Multiple Choice

1. Find the exact value of \( \cot 690^\circ \).
   - a. \( \sqrt{3} \)
   - b. \( \frac{\sqrt{3}}{2} \)
   - c. \( -\sqrt{3} \)
   - d. \( \frac{\sqrt{3}}{3} \)
   - e. \( \frac{\sqrt{3}}{2} \)

2. Use a calculator to find \( \tan 143.8^\circ \).
   Please round the answer to the nearest ten-thousandth.
   - a. \(-0.7219\)
   - b. \(-0.7649\)
   - c. \(-0.7317\)
   - d. \(-0.7119\)
   - e. \(-0.7319\)

3. Use a calculator to find \( \theta \) to the nearest tenth of a degree, if \( 0^\circ < \theta < 360^\circ \) and \( \sin \theta = -0.3020 \) with \( \theta \) in QIII.
   - a. \( 200.6^\circ \)
   - b. \( 195.3^\circ \)
   - c. \( 197.6^\circ \)
   - d. \( 194.1^\circ \)
   - e. \( 198.6^\circ \)

4. Convert to radian measure using exact values.
   \( \theta = 250^\circ \)
   - a. \( \frac{16\pi}{9} \)
   - b. \( \frac{25\pi}{18} \)
   - c. \( \frac{31\pi}{18} \)
   - d. \( \frac{7\pi}{6} \)
   - e. \( \frac{7\pi}{4} \)
5. Through how many radians does the minute hand of a clock turn during a 5-minute period?

   a. \( \frac{\pi}{3} \)
   b. \( \frac{\pi}{6} \)
   c. \( \frac{\pi}{8} \)
   d. \( \frac{\pi}{12} \)
   e. \( \frac{\pi}{10} \)

6. Use the unit circle to find all values of \( \theta \) between 0 and \( 2\pi \) for which \( \tan \theta = -\sqrt{3} \).

   a. \( \frac{\pi}{3}, \frac{4\pi}{3} \)
   b. \( \frac{\pi}{6}, \frac{7\pi}{6} \)
   c. \( \frac{2\pi}{3}, \frac{4\pi}{3} \)
   d. \( \frac{\pi}{3}, \frac{5\pi}{3} \)
   e. \( \frac{2\pi}{3}, \frac{5\pi}{3} \)

7. Graph the unit circle using parametric equations with your calculator set to radian mode. Use a scale of \( \frac{\pi}{12} \). Trace the circle to find all values of \( t \) between 0 and \( 2\pi \) satisfying the following statement. Round your answers to the nearest ten-thousandth.

   \( \sin t = -\frac{1}{2} \)

   a. \( t = 3.6652, 5.7596 \)
   b. \( t = 3.6652, 3.7886 \)
   c. \( t = 3.7886, 5.9754 \)
   d. \( t = 3.6652, 5.9754 \)
   e. \( t = 5.7596, 3.7886 \)
8. Graph the unit circle using parametric equations with your calculator set to degree mode. Use a scale of 5. Trace the circle to find all values of \( t \) between 0\(^\circ\) and 360\(^\circ\) satisfying the statement.

\[ \cos t = -\sin t \]

a. 135\(^\circ\), 310\(^\circ\)
b. 135\(^\circ\), 315\(^\circ\)
c. 130\(^\circ\), 315\(^\circ\)
d. 125\(^\circ\), 145\(^\circ\)
e. 130\(^\circ\), 310\(^\circ\)

9. For the problem below, \( \theta \) is a central angle in a circle of radius \( r \). Find the length of arc \( s \) cut off by \( \theta \).

\[ \theta = 330^\circ, \; r = 6 \text{ inches} \]

a. \( s = 34.6 \text{ inches} \)
b. \( s = 39 \text{ inches} \)
c. \( s = 36.6 \text{ inches} \)
d. \( s = 37 \text{ inches} \)
e. \( s = 33.6 \text{ inches} \)

10. The pendulum on a grandfather clock swings from side to side once every second. If the length of the pendulum is 5 feet and the angle through which it swings is 21\(^\circ\), how far does the tip of the pendulum travel in 1 second?

