

**Trigonometric Functions (Section 4.2)**

1. (a) Given that  $\sin(t) = \frac{6}{7}$  and  $t$  is in quadrant II.

Find the exact value  $\cos(t)$ ,  $\tan(t)$ ,  $\sec(t)$ ,  $\csc(t)$ , and  $\cot(t)$ .

- (b) Given that  $\cos(t) = \frac{-3}{5}$  and  $t$  is in quadrant III.

Find the exact value  $\sin(t)$ ,  $\tan(t)$ ,  $\sec(t)$ ,  $\csc(t)$ , and  $\cot(t)$ .

**Applications (Section 4.3)**

2. A telephone pole is 55 feet tall. How long should a guy wire be if it to be attached 15 feet from the top and is to make an angle of  $35^\circ$  with the ground? Give your answer to the nearest tenth of a foot.

3. A plane is flying at an altitude of 9000m. The pilot finds that the angle of depression to the airport is  $20^\circ$ . Find the distance between a point on the ground directly below the plane and the airport.

**Reference Angle (Section 4.3)**

4. Find the reference angle for each of the following angles;

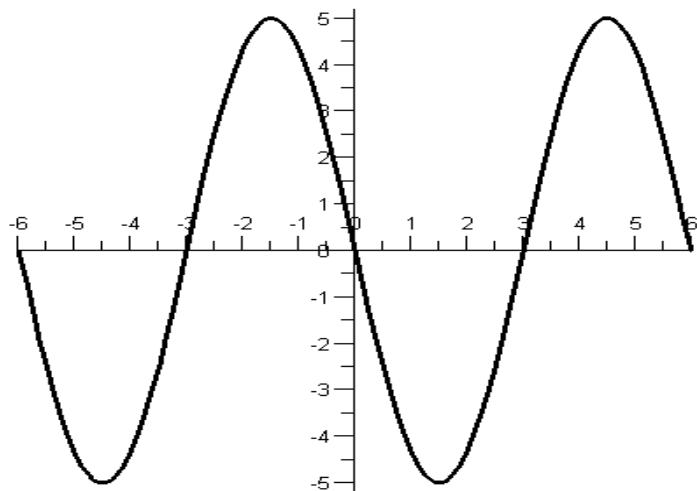
- a)  $210^\circ$       b)  $-250^\circ$       c)  $\frac{23\pi}{4}$       d)  $-\frac{13\pi}{3}$

**Graphs of Trigonometric Functions (Section 4.5 - 4.6)**

5. (a) Given the function  $y = -2\sin\left(2x + \frac{\pi}{2}\right)$  find the amplitude, period, and phase shift.

(b) Given the function  $y = 4\cos(3x + \pi)$  find the amplitude, period, and phase shift.

6. Find the equation for the graph shown below.



7. (a) Suppose  $\sin(-t) = \frac{-1}{2}$  and  $\cos(-t) = \frac{\sqrt{3}}{2}$ , find  $\tan(t)$   
 (b) Suppose  $\sin(-t) = -0.32$  find  $\csc(t)$ .
8. (a) Graph the function  $f(x) = 2\sec(x)$  to determine the range of  $f(x)$ .  
 (b) Graph the function  $g(x) = 3\csc(x)$  to determine the range of  $g(x)$ .

### Inverse Trigonometric Functions (Section 4.7)

Find the exact value of each of the following:

