







## Chapter 14

- 19.** Solve for the largest angle first, in case it is obtuse.

$$b^2 = a^2 + c^2 - 2ac \cos B$$

$$\cos B = \frac{b^2 - a^2 - c^2}{-2ac}$$

$$\cos B = \frac{49^2 - 35^2 - 45^2}{-2(35)(45)}$$

$$\cos B \approx 0.2695$$

$$B \approx 74.4^\circ$$

$$\frac{\sin A}{a} = \frac{\sin B}{b}$$

$$\sin A = \frac{a \sin B}{b}$$

$$\sin A = \frac{35 \sin 74.4^\circ}{49}$$

$$\sin A \approx 0.6880$$

$$A \approx 43.5^\circ$$

$$C \approx 180^\circ - A - B$$

$$C \approx 180^\circ - 43.5^\circ - 74.4^\circ$$

$$C \approx 62.1^\circ$$

Thus,  $A \approx 43.5^\circ$ ,  $B \approx 74.4^\circ$ , and  $C \approx 62.1^\circ$ .

- 28.** SAS information is given.

$$a^2 = b^2 + c^2 - 2bc \cos A$$

$$a = \sqrt{123^2 + 63.2^2 - 2(123)(63.2) \cos 114^\circ}$$

$$a \approx 159.5$$

$$\frac{\sin B}{b} = \frac{\sin A}{a}$$

$$\frac{\sin B}{123} = \frac{\sin 114^\circ}{159.5}$$

$$\sin B \approx 0.7045$$

$$B \approx 44.8$$

$$C \approx 180^\circ - A - B$$

$$C \approx 180^\circ - 114^\circ - 44.8^\circ$$

$$C \approx 21.2^\circ$$

Thus,  $a \approx 159.5$ ,  $B \approx 44.8^\circ$ , and  $C \approx 21.2^\circ$ .

- 37.** SSA information is given.

$$\frac{\sin B}{b} = \frac{\sin A}{a}$$

$$\frac{\sin B}{8} = \frac{\sin 58^\circ}{10}$$

$$\sin B \approx 0.6784$$

$$B \approx 42.7^\circ \text{ or } B \approx 180^\circ - 42.7^\circ = 137.3^\circ \text{ (not possible, since } A = 58^\circ)$$

$$C = 180^\circ - A - B$$

$$C \approx 180^\circ - 58^\circ - 42.7^\circ$$

$$C \approx 79.3^\circ$$

$$\frac{\sin C}{c} = \frac{\sin B}{b}$$

$$c = \frac{b \sin C}{\sin B}$$

$$c \approx \frac{8 \sin 79.3^\circ}{\sin 42.7^\circ}$$

$$c \approx 11.6$$

Thus,  $B \approx 42.7^\circ$ ,  $C \approx 79.3^\circ$ , and  $c \approx 11.6$ .

## Chapter 14

### Lesson 14.3

$$\begin{aligned} 10. \csc \theta &= \frac{r}{y} = \frac{1}{\frac{y}{r}} \\ &= \frac{1}{\sin \theta}, \sin \theta \neq 0 \end{aligned}$$

$$18. \sec \theta \cos^2 \theta = \frac{1}{\cos \theta} \cdot \cos^2 \theta = \cos \theta$$

$$\begin{aligned} 28. (1 - \sin^2 \theta)(1 + \sec^2 \theta) &= \cos^2 \theta \left(1 + \frac{1}{\cos^2 \theta}\right) \\ &= \cos^2 \theta + \frac{\cos^2 \theta}{\cos^2 \theta} \\ &= \cos^2 \theta + 1 \end{aligned}$$

$$42. \frac{\csc \theta}{\sin \theta} = \frac{\frac{1}{\sin \theta}}{\sin \theta} = \frac{1}{\sin^2 \theta} = \csc^2 \theta$$

