Multiple Choice

1. Find the exact value of \( \tan 660^\circ \).
   a. \( \sqrt{3} \)
   b. \( \frac{\sqrt{3}}{2} \)
   c. \( -\frac{\sqrt{3}}{2} \)
   d. \( \frac{\sqrt{3}}{3} \)
   e. \( -\sqrt{3} \)

2. Use a calculator to find \( \csc 710^\circ 20' \).
   Please round the answer to the nearest ten-thousandth.
   a. \( -5.9555 \)
   b. \( -5.9454 \)
   c. \( -5.9254 \)
   d. \( -5.9554 \)
   e. \( -5.9884 \)

3. Use a calculator to find \( \theta \) to the nearest tenth of a degree, if \( 0^\circ < \theta < 360^\circ \) and \( \sec \theta = -3.4110 \) with \( \theta \) in QII.
   a. \( 104.7^\circ \)
   b. \( 104.0^\circ \)
   c. \( 106.0^\circ \)
   d. \( 103.5^\circ \)
   e. \( 107.0^\circ \)

4. Use a calculator to find \( \theta \) to the nearest tenth of a degree, if \( 0^\circ < \theta < 360^\circ \) and \( \cot \theta = -0.7411 \) with \( \theta \) in QII.
   a. \( 124.2^\circ \)
   b. \( 126.5^\circ \)
   c. \( 123.5^\circ \)
   d. \( 127.5^\circ \)
   e. \( 123.0^\circ \)
5. Two cities are approximately 350 miles apart on the surface of the earth. Assuming that the radius of the earth is 4,000 miles, find the radian measure of the central angle with its vertex at the center of the earth that has one city on one side and another one on the other side.

a. 0.1025 radians
b. 0.1075 radians
c. 0.0825 radians
d. 0.0775 radians
e. 0.0875 radians

6. Name the reference angle in both degrees and radians.

\[ \theta = 150^\circ \]

a. \[ 45^\circ = \frac{\pi}{4} \]
b. \[ 10^\circ = \frac{\pi}{18} \]
c. \[ -30^\circ = -\frac{\pi}{6} \]
d. \[ 30^\circ = \frac{\pi}{6} \]
e. \[ -10^\circ = -\frac{\pi}{18} \]
7. Label the reference angle in both degrees and radians.

\[ \theta = \frac{7\pi}{3} \]

a. \(60^\circ = \frac{\pi}{3}\)
b. \(20^\circ = \frac{\pi}{3}\)
c. \(20^\circ = \frac{\pi}{9}\)
d. \(60^\circ = \frac{\pi}{9}\)
e. \(15^\circ = \frac{\pi}{12}\)

8. Use the unit circle to find the six trigonometric functions of \(240^\circ\).

a. \(\sin 240^\circ = -\frac{\sqrt{3}}{2}, \cos 240^\circ = -\frac{1}{2}, \tan 240^\circ = \sqrt{3}, \cot 240^\circ = \frac{\sqrt{3}}{3}, \sec 240^\circ = -2, \csc 240^\circ = -\frac{2\sqrt{3}}{3}\)
b. \(\sin 240^\circ = -\frac{\sqrt{3}}{2}, \cos 240^\circ = -\frac{1}{2}, \tan 240^\circ = \frac{\sqrt{3}}{3}, \cot 240^\circ = \sqrt{3}, \sec 240^\circ = -2, \csc 240^\circ = -\frac{2\sqrt{3}}{3}\)
c. \(\sin 240^\circ = -\frac{1}{2}, \cos 240^\circ = -\frac{\sqrt{3}}{2}, \tan 240^\circ = \frac{\sqrt{3}}{3}, \cot 240^\circ = \sqrt{3}, \sec 240^\circ = -2, \csc 240^\circ = -\frac{2\sqrt{3}}{3}\)
d. \(\sin 240^\circ = -\frac{1}{2}, \cos 240^\circ = -\frac{\sqrt{3}}{2}, \tan 240^\circ = \frac{\sqrt{3}}{3}, \cot 240^\circ = \frac{\sqrt{3}}{3}, \sec 240^\circ = -2, \csc 240^\circ = -\frac{2\sqrt{3}}{3}\)
e. \(\sin 240^\circ = -\frac{\sqrt{3}}{2}, \cos 240^\circ = -\frac{1}{2}, \tan 240^\circ = \sqrt{3}, \cot 240^\circ = \frac{\sqrt{3}}{3}, \sec 240^\circ = -2, \csc 240^\circ = -\frac{2\sqrt{3}}{3}\)
9. Use the unit circle to find the six trigonometric functions of $\frac{5\pi}{4}$.

