}{3}$, $\sec t = \frac{5}{4}$, $\cot t = -\frac{4}{3}$
70. $\sin t = -\sqrt{3}/2$, $\cos t = \frac{1}{2}$, $\tan t = -\sqrt{3}$,
$\csc t = -2\sqrt{3}/3$, $\cot t = -\sqrt{3}/3$
71. $\cos t = -\sqrt{15}/4$, $\tan t = \sqrt{15}/15$, $\csc t = -4$,
$\sec t = -4\sqrt{15}/15$, $\cot t = \sqrt{15}$
72. $\sin t = 4\sqrt{17}/17$, $\cos t = -\sqrt{17}/17$,
$\csc t = \sqrt{17}/4$, $\sec t = -\sqrt{17}$, $\cot t = -\frac{1}{4}$
73. Odd **74.** Even **75.** Odd **76.** Neither **77.** Even
78. Even **79.** Neither **80.** Even
81. $y(0) = 4$, $y(0.25) = -2.828$, $y(0.50) = 0$,
$y(0.75) = 2.828$, $y(1.00) = -4$, $y(1.25) = 2.828$
82. (a) 87 mmHg (b) 82.7 mmHg (c) 80 mmHg
(d) 73.9 mmHg **83.** (a) 0.49870 amp (b) -0.17117 amp
84. $H(0) = 175$ m, $H(1) = 150.4$ m, $H(2) = 100$ m,
$H(4) = 38.6$ m, $H(6) = 100$ m, $H(8) = 150.3$ m,
$H(12) = 58.8$ m

SECTION 5.3 ■ PAGE 396

1. $1, 2\pi$



2. $3, \pi$



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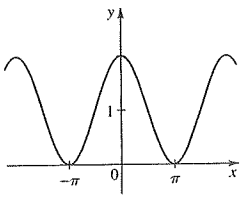
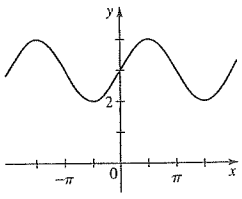


4.



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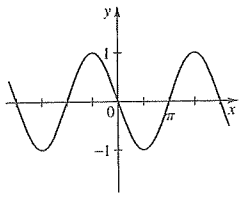

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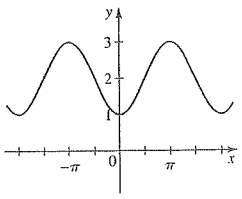

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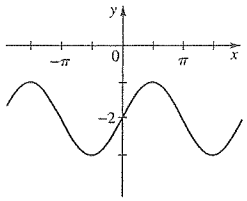

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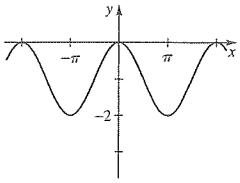

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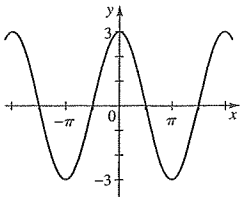

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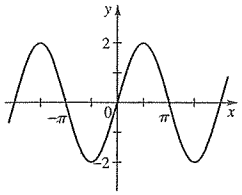

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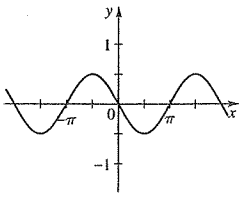

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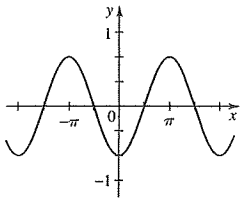

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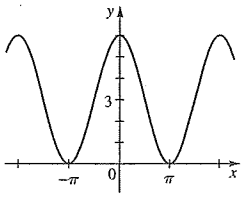

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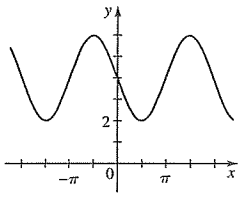

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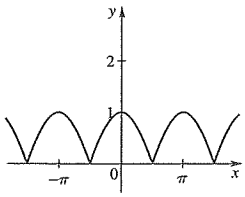

