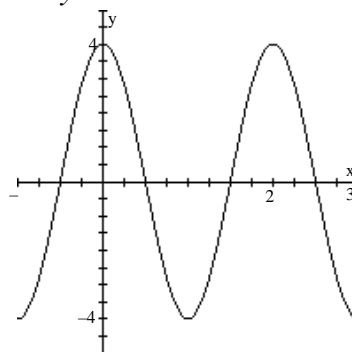
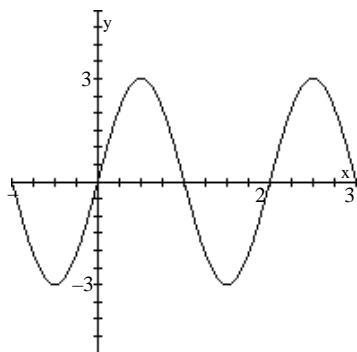


Trigonometric Functions

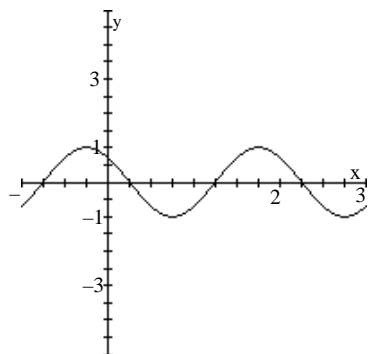
7.6 Graphs of the Sine and Cosine Functions

1. 0
2. 1
3. The graph of $y = \sin x$ is increasing for $-\frac{\pi}{2} < x < \frac{\pi}{2}$.
4. The graph of $y = \cos x$ is decreasing for $0 < x < \pi$.
5. The largest value of $y = \sin x$ is 1.
6. The smallest value of $y = \cos x$ is -1.
7. $\sin x = 0$ when $x = 0, \pi, 2\pi$
8. $\cos x = 0$ when $x = \frac{\pi}{2}, \frac{3\pi}{2}$
9. $\sin x = 1$ when $x = \frac{\pi}{2}$; $\sin x = -1$ when $x = \frac{3\pi}{2}$
10. $\cos x = 1$ when $x = 0, 2\pi$; $\cos x = -1$ when $x = \pi$
11. B, C, F
12. A, D, E
13. $y = 3\sin x$
14. $y = 4\cos x$

