MA 15400
Fall 2014
Exam 1

PYTHAGOREAN IDENTITIES:

\[
\sin^2 \theta + \cos^2 \theta = 1
\]

\[
1 + \tan^2 \theta = \sec^2 \theta
\]

\[
1 + \cot^2 \theta = \csc^2 \theta
\]
MA 15400  
Exam 1  
Covers Lessons 1-11, Sections 6.1, 6.2, 6.3, 6.4, and 6.5

1. Find the angle that is complementary to $48^\circ57'9''$

\[
\begin{array}{c}
48^\circ57'9'' \\
\hline
41^\circ2'51''
\end{array}
\]

A. $42^\circ3'51''$
B. $131^\circ2'51''$
C. $41^\circ2'51''$
D. $132^\circ3'51''$
E. None of the above

2. Express $\theta = 3.5$ in terms of degrees, minutes, and seconds, to the nearest second.

\[
\left(\frac{3.5}{1}\right)\left(\frac{180^\circ}{\pi}\right) = 200.5352^\circ
\]

\[
\begin{array}{c}
0.5352^\circ \\
\times 60'
\end{array}
\]

\[
32.1137'
\]

\[
\begin{array}{c}
0.1137' \\
\times 60''
\end{array}
\]

\[
6.8219''
\]

\[
200^\circ32'7''
\]

A. $200^\circ32'7''$
B. $151^\circ15'22''$
C. $200^\circ53'52''$
D. $151^\circ42'33''$
E. None of the above

3. Find the measure of the central angle $\theta$, to nearest $0.1^\circ$, subtended by the arc of length $s = 3.5$ feet on a circle of radius $r = 18$ inches. (12 inches = 1 foot)

\[
S = r\theta
\]

\[
\begin{array}{c}
3.5 \\
\times 12
\end{array}
\]

\[
42 \text{ in}
\]

\[
42 = 18\theta
\]

\[
\theta = \frac{42}{18} = 2.3 \text{ radians}
\]

\[
\left(\frac{2.3}{1}\right)\left(\frac{180^\circ}{\pi}\right) = 133.6902^\circ
\]

A. $115.9^\circ$
B. $127.8^\circ$
C. $151.5^\circ$
D. $133.7^\circ$
E. None of the above
4. Which one of the following statements is true for the given triangle?

\[ C^2 = b^2 + a^2 \]
\[ c^2 = b^2 - a^2 \]
\[ \sqrt{c^2 - b^2} = a \]

- \( \cot \theta = \frac{c}{b} \)
- \( \sec \theta = \frac{c}{\sqrt{c^2 - b^2}} \)
- \( \tan \theta = \frac{\sqrt{c^2 - b^2}}{b} \)
- \( \cos \theta = \frac{b}{\sqrt{c^2 - b^2}} \)
- \( \csc \theta = \frac{b}{c} \)

5. A forester, 180 feet from the base of a redwood tree, observes that the angle between the ground and the top of the tree is 62°. Find the height of the tree to the nearest whole foot.

\[ \tan 62^\circ = \frac{h}{180} \]

A. 85 feet
B. 159 feet
C. 204 feet
D. 339 feet
E. None of the above

6. Which of the following is equivalent to \( (\cot \theta + \csc \theta)(\tan \theta - \sin \theta) \)?

\[ \left( \frac{\cos \theta + 1}{\sin \theta} \right) \left( \frac{\sin \theta - \sin \theta}{\cos \theta - 1} \right) \]

- \( \sec \theta - \cos \theta \)
- \( 1 + \tan^2 \theta \)
- \( \csc \theta - \sin \theta \)
- \( \csc \theta \sec \theta \)
- \( 1 + \cot^2 \theta \)
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7. Find the exact value of $\sin \theta$ if $\theta$ is in standard position and the terminal side of $\theta$ is in quadrant III and parallel to the line $12x - 5y = 15$

$$\sin \theta = \frac{5}{13}$$
$$\sin \theta = \frac{-12}{13}$$
$$\sin \theta = \frac{-5}{13}$$
$$\sin \theta = \frac{12}{13}$$
$$\text{E. None of the above}$$

8. Use the graph to complete the statement: As $x \to \frac{\pi}{2}$, $\cot(x) \to$

$$\text{A. } -\infty$$
$$\text{B. } 1$$
$$\text{C. } 0$$
$$\text{D. } \infty$$
$$\text{E. None of the above}$$

9. In March in Tucson, Arizona, the temperature in degrees Fahrenheit could be described by the equation $T(t) = -11 \cos \left( \frac{\pi}{12} t \right) + 57$, where $t$ is in hours and $t = 0$ corresponds to 6 A.M.