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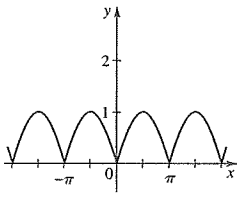
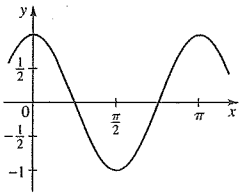
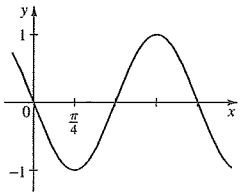


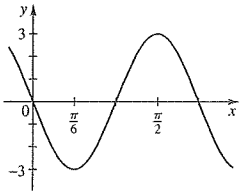
17. 1, π



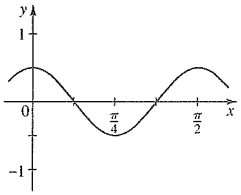
18. 1, π



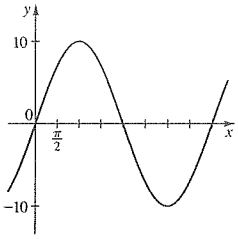
19. 3, $2\pi/3$



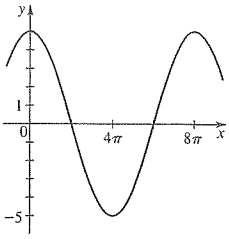
20. $\frac{1}{2}$, $\pi/2$



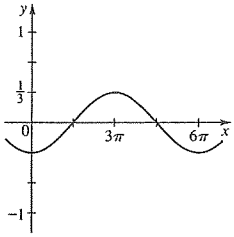
21. 10, 4π



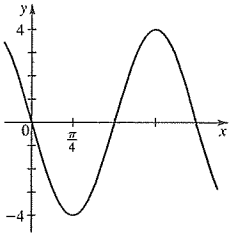
22. 5, 8π



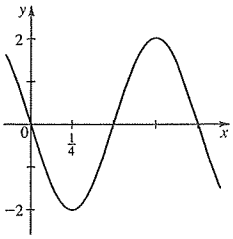
23. $\frac{1}{3}$, 6π



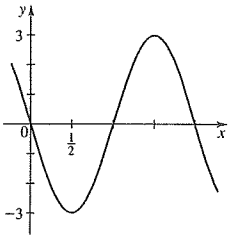
24. 4, π



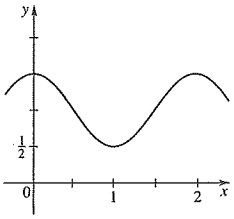
25. 2, 1



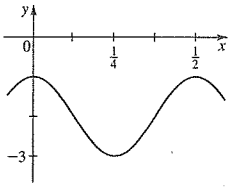
26. 3, 2



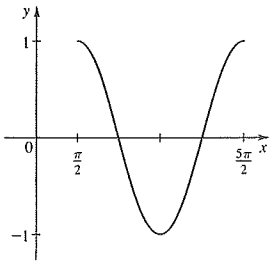
27. $\frac{1}{2}$, 2



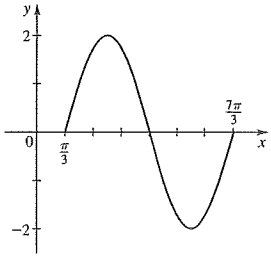
28. 1, $\frac{1}{2}$



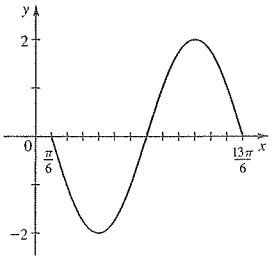
29. 1, 2π, $\pi/2$



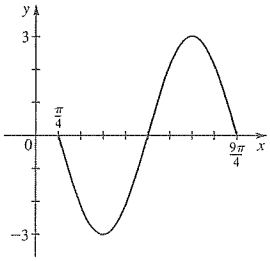
30. 2, 2π, $\pi/3$



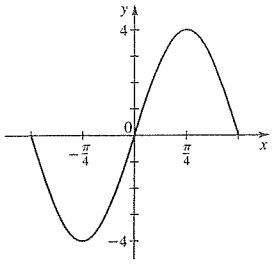
31. 2, 2π, $\pi/6$



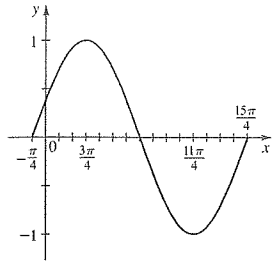
32. 3, 2π, $-\pi/4$



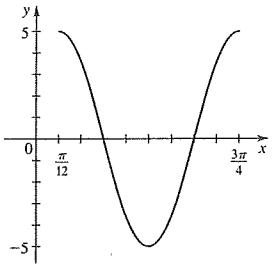