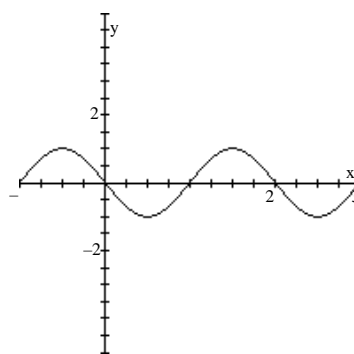


Section 7.6 Graphs of the Sine and Cosine Functions

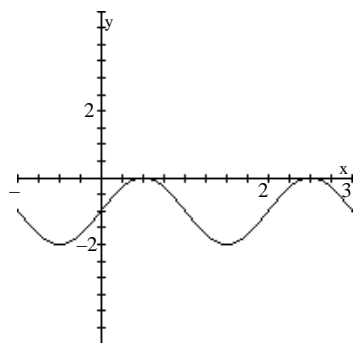
15. $y = \cos x + \frac{3}{4}$



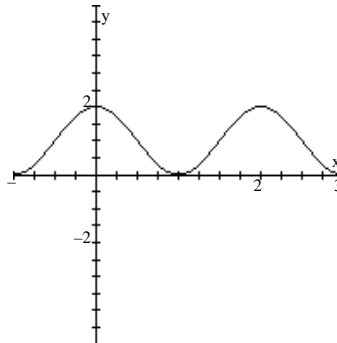
16. $y = \sin(x - \frac{\pi}{2})$



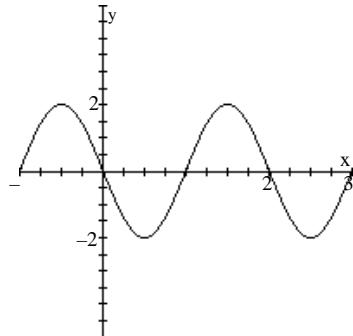
17. $y = \sin x - 1$



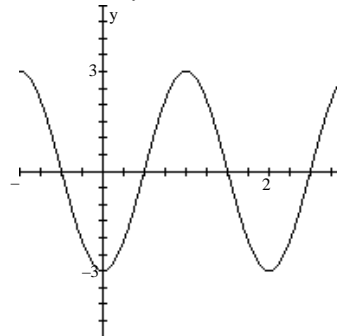
18. $y = \cos x + 1$



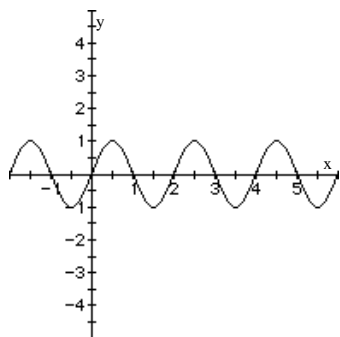
19. $y = -2\sin x$



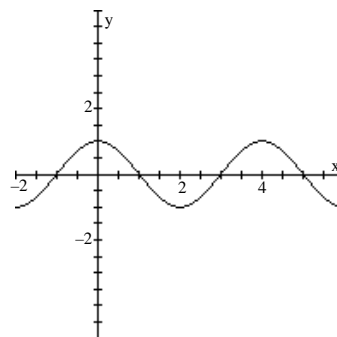
20. $y = -3\cos x$



21. $y = \sin(\frac{1}{2}x)$

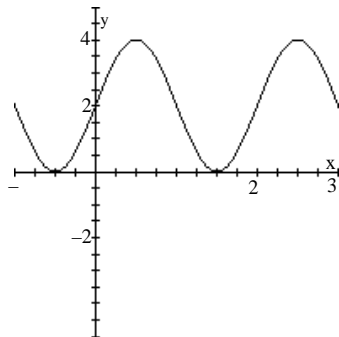


22. $y = \cos \frac{\pi}{2}x$

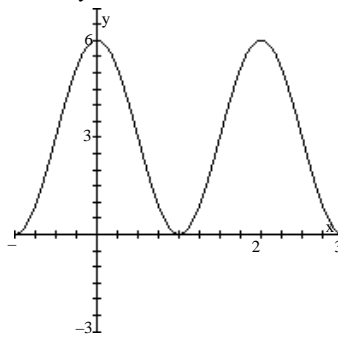


Chapter 7 Trigonometric Functions

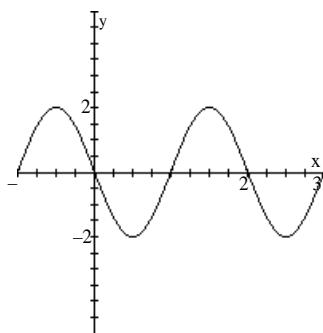
23. $y = 2\sin x + 2$



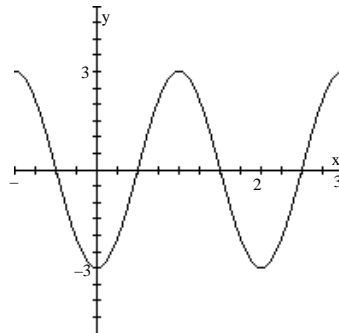
24. $y = 3\cos x + 3$



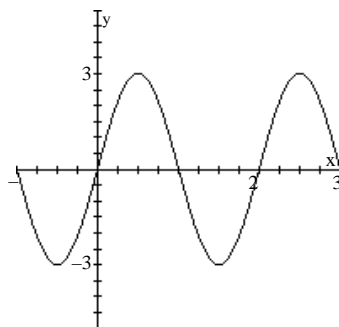
25. $y = -2\cos x - \frac{1}{2}$



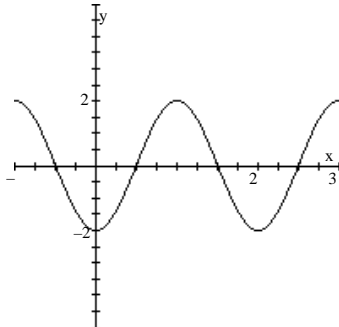
26. $y = -3\sin x + \frac{1}{2}$



27. $y = 3\sin(-x)$



28. $y = 2\cos(-x)$



29. $y = 2\sin x$

This is in the form $y = A\sin(\omega x)$ where $A = 2$ and $\omega = 1$.

