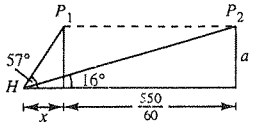
39. $\tan 57° = \dfrac{a}{x} \Rightarrow x = a \cot 57°$



$$\tan 16° = \frac{a}{x + (55/6)}$$

$$\tan 16° = \frac{a}{a \cot 57° + (55/6)}$$

$$\cot 16° = \frac{a \cot 57° + (55/6)}{a}$$

$$a \cot 16° - a \cot 57° = \frac{55}{6} \Rightarrow a \approx 3.23 \text{ miles} \approx 17{,}054 \text{ feet}$$

41. L_1: $3x - 2y = 5 \Rightarrow y = \dfrac{3}{2}x - \dfrac{5}{2} \Rightarrow m_1 = \dfrac{3}{2}$

L_2: $x + y = 1 \Rightarrow y = -x + 1 \Rightarrow m_2 = -1$

$$\tan \alpha = \left|\frac{-1 - (3/2)}{1 + (-1)(3/2)}\right| = \left|\frac{-5/2}{-1/2}\right| = 5$$

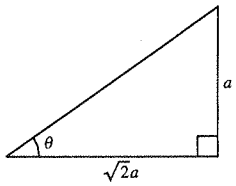
$$\alpha = \arctan 5 \approx 78.7°$$

43. The diagonal of the base has a length of $\sqrt{a^2 + a^2} = \sqrt{2}a$. Now, we have:

$$\tan \theta = \frac{a}{\sqrt{2}a} = \frac{1}{\sqrt{2}}$$

$$\theta = \arctan \frac{1}{\sqrt{2}}$$

$$\theta \approx 35.3°$$

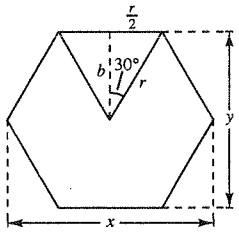


45. $\cos 30° = \dfrac{b}{r}$

$$b = \cos 30° r$$

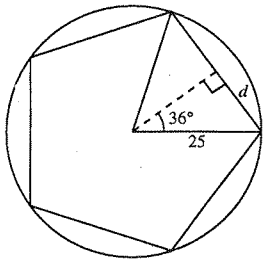
$$b = \frac{\sqrt{3}r}{2}$$

$$y = 2b = 2\left(\frac{\sqrt{3}r}{2}\right) = \sqrt{3}r$$



47. $\sin 36° = \dfrac{d}{25} \Rightarrow d \approx 14.695$

Length of side: $2d \approx 29.39$ inches

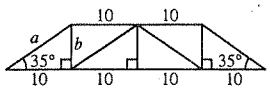


49. $\tan 35° = \dfrac{b}{10}$

$$b = 10 \tan 35° \approx 7$$

$$\cos 35° = \frac{10}{a}$$

$$a = \frac{10}{\cos 35°} \approx 12.2$$



51. $d = 0$ when $t = 0$, $a = 8$, period $= 2$

Use $d = a \sin wt$ since $d = 0$ when $t = 0$.

$$\frac{2\pi}{w} = 2 \Rightarrow w = \pi$$

Thus, $d = 8 \sin \pi t$.

53. $d = 3$ when $t = 0$, $a = 3$, period $= 1.5$

Use $d = a\cos wt$ since $d = 3$ when $t = 0$.

$$\frac{2\pi}{w} = 1.5 \Rightarrow w = \frac{4}{3}\pi$$

Thus, $d = 3\cos\left(\frac{4}{3}\pi t\right)$.

55. $d = 4\cos 8\pi t$

(a) Maximum displacement = amplitude = 4

(b) Frequency $= \dfrac{\omega}{2\pi} = \dfrac{8\pi}{2\pi}$

$= 4$ cycles per unit of time

(c) $d = 4\cos(8\pi(5)) = 4$

(d) $8\pi t = \dfrac{\pi}{2} \Rightarrow t = \dfrac{1}{16}$

57. $d = \dfrac{1}{16}\sin 140\pi t$

(a) Maximum displacement = amplitude $= \dfrac{1}{16}$

(b) Frequency $= \dfrac{\omega}{2\pi} = \dfrac{140\pi}{2\pi}$

$= 70$ cycles per unit of time

(c) $d = 0$

(d) $140\pi t = \pi \Rightarrow t = \dfrac{1}{140}$

59. $d = a\sin\omega t$

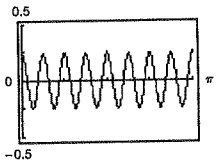
$$\text{Period} = \frac{2\pi}{\omega} = \frac{1}{\text{frequency}}$$

$$\frac{2\pi}{\omega} = \frac{1}{264}$$

$$\omega = 2\pi(264) = 528\pi$$

61. $y = \dfrac{1}{4}\cos 16t,\ t > 0$

(a)