a. 1.73 feet  
b. 1.63 feet  
c. 1.43 feet  
d. 2.13 feet  
e. 1.83 feet

11. An arc of length 3 feet is cut off by a central angle of \( \frac{\pi}{2} \) radians. Find the area of the sector formed.

a. 2.92 \( \text{ft}^2 \)
b. 2.88 \( \text{ft}^2 \)
c. 2.78 \( \text{ft}^2 \)
d. 2.86 \( \text{ft}^2 \)
e. 2.82 \( \text{ft}^2 \)
12. Find the angular velocity associated with the given rpm.

\[35 \frac{1}{3} \text{ rpm}\]

a. 222 rad/min  
b. 323 rad/min  
c. 238 rad/min  
d. 147 rad/min  
e. 272 rad/min

13. 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 13-foot-diameter pulley, called a sheave (see the figure). The sheave turns at a rate of 18 revolutions per minute. Find the speed of the cable car, in miles per hour (rounded to three significant digits), by determining the linear velocity of the cable. (1 mi = 5,280 ft).

\[\text{a. 7.52 mph} \quad \text{b. 8.63 mph} \quad \text{c. 8.35 mph} \quad \text{d. 8.77 mph} \quad \text{e. 8.91 mph}\]

**Numeric Response**

14. Use a calculator to find \(\sin(-220)\)°.

Please round the answer to the nearest ten-thousandth.

15. Use a calculator to find \(\theta\) to the nearest tenth of a degree, if \(0^\circ < \theta < 360^\circ\) and \(\sin \theta = -0.3010\) with \(\theta\) in QIII.

\[\theta = \boxed{\text{_______}}^\circ\]
16. For the problem below, $\theta$ is a central angle in a circle of radius $r$. Find the length of arc $s$ cut off by $\theta$.

\[ \theta = 6, \ r = 2 \text{ inches} \]

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

$s = \underline{\phantom{000}} \text{ inches}$

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.

\[ \underline{\phantom{000}} \text{ miles} \]

18. Find the distance $s$ covered by a point moving with linear velocity $v$ for a time $t$ if $v = 28 \text{ mi/hr}$ and $t = 15 \text{ min}$.

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

\[ \underline{\phantom{000}} \text{ mi} \]

19. A point is traveling with uniform circular motion on a circular path of radius $r$. Find $\omega$ if $r = 2 \text{ cm}$ and $v = 3 \text{ cm/sec}$.

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

\[ \underline{\phantom{000}} \text{ rad/sec} \]

**Short Answer**

20. Through how many radians does the minute hand of a clock turn during a 15-minute period?

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

\[ y = \cos(x - \frac{\pi}{6}) \text{ for } x = \frac{\pi}{6}, \ \frac{\pi}{3}, \ \frac{2\pi}{3}, \ \frac{7\pi}{6} \]

201
22. Graph the unit circle using parametric equations with your calculator set to degree mode. Use a scale of 5. Trace the circle to find the sine and cosine of the angle to the nearest ten-thousandth.

235°

\[ \sin 235° = \underline{} \]

\[ \cos 235° = \underline{} \]

23. For the problem below, \( \theta \) is a central angle in a circle of radius \( r \). Find the length of arc \( s \) cut off by \( \theta \).

\( \theta = 30°, r = 2 \text{ mm} \)

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

\( s = \underline{} \text{ mm} \)

24. Find the angular velocity associated with the given rpm.

\( 30 \frac{1}{3} \text{ rpm} \)

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

\( \underline{} \text{ rad/min} \)

25. Find the angular velocity associated with the given rpm.

\( 9.6 \text{ rpm} \)

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

\( \underline{} \text{ rad/min} \)
Answer Section

MULTIPLE CHOICE

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

NUMERIC RESPONSE

14. 0.6428
15. 197.5
16. 12
17. 810,000
18. 7
19. 1.5

SHORT ANSWER

20. \( \frac{\pi}{2} \)
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. -0.8192; -0.5736
23. 1.05
24. 191
25. 60.3