### Lesson 14.4

$$\begin{aligned} 15. \sin(135^\circ + 180^\circ) &= \sin 135^\circ \cos 180^\circ + \cos 135^\circ \sin 180^\circ \\ &= \frac{\sqrt{2}}{2}(-1) + \left(-\frac{\sqrt{2}}{2}\right)(0) = -\frac{\sqrt{2}}{2} \end{aligned}$$

$$\begin{aligned} 25. \cos(90^\circ + \theta) &= \cos 90^\circ \cos \theta - \sin 90^\circ \sin \theta \\ &= 0 \cdot \cos \theta - 1 \cdot \sin \theta \\ &= -\sin \theta \end{aligned}$$

30. Answers may vary. Sample answer:

Let  $A = 30^\circ$  and  $B = 60^\circ$ .

$$\cos(A + B) = \cos(30^\circ + 60^\circ)$$

$$= \cos 90^\circ = 0$$

$$\cos A + \cos B = \cos 30^\circ + \cos 60^\circ$$

$$= \frac{\sqrt{3}}{2} + \frac{1}{2}$$

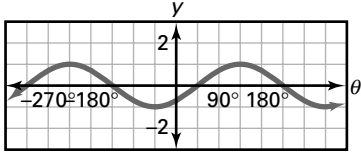
$$= \frac{\sqrt{3} + 1}{2}$$

So,  $\cos(A + B) \neq \cos A + \cos B$

$$\begin{aligned} 37. \sin 15^\circ &= \sin(60^\circ - 45^\circ) \\ &= \sin 60^\circ \cos 45^\circ - \cos 60^\circ \sin 45^\circ \\ &= \frac{\sqrt{3}}{2} \left(\frac{\sqrt{2}}{2}\right) - \frac{1}{2} \left(\frac{\sqrt{2}}{2}\right) \\ &= \frac{\sqrt{6}}{4} - \frac{\sqrt{2}}{4} = \frac{\sqrt{6} - \sqrt{2}}{4} \end{aligned}$$

## Chapter 14

54.  $y = \sin(\theta - 45^\circ)$



61. 
$$\begin{bmatrix} \cos 135^\circ & -\sin 135^\circ \\ \sin 135^\circ & \cos 135^\circ \end{bmatrix} \begin{bmatrix} -3 \\ 2 \end{bmatrix}$$

$$= \begin{bmatrix} -\frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} \\ \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} \end{bmatrix} \begin{bmatrix} -3 \\ 2 \end{bmatrix}$$

$$= \begin{bmatrix} \frac{3\sqrt{2}}{2} - \frac{2\sqrt{2}}{2} \\ -\frac{3\sqrt{2}}{2} - \frac{2\sqrt{2}}{2} \end{bmatrix} = \begin{bmatrix} \frac{\sqrt{2}}{2} \\ -\frac{5\sqrt{2}}{2} \end{bmatrix}$$

$P\left(\frac{\sqrt{2}}{2}, -\frac{5\sqrt{2}}{2}\right)$

### Lesson 14.5

10.  $\cos 2\theta + 2 \sin^2 \theta = \cos^2 \theta - \sin^2 \theta + 2 \sin^2 \theta$   
 $= \cos^2 \theta + \sin^2 \theta = 1$

15.  $\sin 4\theta = \sin(2\theta + 2\theta)$   
 $= \sin 2\theta \cos 2\theta + \cos 2\theta \sin 2\theta$   
 $= 2 \sin 2\theta \cos 2\theta$   
 $= 2(2 \sin \theta \cos \theta)(\cos^2 \theta - \sin^2 \theta)$   
 $= 4 \sin \theta \cos \theta (\cos^2 \theta - \sin^2 \theta)$   
 $= 4 \sin \theta \cos^3 \theta - 4 \sin^3 \theta \cos \theta$

26.  $x = 2, y = -\sqrt{21}, r = 5; \sin \theta = -\frac{\sqrt{21}}{5}, \cos \theta = \frac{2}{5}$