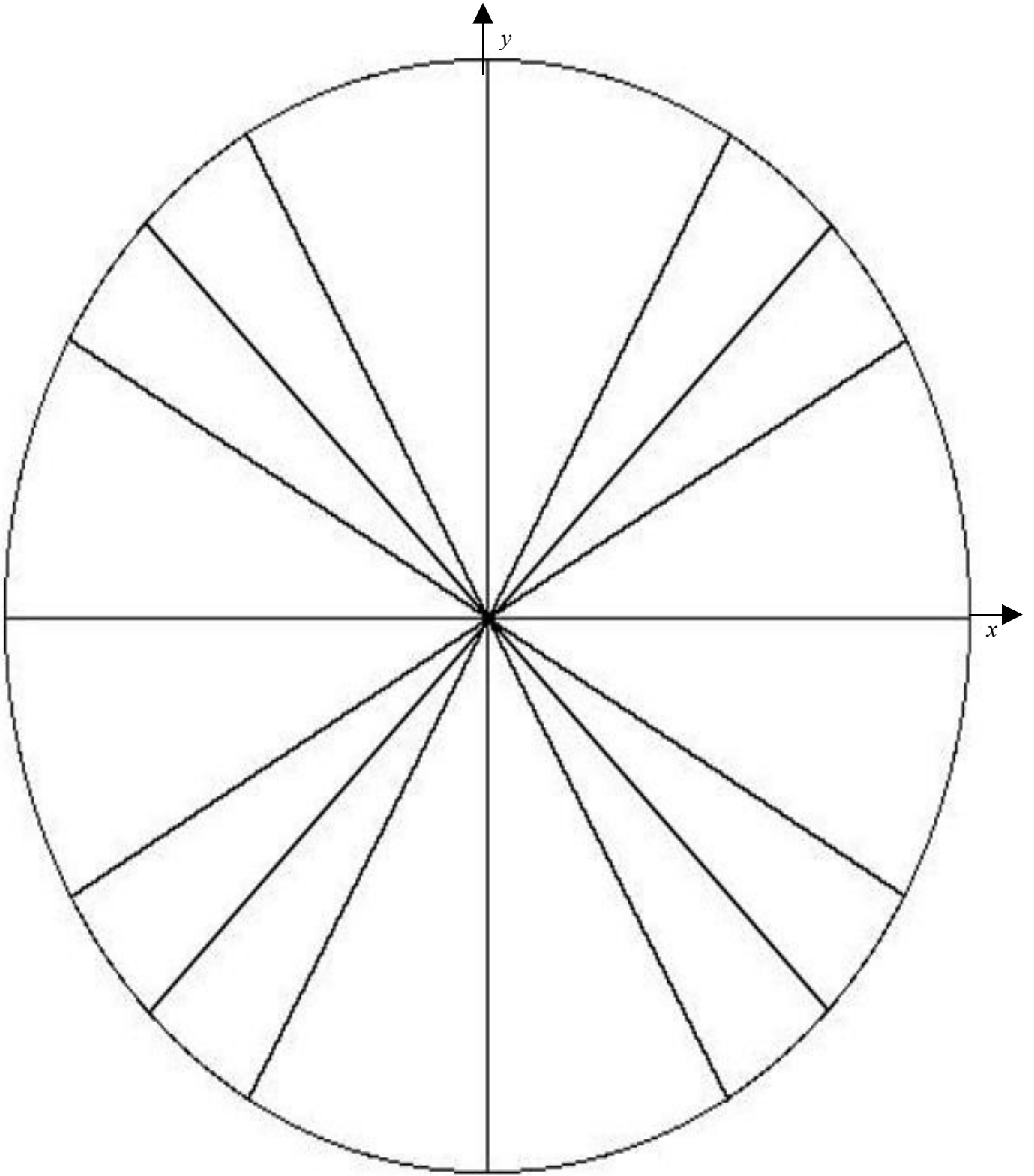
9.  $\sin^{-1}\left(\frac{-\sqrt{3}}{2}\right)$       10.  $\cos\left[\tan^{-1}\left(\frac{2}{3}\right)\right]$       11.  $\tan(\cos^{-1} x)$
12.  $\sin^{-1}\left[\sin\left(\frac{2\pi}{3}\right)\right]$       13.  $\cos^{-1}[\cos(135^\circ)]$       14.  $\sin^{-1}\left[\sin\left(\frac{7\pi}{6}\right)\right]$
15.  $\cos\left(\sin^{-1}\left(\frac{x}{3}\right)\right)$       16.  $\tan(\sin^{-1}(3x))$

### Verifying Trigonometric Identities (Section 5.1)

Verify each trigonometric identity:

17.  $(\cos(\theta) - \sin(\theta))^2 + (\cos(\theta) + \sin(\theta))^2 = 2$
18.  $\frac{\tan(\theta) \cdot \cot(\theta)}{\csc(\theta)} = \sin(\theta)$       19.  $\tan(\theta) + \frac{\cos(\theta)}{1 + \sin(\theta)} = \sec(\theta)$
20.  $\cot(x) + \tan(x) = \sec(x)\csc(x)$       21.  $(\sec(x) - \tan(x))^2 = \frac{1 - \sin(x)}{1 + \sin(x)}$
22.  $\frac{1 - \cot(x)}{\cos(x)} = \sec(x) - \csc(x)$

23. (Section 4.2) Label the unit circle, i.e. label all the special angles, and the  $x$  and  $y$  coordinates for the angles.