a. $\sin \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$, $\cos \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$, $\tan \frac{5\pi}{4} = -1$, $\cot \frac{5\pi}{4} = -1$, $\sec \frac{5\pi}{4} = -\sqrt{2}$, $\csc \frac{5\pi}{4} = -\sqrt{2}$

b. $\sin \frac{5\pi}{4} = -1$, $\cos \frac{5\pi}{4} = -1$, $\tan \frac{5\pi}{4} = \frac{\sqrt{2}}{2}$, $\cot \frac{5\pi}{4} = \sqrt{2}$, $\sec \frac{5\pi}{4} = -1$, $\csc \frac{5\pi}{4} = -1$

c. $\sin \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$, $\cos \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$, $\tan \frac{5\pi}{4} = 1$, $\cot \frac{5\pi}{4} = 1$, $\sec \frac{5\pi}{4} = -\sqrt{2}$, $\csc \frac{5\pi}{4} = -\sqrt{2}$

d. $\sin \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$, $\cos \frac{5\pi}{4} = -1$, $\tan \frac{5\pi}{4} = \frac{\sqrt{2}}{2}$, $\cot \frac{5\pi}{4} = \sqrt{2}$, $\sec \frac{5\pi}{4} = -1$, $\csc \frac{5\pi}{4} = -\sqrt{2}$

e. $\sin \frac{5\pi}{4} = -1$, $\cos \frac{5\pi}{4} = -\frac{\sqrt{2}}{2}$, $\tan \frac{5\pi}{4} = \sqrt{2}$, $\cot \frac{5\pi}{4} = \frac{\sqrt{2}}{2}$, $\sec \frac{5\pi}{4} = -\sqrt{2}$, $\csc \frac{5\pi}{4} = -1$

10. Use the unit circle to find all values of $\Theta$ between 0 and $2\pi$ for which $\sin \Theta = \frac{\sqrt{3}}{2}$.

a. $\frac{\pi}{3}$

b. $\frac{7\pi}{6}$, $\frac{11\pi}{6}$

c. $\frac{\pi}{3}$, $\frac{2\pi}{3}$

d. $\frac{5\pi}{6}$, $\frac{7\pi}{6}$

e. $\frac{\pi}{6}$, $\frac{11\pi}{6}$
11. **Arc length.** The minute hand of a clock is 1.8 centimeters long. How far does the tip of the minute hand travel in 40 minutes?

Round to three significant digits.

a. 7.54 centimeters  
b. 7.14 centimeters  
c. 7.34 centimeters  
d. 7.44 centimeters  
e. 7.84 centimeters

12. Find the distance \( s \) covered by a point moving with linear velocity \( v \) for a time \( t \) if \( v = 10 \text{ ft/sec} \) and \( t = 3 \text{ sec} \).

a. 10 ft  
b. 40 ft  
c. 60.2 ft  
d. 11.6 ft  
e. 30 ft

13. Point \( P \) sweeps out central angle \( \theta \) as it rotates on a circle of radius \( r \). Find the angular velocity of point \( P \).

\[
\theta = \frac{2\pi}{5}, \ t = 5 \text{ sec}
\]

a. 0.173 rad/sec  
b. 0.234 rad/sec  
c. 0.190 rad/sec  
d. 0.251 rad/sec  
e. 0.208 rad/sec

14. Point \( P \) sweeps out central angle \( \theta \) as it rotates on a circle of radius \( r \). Find the angular velocity of point \( P \).