(b) Period: $\dfrac{2\pi}{16} = \dfrac{\pi}{8}$ seconds

(c) $\dfrac{1}{4}\cos 16t = 0$ when

$16t = \dfrac{\pi}{2} \Rightarrow t = \dfrac{\pi}{32}$ seconds.

63. (a), (b)

Base 1	Base 2	Altitude	Area
8	$8 + 16\cos 10°$	$8\sin 10°$	22.1
8	$8 + 16\cos 20°$	$8\sin 20°$	42.5
8	$8 + 16\cos 30°$	$8\sin 30°$	59.7
8	$8 + 16\cos 40°$	$8\sin 40°$	72.7
8	$8 + 16\cos 50°$	$8\sin 50°$	80.5
8	$8 + 16\cos 60°$	$8\sin 60°$	83.1
8	$8 + 16\cos 70°$	$8\sin 70°$	80.7

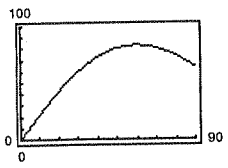
Maximum $\approx$ 83.1 square feet

(c) $A = \frac{1}{2}(b_1 + b_2)h$

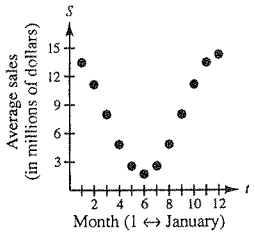
$= \frac{1}{2}[8 + 8 + 16\cos\theta]\,8\sin\theta$

$= 64(1 + \cos\theta)\sin\theta$

(d) Maximum area is approximately 83.1 square feet for $\theta = 60°$.



65. (a)



(b) $a = \frac{1}{2}(14.30 - 1.70) = 6.3$

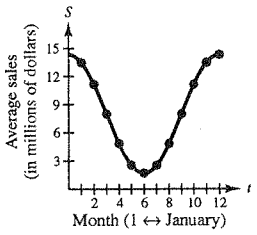
$\frac{2\pi}{b} = 12 \Rightarrow b = \frac{\pi}{6}$

Shift: $d = 14.3 - 6.3 = 8$

$S = d + a\cos bt$

$S = 8 + 6.3\cos\left(\frac{\pi t}{6}\right)$

The model is a good fit.



(c) Period: $\frac{2\pi}{\pi/6} = 12$

This corresponds to the 12 months in a year. Since the sales of outerwear is seasonal, this is reasonable.

(d) The amplitude represents the maximum displacement from the average sale of 8 million dollars. Sales are greatest in December (cold weather + holidays) and least in June.

67. False. The other acute angle is $90° - 48.1° = 41.9°$. Then

$$\tan(41.9°) = \frac{\text{opp}}{\text{adj}} = \frac{a}{22.56} \Rightarrow a = 22.56 \cdot \tan(41.9°).$$

69. $y - 2 = 4(x + 1)$

$4x - y + 6 = 0$

71. $\text{Slope} = \frac{6 - 2}{-2 - 3} = -\frac{4}{5}$

$y - 2 = -\frac{4}{5}(x - 3)$

$5y - 10 = -4x + 12$

$4x + 5y - 22 = 0$

73. Domain: $(-\infty, \infty)$

75. Domain: $(-\infty, \infty)$

77. Domain: all $x \neq 0, 2$

79. Domain: $(-\infty, \infty)$

81. $e^{2x} = 54$

$2x = \ln 54$

$x = \frac{1}{2}\ln 54 \approx 1.994$

83. $\ln(x^2 + 1) = 3.2$

$x^2 + 1 = e^{3.2}$

$x = \pm\sqrt{e^{3.2} - 1} \approx \pm 4.851$

Review Exercises for Chapter 5

Solutions to Odd-Numbered Exercises

1. Approximately $-320°$