Thus, the amplitude is $|A| = |2| = 2$ and the period is $T = \frac{2}{\omega} = \frac{2}{1} = 2$.

30. $y = 3\cos x$

This is in the form $y = A\cos(\omega x)$ where $A = 3$ and $\omega = 1$.

Thus, the amplitude is $|A| = |3| = 3$ and the period is $T = \frac{2}{\omega} = \frac{2}{1} = 2$.

Section 7.6 Graphs of the Sine and Cosine Functions

31. $y = -4\cos(2x)$

This is in the form $y = A\cos(\omega x)$ where $A = -4$ and $\omega = 2$.

Thus, the amplitude is $|A| = |-4| = 4$ and the period is $T = \frac{2}{\omega} = \frac{2}{2} = 1$.

32. $y = -\sin \frac{1}{2}x$

This is in the form $y = A \sin(\omega x)$ where $A = -1$ and $\omega = \frac{1}{2}$.

Thus, the amplitude is $|A| = |-1| = 1$ and the period is $T = \frac{2}{\omega} = \frac{2}{\frac{1}{2}} = 4$.

33. $y = 6\sin(x)$

This is in the form $y = A\sin(\omega x)$ where $A = 6$ and $\omega = 1$.

Thus, the amplitude is $|A| = |6| = 6$ and the period is $T = \frac{2}{\omega} = \frac{2}{1} = 2$.

34. $y = -3\cos(3x)$

This is in the form $y = A\cos(\omega x)$ where $A = -3$ and $\omega = 3$.

Thus, the amplitude is $|A| = |-3| = 3$ and the period is $T = \frac{2}{\omega} = \frac{2}{3}$.

35. $y = -\frac{1}{2}\cos \frac{3}{2}x$

This is in the form $y = A \cos(\omega x)$ where $A = -\frac{1}{2}$ and $\omega = \frac{3}{2}$.

Thus, the amplitude is $|A| = \left| -\frac{1}{2} \right| = \frac{1}{2}$ and the period is $T = \frac{2}{\omega} = \frac{2}{\frac{3}{2}} = \frac{4}{3}$.

36. $y = \frac{4}{3}\sin \frac{2}{3}x$

This is in the form $y = A \sin(\omega x)$ where $A = \frac{4}{3}$ and $\omega = \frac{2}{3}$.

Thus, the amplitude is $|A| = \left| \frac{4}{3} \right| = \frac{4}{3}$ and the period is $T = \frac{2}{\omega} = \frac{2}{\frac{2}{3}} = 3$.

37. $y = \frac{5}{3}\sin -\frac{2\pi}{3}x = -\frac{5}{3}\sin \frac{2\pi}{3}x$

This is in the form $y = A \sin(\omega x)$ where $A = -\frac{5}{3}$ and $\omega = \frac{2\pi}{3}$.

Thus, the amplitude is $|A| = \left| -\frac{5}{3} \right| = \frac{5}{3}$ and the period is $T = \frac{2}{\omega} = \frac{2}{\frac{2\pi}{3}} = \frac{3}{\pi}$.

$$38. \quad y = \frac{9}{5} \cos -\frac{3\pi}{2} x = \frac{9}{5} \cos \frac{3\pi}{2} x$$

This is in the form $y = A \cos(\omega x)$ where $A = \frac{9}{5}$ and $\omega = \frac{3\pi}{2}$.

Thus, the amplitude is $|A| = \left| \frac{9}{5} \right| = \frac{9}{5}$ and the period is $T = \frac{2}{\omega} = \frac{2}{\frac{3\pi}{2}} = \frac{4}{3} = \frac{4}{3}$.