33. $4, \pi, -\pi/2$



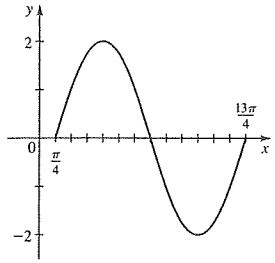
34. $1, 4\pi, -\pi/4$



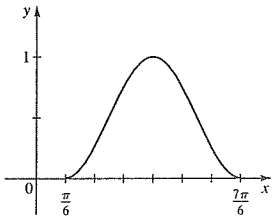
35. $5, 2\pi/3, \pi/12$



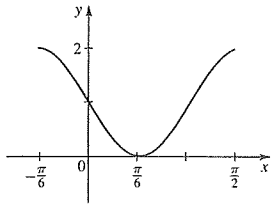
36. $2, 3\pi, \pi/4$



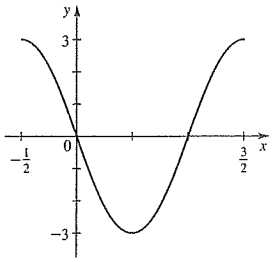
37. $\frac{1}{2}, \pi, \pi/6$



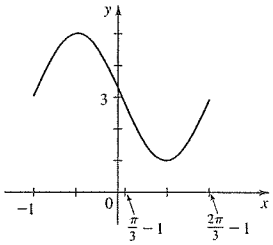
38. $1, 2\pi/3, -\pi/6$



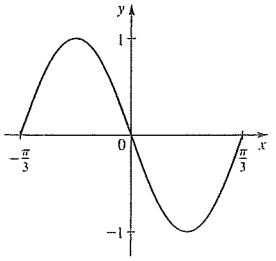
39. $3, 2, -\frac{1}{2}$



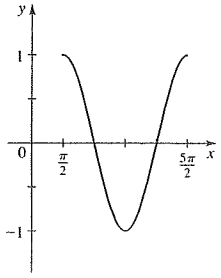
40. $2, 2\pi/3, -1$



41. $1, 2\pi/3, -\pi/3$

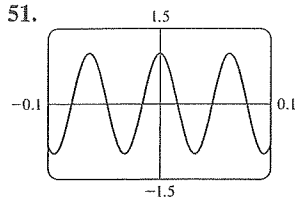


42. $1, 2\pi, \pi/2$

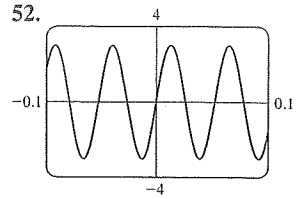


43. (a) $4, 2\pi, 0$ (b) $y = 4 \sin x$
44. (a) $2, \pi, 0$ (b) $y = 2 \cos 2x$
45. (a) $\frac{3}{2}, \frac{2\pi}{3}, 0$ (b) $y = \frac{3}{2} \cos 3x$
46. (a) $3, 4\pi, 0$ (b) $y = 3 \sin \frac{1}{2}x$
47. (a) $\frac{1}{2}, \pi, -\frac{\pi}{3}$ (b) $y = -\frac{1}{2} \cos 2(x + \pi/3)$
48. (a) $\frac{1}{10}, \pi, -\frac{3\pi}{4}$ (b) $y = -\frac{1}{10} \cos 2(x + 3\pi/4)$
49. (a) $4, \frac{3}{2}, -\frac{1}{2}$ (b) $y = 4 \sin \frac{4\pi}{3}(x + \frac{1}{2})$
50. (a) $5, 1, -\frac{1}{4}$ (b) $y = 5 \sin 2\pi(x + \frac{1}{4})$

51.



