### PART 1: Put your answer on the line provided. Each question is worth 2 pts. No partial credit for this part.

<table>
<thead>
<tr>
<th>Question</th>
<th>Answer</th>
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</thead>
<tbody>
<tr>
<td>1. Find the <strong>range</strong> of the function: $g(x) = 5 - 3\cos(2x)$</td>
<td>$\frac{2\pi}{3}$</td>
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<tr>
<td>2. Find the <strong>period</strong> of the function: $f(x) = 3\sin(\pi x)$</td>
<td>$\frac{2\pi}{1} = 2$</td>
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<tr>
<td>3. Write $f(x)$ as a <strong>cosine</strong> function: $f(x) = 3 - \sin(4x)$</td>
<td></td>
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<tr>
<td>4. How many solutions will $3\tan(2x) = 3$ have on the interval $0 \leq x \leq 2\pi$?</td>
<td>$n \pi$ for $n \in \mathbb{Z}$</td>
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<tr>
<td>5. Find the measures of two angles, one positive and one negative, that are coterminal with $\theta = \frac{\pi}{3}$</td>
<td>$-\frac{\pi}{3}$, $\frac{7\pi}{3}$</td>
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<tr>
<td>6. Find the value of a unique real number, $\theta$, between 0 and $2\pi$, that satisfies the condition: $\tan \theta = 0$ and $\sin \theta &lt; 0$.</td>
<td>$\theta = \pi$</td>
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<tr>
<td>7. Evaluate. (Exact answer only): $\cot \frac{3\pi}{2} + \cos \frac{4\pi}{3}$</td>
<td>$\frac{-3\sqrt{3}}{2}$</td>
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<tr>
<td>8. Find the midline for the following graph:</td>
<td>$x = 1.45$</td>
</tr>
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9. Find the period (in radians) of the following graph:

\[ \text{Per} = 2\pi \]

10. Find the frequency of the following sinusoidal function:

\[ f = \frac{2\pi}{\text{Per}} = \frac{2\pi}{4} = \frac{\pi}{2} \]

11. Find the solution, to the nearest tenth of a radian, to \(3\sin x + 2 = 0\) on the interval \(-\pi \leq x \leq -\pi/2\):

\[ \sin x = -\frac{2}{3} \]
\[ x = \arcsin\left(-\frac{2}{3}\right) = -0.7297 \]

12. On the interval \(0 \leq x < 2\pi\), where is \(y = \csc(2x - 1)\) undefined? (Exact answers only)

\[ \csc(2x - 1) = 0 \]
\[ 2x - 1 = \pi \]
\[ x = \frac{\pi + 1}{2} \]

13. Evaluate and simplify: \(\lim_{x \to 2\pi} (\cos(\tan(2\pi)))\)

\[ \cos\left(\frac{\tan(4\pi)}{0}\right) = 1 \]

14. Given \(\cot \theta = -\frac{40}{9}\), and that \(\cos \theta < 0\), then evaluate \(\cos(2\theta)\):

\[ \tan \theta = -\frac{9}{40} \]
\[ \sec \theta = \frac{-\sqrt{401}}{40} \]
\[ \cos \theta = \frac{-\sqrt{401}}{1681} \]
\[ \cos(2\theta) = 2(\cos^2 \theta) - 1 = \frac{1579}{1681} \]
Part II: Trig Equations: Answers should be left in exact values.

15. (a) Solve for $x$ on the interval $[-2\pi, 2\pi]$:

\[4\cos^2 x - 5\sin x - 5 = 0\]

\[4(1 - \sin^2 x) - 5\sin x - 5 = 0\]

\[4 - 4\sin^2 x - 5\sin x - 5 = 0\]

\[-4\sin^2 x - 5\sin x - 1 = 0\]

\[4\sin^2 x + 5\sin x + 1 = 0\]

\[(4\sin x + 1)(\sin x + 1) = 0\]

\[4\sin x + 1 = 0\]
\[-1 - 1\]
\[\sin x = \frac{-1}{4}\]
\[\sin x = \frac{-1}{4}\]

\[x_{\text{rej}} = \sin^{-1}\left(\frac{-1}{4}\right)\]

\[\text{III: } \pi + \sin^{-1}\left(\frac{-1}{4}\right)\]
\[\text{IV: } 2\pi - \sin^{-1}\left(\frac{-1}{4}\right)\]

(b) Solve for $x$ on the interval $[0, 2\pi]$:

\[3\cos x + \sin 2x = 0\]

\[\cos x (3 + 2\sin x) = 0\]

\[\cos x = 0\]

\[x = \frac{\pi}{2}, \frac{3\pi}{2}\]

\[3 + 2\sin x = 0\]
\[-3 - 3\]

\[2\sin x = -\frac{3}{2}\]
\[\sin x = -\frac{3}{2} \text{ or } -1.5\]

\[\text{Reject!}\]
Rodeo Problem: A rodeo performer spins a lasso in a circle perpendicular to the ground. The height (in feet) of the knot from the ground is modeled by \( h(t) = -3 \cos \left( \frac{\pi}{5} t \right) + 3.5 \), where \( t \) is the time measured in seconds after the lasso has begun to spin in a perfect circle.

(a) What's the highest point reached by the knot? (Exact answer)
(b) What's the lowest point reached by the knot? (Exact answer)
(c) How long does it take for the knot to make a complete rotation? (Exact answer)
(d) According to the model, find the height of the knot after 10 seconds. (Round to the nearest tenth.)
(e) When will the knot first reach a height of 3 from the ground? Only an algebraic solution will be accepted. (Round to the nearest tenth.)
(f) If the performer spins this lasso for 12 seconds, how many times will that knot have reached the height of 3 feet from the ground?

\[
\begin{align*}
\text{a)} & \quad 3.5 + 3 = 6.5 \\
\text{b)} & \quad 3.5 - 3 = 0.5 \\
\text{c)} & \quad \frac{2\pi}{\left(\frac{\pi}{5}\right)} = 10 \text{ sec, or } 1.2 \text{ sec} \\
\text{d)} & \quad h(10) = -3 \cos \left( \frac{\pi}{5} \cdot 10 \right) + 3.5 = 0.7 \\
\text{e)} & \quad h(t) = 3 \\
\end{align*}
\]

\[
\begin{align*}
\text{OR USE GRAPHICAL SOLUTION SHOWN ABOVE!}
\end{align*}
\]

\[
\begin{align*}
\text{f)} & \quad 10 \text{ cycles} \quad (1.2 \text{ sec per cycle for } 12 \text{ sec}) \Rightarrow [20 \text{ times total}] \\
\text{2 times per cycle so there are 10 cycles in } 12 \text{ seconds!}
\end{align*}
\]