What is the temperature at 3 P.M.? Angles are in radians and round to a whole number.

$$T(9) = -11 \cos \left( \frac{\pi}{2} \cdot 9 \right) + 57$$
$$= 64.7782$$

$$\text{A. } 49^\circ$$
$$\text{B. } 57^\circ$$
$$\text{C. } 68^\circ$$
$$\text{D. } 54^\circ$$
$$\text{E. } 65^\circ$$
10. A point $P\left(\frac{3}{5}, \frac{-4}{5}\right)$ is the point of intersection between the terminal side of angle $t$ and the Unit circle. Find the exact value of $\cot(t)$

\[\sin t = -\frac{4}{5}\]
\[\cos t = \frac{3}{5}\]
\[\cot t = \frac{\cos t}{\sin t} = \frac{\frac{3}{5}}{-\frac{4}{5}} = -\frac{3}{4}\]

A. $\cot(t) = \frac{3}{5}$
B. $\cot(t) = -\frac{4}{5}$
C. $\cot(t) = \frac{4}{3}$
D. $\cot(t) = -\frac{3}{4}$

E. None of the above

11. Find the reference angle $\theta_r$ if $\theta = 300^\circ$

\[\theta_r = 360^\circ - 300^\circ = 60^\circ\]

A. $\theta_r = 60^\circ$
B. $\theta_r = 30^\circ$
C. $\theta_r = 120^\circ$
D. $\theta_r = 45^\circ$
E. None of the above

12. Find the Period of the given graph.

A. Period = 8
B. Period = 6
C. Period = 4
D. Period = 2
E. Period = $\infty$
13. Write the equation in the form $y = a \sin(bx + c)$ for $a > 0$, $b > 0$, and the least positive real number $c$.

A. $y = \sin \left( \frac{2}{3} x + \pi \right)$
B. $y = \sin \left( \frac{1}{3} x + 2\pi \right)$
C. $y = \sin \left( \frac{2}{3} x + 2\pi \right)$
D. $y = \sin \left( \frac{1}{3} x + \pi \right)$
E. $y = \sin(6x + 3\pi)$

14. Approximate, to the nearest 0.1°, all angles $\theta$ in the interval [0°, 360°) that satisfy equation $\sec \theta = 2.3456$.

A. $\theta = 64.8°, 295.2°$
B. $\theta = 115.2°, 244.8°$
C. $\theta = 64.8°, 244.8°$
D. $\theta = 115.2°, 295.2°$
E. None of the above

15. Approximate, to the nearest 0.0001 radians, all angles $\theta$ in the interval [0, 2π) that satisfy equation $\sin \theta = -0.8765$.

A. $\theta = 1.0685, 5.2146$
B. $\theta = 2.0730, 4.2101$
C. $\theta = 4.2101, 5.2146$
D. $\theta = 1.0685, 2.0730$
E. None of the above
<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
<th>Letter</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>41°2'51&quot;</td>
<td>C</td>
</tr>
<tr>
<td>2.</td>
<td>200°32'7&quot;</td>
<td>A</td>
</tr>
<tr>
<td>3.</td>
<td>133.7°</td>
<td>D</td>
</tr>
<tr>
<td>4.</td>
<td>( \sec \theta = \frac{c}{\sqrt{c^2 - b^2}} )</td>
<td>B</td>
</tr>
<tr>
<td>5.</td>
<td>339 feet</td>
<td>D</td>
</tr>
<tr>
<td>6.</td>
<td>( \sec \theta - \cos \theta )</td>
<td>A</td>
</tr>
<tr>
<td>7.</td>
<td>( \sin \theta = \frac{-12}{13} )</td>
<td>B</td>
</tr>
<tr>
<td>8.</td>
<td>0</td>
<td>C</td>
</tr>
<tr>
<td>9.</td>
<td>65°</td>
<td>E</td>
</tr>
<tr>
<td>10.</td>
<td>( \cot (t) = \frac{-3}{4} )</td>
<td>D</td>
</tr>
<tr>
<td>11.</td>
<td>( \theta_r = 60° )</td>
<td>A</td>
</tr>
<tr>
<td>12.</td>
<td>Period = 6</td>
<td>B</td>
</tr>
<tr>
<td>13.</td>
<td>( y = \sin \left( \frac{1}{3} x + \pi \right) )</td>
<td>D</td>
</tr>
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<td>14.</td>
<td>( \theta = 64.8°, 295.2° )</td>
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<td>15.</td>
<td>( \theta = 4.2101, 5.2146 )</td>
<td>C</td>
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