$\begin{aligned} \sin 2\theta &= 2 \sin \theta \cos \theta \\ &= 2\left(\frac{\sqrt{21}}{5}\right)\left(-\frac{2}{5}\right) \\ &= -\frac{4\sqrt{21}}{25} \end{aligned}$	$\begin{aligned} \cos 2\theta &= \cos^2 \theta - \sin^2 \theta \\ &= \left(\frac{2}{5}\right)^2 - \left(\frac{\sqrt{21}}{5}\right)^2 \\ &= \frac{4}{25} - \frac{21}{25} = -\frac{17}{25} \end{aligned}$
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35.  $x = -\sqrt{11}, y = 5, r = 6; \sin \theta = \frac{5}{6}, \cos \theta = -\frac{\sqrt{11}}{6}$

$\begin{aligned} \sin \frac{\theta}{2} &= \sqrt{\frac{1 - \cos \theta}{2}} \\ &= \sqrt{\frac{1 - \left(-\frac{\sqrt{11}}{6}\right)}{2}} \\ &= \sqrt{\frac{1}{2}\left(\frac{6 + \sqrt{11}}{6}\right)} \\ &= \sqrt{\frac{6 + \sqrt{11}}{12}} = \sqrt{\frac{1}{2} + \frac{\sqrt{11}}{12}} \end{aligned}$	$\begin{aligned} \cos \frac{\theta}{2} &= \sqrt{\frac{1 + \cos \theta}{2}} \\ &= \sqrt{\frac{1 + \left(-\frac{\sqrt{11}}{6}\right)}{2}} \\ &= \sqrt{\frac{1}{2}\left(\frac{6 - \sqrt{11}}{6}\right)} \\ &= \sqrt{\frac{6 - \sqrt{11}}{12}} = \sqrt{\frac{1}{2} - \frac{\sqrt{11}}{12}} \end{aligned}$
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## Lesson 14.6

11.  $4 \cos \theta - 2 = 0$

$4 \cos \theta = 2$

$\cos \theta = \frac{1}{2}$

$\theta = 60^\circ, 300^\circ$

Thus,  $\theta = 60^\circ + n360^\circ$  or

$\theta = 300^\circ + n360^\circ$ .

16.  $\tan \theta - \sqrt{3} = 0$

$\tan \theta = \sqrt{3}$

$\theta = 60^\circ, 240^\circ$

Thus,  $\theta = 60^\circ + n360^\circ$  or  $\theta = 240^\circ + n360^\circ$ .

21.  $2 \sin^2 \theta = 1 - \sin \theta$

$2 \sin^2 \theta + \sin \theta - 1 = 0$

Let  $u = \sin \theta$ .

$2u^2 + u - 1 = 0$

$(2u - 1)(u + 1) = 0$

$2u - 1 = 0$  or  $u + 1 = 0$

$u = \frac{1}{2}$  or  $u = -1$

$\sin \theta = \frac{1}{2}$  or  $\sin \theta = -1$

$\theta = 30^\circ, 150^\circ$  or  $\theta = 270^\circ$

Thus,  $\theta = 30^\circ, 150^\circ, \text{ or } 270^\circ$ .

27.  $\cos^2 \theta + \cos \theta = 0$

$\cos \theta(\cos \theta + 1) = 0$

$\cos \theta = 0$  or  $\cos \theta + 1 = 0$

$\theta = 90^\circ, 270^\circ$  or  $\cos \theta = -1$

$\theta = 180^\circ$

Thus,  $\theta = 90^\circ, 180^\circ \text{ or } 270^\circ$ .

52.  $y = 5 \cos(\pi t)$

$5 = 5 \cos(\pi t)$

$1 = \cos(\pi t)$

$\pi t = 0$  or  $\pi t = 2\pi$

$t = 0$  or  $t = 2$

The weight is 5 centimeters above the rest position at  $0 + 2n$  seconds.