39. F

40. E

41. A

42. I

43. H

44. B

45. C

46. G

47. J

48. D

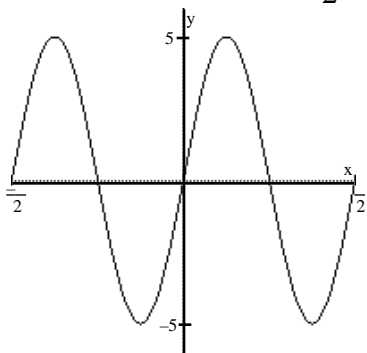
49. A

50. E

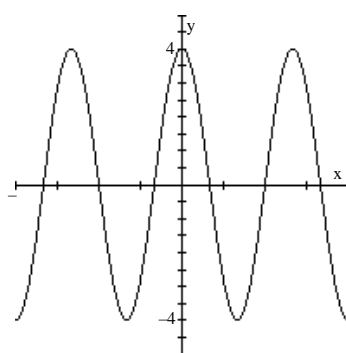
51. D

52. F

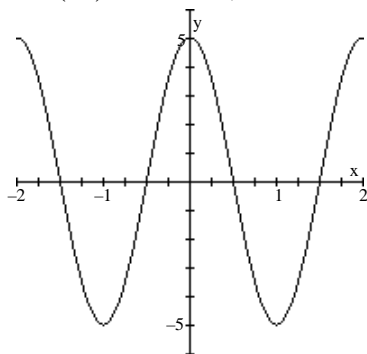
$$53. \quad y = 5\sin(4x) \quad A = 5; \quad T = \frac{\pi}{2}$$



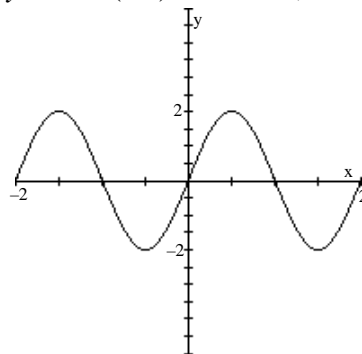
$$54. \quad y = 4\cos(\frac{\pi}{3}x) \quad A = 4; \quad T = \frac{6}{\pi}$$