52.



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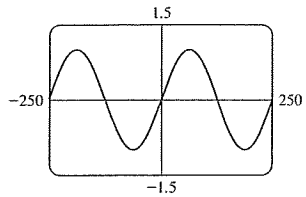

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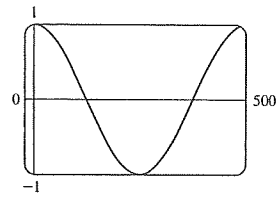

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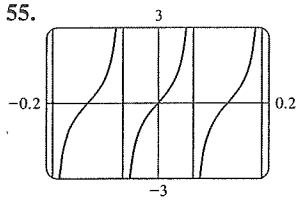

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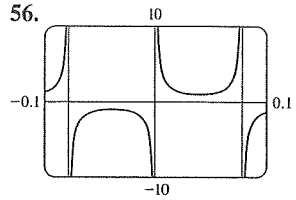

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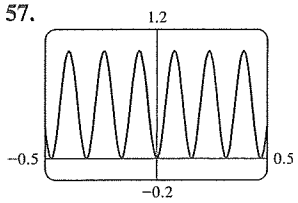

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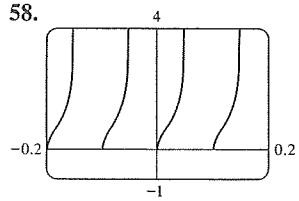

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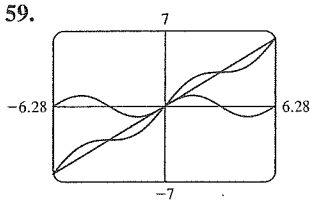

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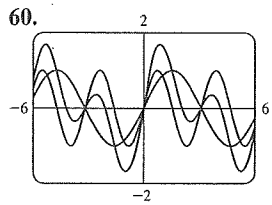

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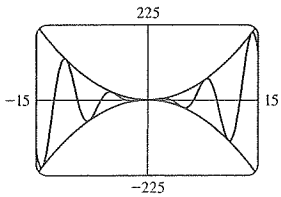
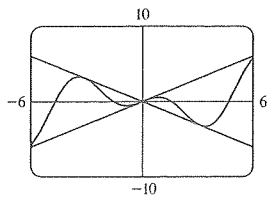


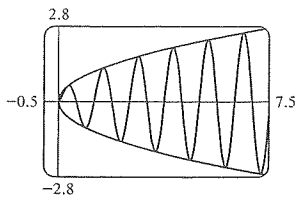
$y = x^2 \sin x$ is a sine curve that lies between the graphs of $y = x^2$ and $y = -x^2$

62.



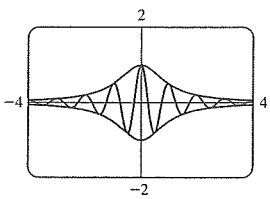
$y = x \cos x$ is a cosine curve that lies between the graphs of $y = x$ and $y = -x$

63.



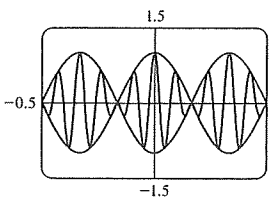
$y = \sqrt{x}\sin 5\pi x$ is a sine curve that lies between the graphs of $y = \sqrt{x}$ and $y = -\sqrt{x}$

64.



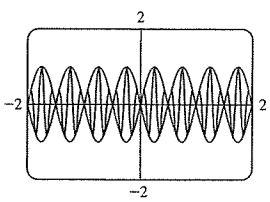
$y = \dfrac{\cos 2\pi x}{1 + x^2}$ is a cosine curve that lies between the graphs of $y = \dfrac{1}{1 + x^2}$ and $y = -\dfrac{1}{1 + x^2}$

65.