### Sum and Difference Formulas (Section 5.2)

24. Find the exact value of the expression:  $\cos \frac{5\pi}{12} \cos \frac{\pi}{12} + \sin \frac{5\pi}{12} \sin \frac{\pi}{12}$

25. Find the exact value of the expression:  $\cos(135^\circ + 30^\circ)$

26. Find the exact value of the expression:  $\frac{\tan \frac{\pi}{5} - \tan \frac{\pi}{30}}{1 + \tan \frac{\pi}{5} \tan \frac{\pi}{30}}$

27. Verify the identity:  $\cos(x - \frac{\pi}{2}) = \sin x$

### Double-Angle, Power-Reducing, and Half-Angle Formulas (Section 5.3)

28. Find the exact value of the expression:  $\cos 22.5^\circ$

29. Verify the identity:  $\cos^2 \frac{\theta}{2} = \frac{\sin \theta + \tan \theta}{2 \tan \theta}$

30. Find the exact value of  $\sin 2\theta$  given that  $\sin \theta = \frac{15}{17}$  and  $\theta$  lies in quadrant II.

### Answers

1. a)  $\cos(t) = -\frac{\sqrt{13}}{7}$        $\tan(t) = -\frac{6}{\sqrt{13}} = -\frac{6\sqrt{13}}{13}$        $\sec(t) = -\frac{7}{\sqrt{13}} = -\frac{7\sqrt{13}}{13}$

$\csc(t) = \frac{7}{6}$        $\cot(t) = -\frac{\sqrt{13}}{6}$

b)  $\sin(t) = -\frac{4}{5}$        $\tan(t) = \frac{4}{3}$        $\cot(t) = \frac{3}{4}$        $\csc(t) = -\frac{5}{4}$        $\sec(t) = -\frac{5}{3}$

2. 69.7 feet    3. 24727.3 m    4. a)  $30^\circ$     b)  $70^\circ$     c)  $\frac{\pi}{4}$     d)  $\frac{\pi}{3}$

5. a) amplitude = 2, period =  $\pi$ , phase shift =  $\frac{\pi}{4}$  to the left

b) amplitude = 4, period =  $\frac{2\pi}{3}$ , phase shift =  $\frac{\pi}{3}$  to the left

6.  $-5 \sin\left(\frac{\pi}{3}x\right)$  or  $5 \sin\left(\frac{\pi}{3}(x-3)\right)$  or  $5 \sin\left(\frac{\pi}{3}(x+3)\right)$  or  $5 \cos\left(\frac{\pi}{3}(x-4.5)\right)$

7. a)  $\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$  b) 3.125    8. a)  $(-\infty, -2] \cup [2, \infty)$  b)  $(-\infty, -3] \cup [3, \infty)$

9.  $-60^\circ$  or  $-\frac{\pi}{3}$     10.  $\frac{3\sqrt{13}}{13}$     11.  $\frac{\sqrt{1-x^2}}{x}$     12.  $\frac{\pi}{3}$  or  $60^\circ$     13.  $135^\circ$  or  $\frac{3\pi}{4}$