$$55. \quad y = 5\cos(x) \quad A = 5; \quad T = 2\pi$$

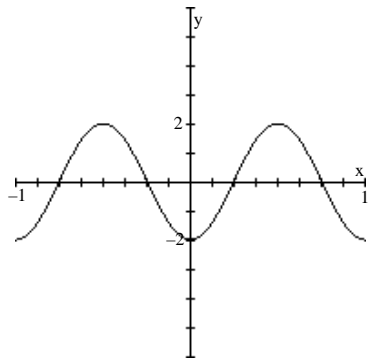


$$56. \quad y = 2\sin(\frac{\pi}{2}x) \quad A = 2; \quad T = 4$$

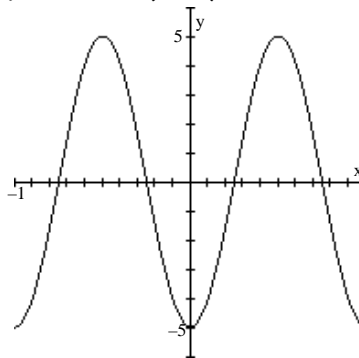


Section 7.6 Graphs of the Sine and Cosine Functions

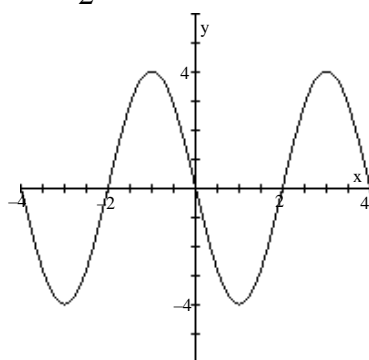
57. $y = -2\cos(2x)$ $A = -2$; $T = 1$



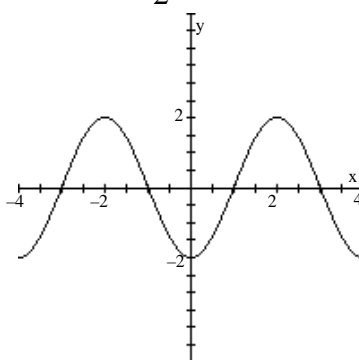
58. $y = -5\cos(2x)$ $A = -5$; $T = 1$



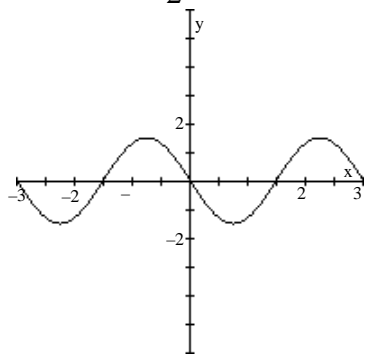
59. $y = -4\sin\left(\frac{1}{2}x\right)$ $A = -4$; $T = 4$



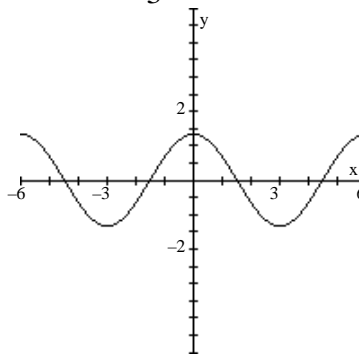
60. $y = -2\cos\left(\frac{1}{2}x\right)$ $A = -2$; $T = 4$



61. $y = \frac{3}{2}\sin\left(-\frac{2}{3}x\right) = -\frac{3}{2}\sin\left(\frac{2}{3}x\right)$
 $A = -\frac{3}{2}$; $T = 3$



62. $y = \frac{4}{3}\cos\left(-\frac{1}{3}x\right) = \frac{4}{3}\cos\left(\frac{1}{3}x\right)$
 $A = \frac{4}{3}$; $T = 6$



63. $|A| = 3$ $T =$; $\omega = \frac{2}{T} = \frac{2}{1} = 2$; $y = 3\sin(2x)$

64. $|A| = 2$; $T = 4$; $\omega = \frac{2}{T} = \frac{2}{4} = \frac{1}{2}$; $y = 2\sin\left(\frac{1}{2}x\right)$

65. $|A| = 3$ $T = 2$; $\omega = \frac{2}{T} = \frac{2}{2} =$; $y = 3\sin(x)$

Chapter 7 Trigonometric Functions

66. $|A| = 4$; $T = 1$; $\omega = \frac{2}{T} = \frac{2}{1} = 2$; $y = 4\sin(2x)$

67. The graph is a cosine graph with an amplitude of 5 and a period of 8. Find ω :

$$8 = \frac{2}{\omega} \quad 8\omega = 2 \quad \omega = \frac{2}{8} = \frac{1}{4}$$

The equation is: $y = 5\cos \frac{1}{4}x$.

68. The graph is a sine graph with an amplitude of 4 and a period of 8 . Find ω :

$$8 = \frac{2}{\omega} \quad 8\omega = 2 \quad \omega = \frac{2}{8} = \frac{1}{4}$$

The equation is: $y = 4\sin \frac{1}{4}x$.

69. The graph is a reflected cosine graph with an amplitude of 3 and a period of 4 . Find ω :

$$4 = \frac{2}{\omega} \quad 4\omega = 2 \quad \omega = \frac{2}{4} = \frac{1}{2}$$

The equation is: $y = -3\cos \frac{1}{2}x$.

70. The graph is a reflected sine graph with an amplitude of 2 and a period of 4. Find ω :

$$4 = \frac{2}{\omega} \quad 4\omega = 2 \quad \omega = \frac{2}{4} = \frac{1}{2}$$

The equation is: $y = -2\sin \frac{1}{2}x$.

71. The graph is a sine graph with an amplitude of $\frac{3}{4}$ and a period of 1. Find ω :

$$1 = \frac{2}{\omega} \quad \omega = 2$$

The equation is: $y = \frac{3}{4}\sin(2x)$.