\[
\theta = 52\pi, \ t = 1.6 \text{ hr}
\]

a. 155 rad/hr  
b. 102 rad/hr  
c. 147 rad/hr  
d. 118 rad/hr  
e. 169 rad/hr

**Numeric Response**

15. Use a calculator to find \( \theta \) to the nearest tenth of a degree, if \( 0^\circ < \theta < 360^\circ \) and \( \sec \theta = -3.4190 \) with \( \theta \) in QII.

\[
\theta = \underline{\hspace{2cm}}^\circ
\]
16. Find $\theta$, if $0^\circ < \theta < 360^\circ$ and $\sin \theta = \frac{\sqrt{3}}{2}$ and $\theta$ in QI.

$$\theta = \text{________}^\circ$$

17. If the distance to the sun is approximately 93 million miles, and, from the earth, the sun subtends an angle of approximately $0.5^\circ$, estimate the diameter of the sun to the nearest 10,000 miles.

$$\text{________ miles}$$

18. $\theta$ is a central angle that cuts off an arc of length $s$. Find the radius of the circle if $\theta = 6^\circ$, $s = \frac{\pi}{2}$ m.

If the answer needs rounding, round it to three significant digits.

$$r = \text{________ m}$$

19. Find the distance $s$ covered by a point moving with linear velocity $v$ for a time $t$ if $v = 10$ ft/sec and $t = 3$ sec.

If the answer needs rounding round it to three significant digits.

$$\text{________ ft}$$

20. A point is traveling with uniform circular motion on a circular path of radius $r$. Find $\omega$ if $r = 6$ cm and $v = 15$ cm/sec.

If the answer needs rounding, round it to three significant digits.

$$\text{________ rad/sec}$$

Short Answer

21. For the following expression, find the value of $y$ that corresponds to each value of $x$, then write your results as ordered pairs $(x, y)$.

$$y = \cos(x - \frac{\pi}{6}) \text{ for } x = \frac{\pi}{6}, \frac{\pi}{3}, \frac{2\pi}{3}, \frac{7\pi}{6}$$
22. A light truck with manual transmission has a circular brake drum with a diameter of 323 millimeters. Each brake pad, which presses against the drum, is 308 millimeters long. What central angle is subtended by one of the brake pads? Write your answer in both radians and in degrees. If the answer needs rounding round it to three significant digits.

\[ \text{__________ radians} \]
\[ \text{__________ degrees} \]

23. An arc of length 3 feet is cut off by a central angle of \( \frac{\pi}{4} \) radians. Find the area of the sector formed.

If the answer needs rounding, round it to three significant digits.

\[ A = \text{__________ ft}^2 \]

24. Point \( P \) moves with angular velocity \( \omega \) on a circle of radius \( r \). Find the distance \( s \) traveled by the point in time \( t \).

\[ \omega = \frac{3\pi}{4} \text{ rad/sec}, \ r = 4 \text{ m}, \ t = 40 \text{ sec} \]

If the answer needs rounding, round it to three significant digits.

\[ \text{__________ m} \]
25. The San Francisco cable cars travel by clamping onto a steel cable that circulates in a channel beneath the streets. This cable is driven by a large 12-foot-diameter pulley, called a sheave (see the figure). The sheave turns at a rate of 17 revolutions per minute. Find the speed of the cable car, in miles per hour, by determining the linear velocity of the cable. (1 mi = 5,280 ft)

If the answer needs rounding, round it to three significant digits.

_________ mph
Answer Section

MULTIPLE CHOICE

1. E
2. D
3. E
4. B
5. E
6. D
7. A
8. A
9. C
10. C
11. A
12. E
13. D
14. B

NUMERIC RESPONSE

15. 107.0
16. 60
17. 810,000
18. 15
19. 30
20. 2.5

SHORT ANSWER

21. \( \left( \frac{\pi}{6}, 1 \right), \left( \frac{\pi}{3}, \frac{\sqrt{3}}{2} \right), \left( \frac{2\pi}{3}, 0 \right), \left( \pi - \frac{\sqrt{3}}{2} \right), \left( \frac{7\pi}{6}, -1 \right) \)
22. 1.91; 109
23. 5.73
24. 377
25. 7.28