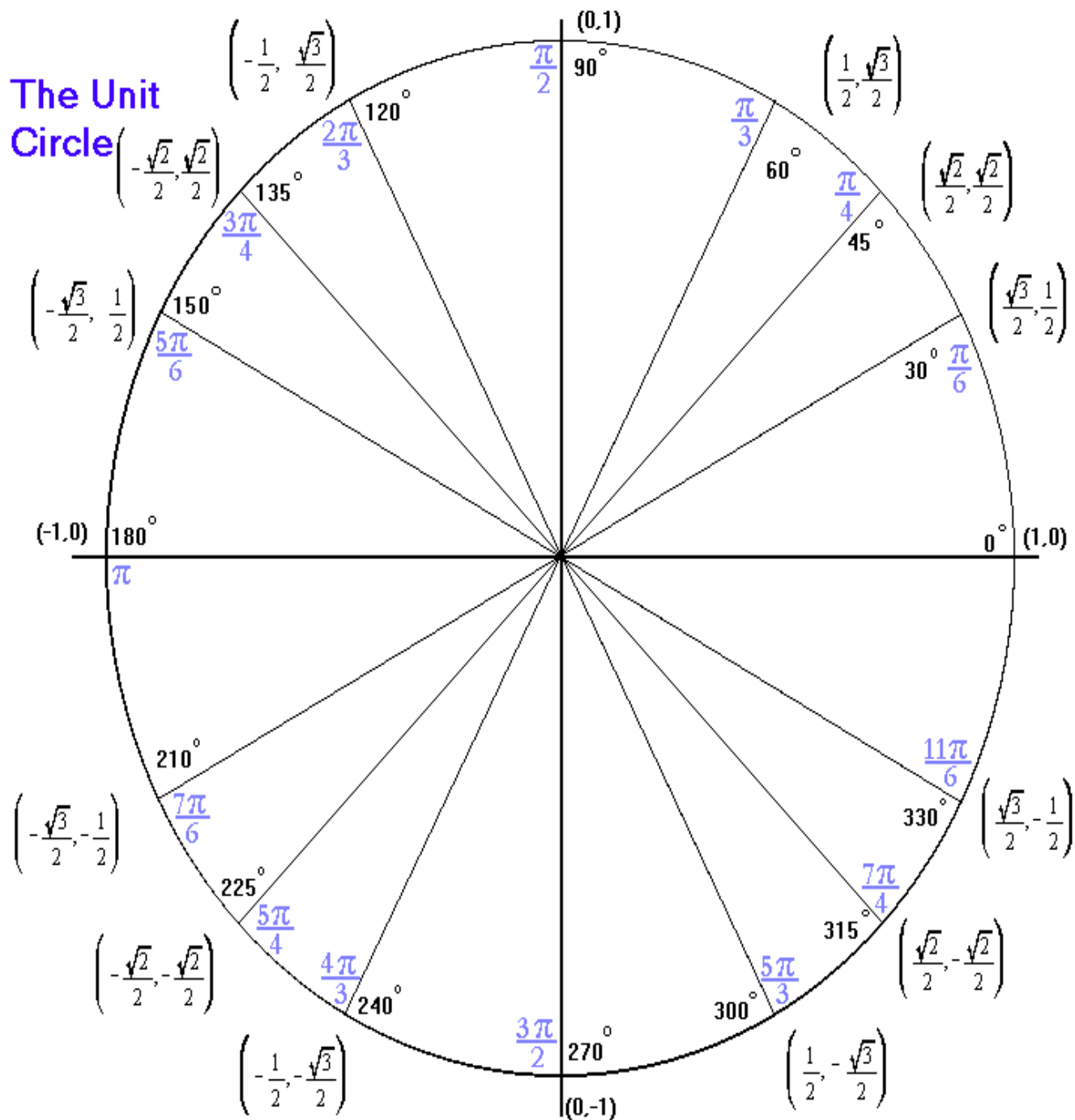
14.  $-30^\circ$  or  $-\frac{\pi}{6}$     15.  $\frac{\sqrt{9-x^2}}{3}$     16.  $\frac{3x}{\sqrt{1-9x^2}}$

### Verifying Trigonometric Identities

Methods may vary.

## 23. THE UNIT CIRCLE

# The Unit Circle



24.  $\frac{1}{2}$     25.  $-\frac{1}{4}\sqrt{2}(\sqrt{3}+1)$     26.  $\frac{\sqrt{3}}{3}$     27. Methods may vary.    28.  $\frac{\sqrt{2+\sqrt{2}}}{2}$   
 29. Methods may vary.    30.  $\frac{-240}{289}$