72. The graph is a reflected cosine graph with an amplitude of $\frac{5}{2}$ and a period of 2. Find ω :

$$2 = \frac{2}{\omega} \quad 2\omega = 2 \quad \omega = \frac{2}{2} = 1$$

The equation is: $y = -\frac{5}{2}\cos(x)$.

73. The graph is a reflected sine graph with an amplitude of 1 and a period of $\frac{4}{3}$. Find ω :

$$\frac{4}{3} = \frac{2}{\omega} \quad 4\omega = 6 \quad \omega = \frac{6}{4} = \frac{3}{2}$$

The equation is: $y = -\sin \frac{3}{2}x$.

Section 7.6 Graphs of the Sine and Cosine Functions

74. The graph is a reflected cosine graph with an amplitude of 2 and a period of 2π .

Find ω :

$$2 = \frac{2}{\omega} \quad 2\omega = 2 \quad \omega = \frac{2}{2} = 1$$

The equation is: $y = -2 \cos x$.

75. The graph is a reflected cosine graph with an amplitude of 2 and a period of $\frac{4\pi}{3}$.

Find ω :

$$\frac{4}{3} = \frac{2}{\omega} \quad 4\omega = 6 \quad \omega = \frac{6}{4} = \frac{3}{2}$$

The equation is: $y = -2 \cos \frac{3}{2}x$.

76. The graph is a reflected sine graph with an amplitude of $\frac{1}{2}$ and a period of $\frac{4\pi}{3}$.

Find ω :

$$\frac{4}{3} = \frac{2}{\omega} \quad 4\omega = 6 \quad \omega = \frac{6}{4} = \frac{3}{2}$$

The equation is: $y = -\frac{1}{2} \sin \frac{3}{2}x$.

77. The graph is a sine graph with an amplitude of 3 and a period of 4. Find ω :

$$4 = \frac{2}{\omega} \quad 4\omega = 2 \quad \omega = \frac{2}{4} = \frac{1}{2}$$

The equation is: $y = 3 \sin \frac{1}{2}x$.

78. The graph is a reflected cosine graph with an amplitude of 2 and a period of 2π .

Find ω :

$$2 = \frac{2}{\omega} \quad 2\omega = 2 \quad \omega = \frac{2}{2} = 1$$

The equation is: $y = -2 \cos(x)$.

79. The graph is a reflected cosine graph with an amplitude of 4 and a period of $\frac{2\pi}{3}$.

Find ω :

$$\frac{2}{3} = \frac{2}{\omega} \quad 2\omega = 6 \quad \omega = \frac{6}{2} = 3$$

The equation is: $y = -4 \cos(3x)$.

80. The graph is a sine graph with an amplitude of 4 and a period of π . Find ω :

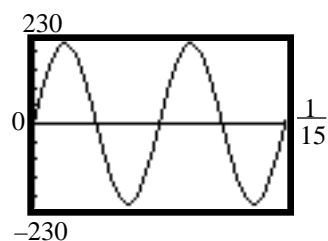
$$\pi = \frac{2}{\omega} \quad \omega = 2 \quad \omega = \frac{2}{\pi} = \frac{2}{\pi}$$

The equation is: $y = 4 \sin(2x)$.

81. $I = 220\sin(60t), t \geq 0$

Period: $T = \frac{2}{\omega} = \frac{2}{60} = \frac{1}{30}$

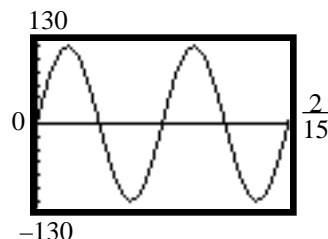
Amplitude: $|A| = |220| = 220$



82. $I = 120\sin(30t), t \geq 0$

Period: $T = \frac{2}{\omega} = \frac{2}{30} = \frac{1}{15}$

Amplitude: $|A| = |120| = 120$

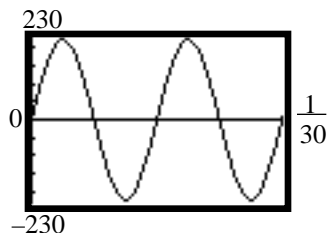


83. $V = 220\sin(120t)$

(a) Amplitude $|A| = |220| = 220$

Period: $T = \frac{2}{\omega} = \frac{2}{120} = \frac{1}{60}$

(b)