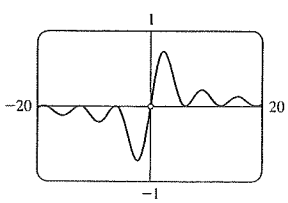
$y = \cos 3\pi x \cos 21\pi x$ is a cosine curve that lies between the graphs of $y = \cos 3\pi x$ and $y = -\cos 3\pi x$

66.



$y = \sin 2\pi x \sin 10\pi x$ is a sine curve that lies between the graphs of $y = \sin 2\pi x$ and $y = -\sin 2\pi x$

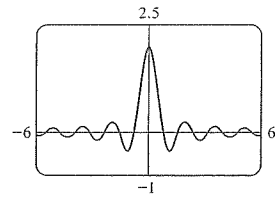
67. Maximum value 1.76 when $x \approx 0.94$, minimum value -1.76 when $x \approx -0.94$ (The same maximum and minimum values occur at infinitely many other values of x.)
68. Maximum value 6.97 when $x \approx 5.24$, minimum value -0.68 when $x \approx 1.05$ (The same maximum and minimum values occur at infinitely many other values of x.)
69. Maximum value 3.00 when $x \approx 1.57$, minimum value -1.00 when $x \approx -1.57$ (The same maximum and minimum values occur at infinitely many other values of x.)
70. Maximum value 0.58 when $x \approx 5.76$ (exact value is $x = 11\pi/6$; Minimum value -0.58 when $x \approx 3.67$ (exact value is $x = 7\pi/6$) (The same maximum and minimum values occur at infinitely many other values of x.)
71. 1.16 **72.** 1.11 **73.** 0.34, 2.80 **74.** 0.74
75. **(a)** Odd **(b)** $0, \pm 2\pi, \pm 4\pi, \pm 6\pi, \ldots$
(c)



(d) $f(x)$ approaches 0
(e) $f(x)$ approaches 0

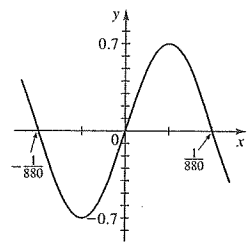
76. **(a)** Even
(b) $0, \pm\pi/4, \pm 2\pi/4, \pm 3\pi/4, \ldots$

(c)

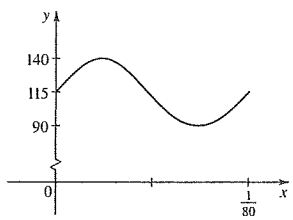


(d) $f(x)$ approaches 0
(e) $f(x)$ approaches 2

77. **(a)** 20 s **(b)** 6 ft
78. **(a)** $\frac{1}{440}$ s **(b)** 440 **(c)**

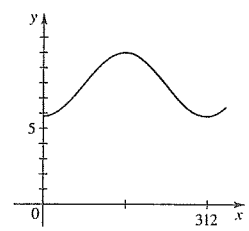


79. **(a)** $\frac{1}{80}$ min **(b)** 80
(c)



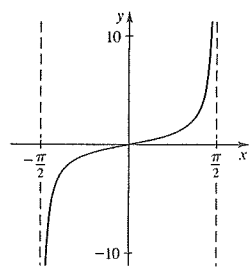
(d) $\frac{140}{90}$; it is higher than normal

80. **(a)** 312 days **(b)** 10, 5.8 **(c)**

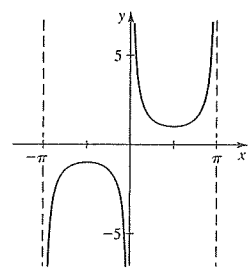


SECTION 5.4 ■ PAGE 405

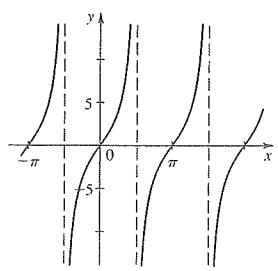
1. π; $\frac{\pi}{2} + n\pi$, n an integer



2. 2π; $n\pi$, n an integer



3. II **4.** III **5.** VI **6.** I **7.** IV **8.** V
9. π



10. π