(c) $V = IR$

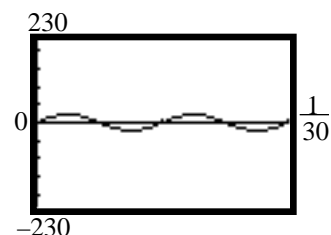
$220\sin(120t) = 10I$

$22\sin(120t) = I$

(d) Amplitude: $|A| = |22| = 22$

Period: $T = \frac{2}{\omega} = \frac{2}{120} = \frac{1}{60}$

(e)

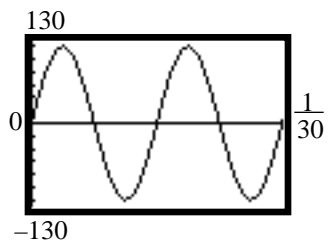


84. $V = 120\sin(120t)$

(a) Amplitude $|A| = |120| = 120$

Period: $T = \frac{2}{\omega} = \frac{2}{120} = \frac{1}{60}$

(b)



(c) $V = IR$

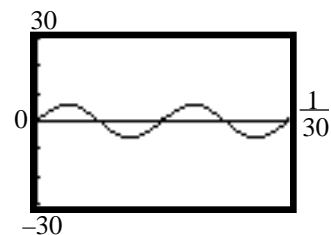
$120\sin(120t) = 20I$

$6\sin(120t) = I$

(d) Amplitude: $|A| = |6| = 6$

Period: $T = \frac{2}{\omega} = \frac{2}{120} = \frac{1}{60}$

(e)

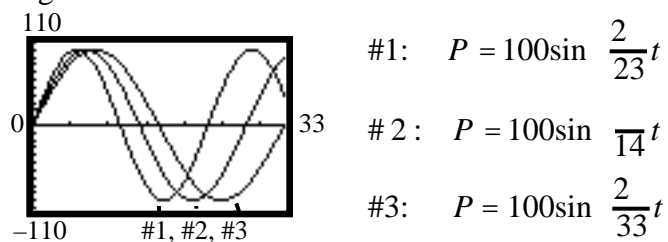


Section 7.6 Graphs of the Sine and Cosine Functions

85. (a) $P = \frac{V^2}{R} = \frac{(V_0 \sin(2\pi f t))^2}{R} = \frac{V_0^2 \sin^2(2\pi f t)}{R}$
- (b) The graph is the reflected cosine graph translated up a distance equivalent to the amplitude. The period is $\frac{1}{2f}$, so $\omega = 4\pi f$. The amplitude is $\frac{1}{2} \frac{V_0^2}{R} = \frac{V_0^2}{2R}$.
- The equation is: $P = -\frac{V_0^2}{2R} \cos(4\pi f t) + \frac{V_0^2}{2R} = \frac{V_0^2}{R} \cdot \frac{1}{2} (1 - \cos(4\pi f t))$
- (c) Comparing the formulas:
- $$\sin^2(2\pi f t) = \frac{1}{2} (1 - \cos(4\pi f t))$$

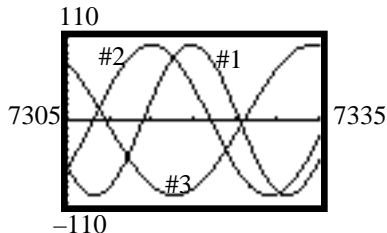
86. (a) Physical potential: $\omega = \frac{2}{23}$; Emotional potential: $\omega = \frac{2}{28} = \frac{1}{14}$;
Intellectual potential: $\omega = \frac{2}{33}$

(b) Graphing:



(c) No

(d) Graphing:



Physical potential peaks 15 days after the 20th birthday. Emotional potential has a maximum at 10 days and a minimum at the 24th day. Intellectual potential peaks on the 29th day and is at a minimum on the 13th day.