NAME (please print legibly): ____________________________________________
Your University ID Number: ____________________________________________
Indicate your instructor with a check in the box:

<table>
<thead>
<tr>
<th>Instructor</th>
<th>Time</th>
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<tbody>
<tr>
<td>Ang Wei</td>
<td>MWF 9:00 - 9:50 AM</td>
</tr>
<tr>
<td>Doug Ravenel</td>
<td>MWF 10:00 - 10:50 AM</td>
</tr>
<tr>
<td>Jon Carsteal</td>
<td>MW 2:00 - 3:15 PM</td>
</tr>
</tbody>
</table>

- The presence of calculators, cell phones, iPods and other electronic devices at this exam is strictly forbidden.

- Show your work and justify your answers. You may not receive full credit for a correct answer if insufficient work is shown or insufficient justification is given.

- Put your answers in the boxes provided at the bottom of each page or half page. You will not get credit for answers written elsewhere.

- You are responsible for checking that this exam has all 8 pages.

<table>
<thead>
<tr>
<th>QUESTION</th>
<th>VALUE</th>
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1. (20 points)

(a) Compute the area of surface of revolution obtained by rotating the curve \( y = \sqrt{4-x^2} \) around the \( x \)-axis.

**ANSWER:**

(b) Do the same for the curve \( y = 1 - |x|, -1 \leq x \leq 1 \).

**ANSWER:**
2. (20 points)

Consider the parametric curve

\[ x = \cos(t), \quad y = \sin(2t), \quad t \in [0, 2\pi]. \]

(a) At what points is the tangent horizontal or vertical?

\[
\text{ANSWER:}
\]

(b) The curve passes through the origin twice. What are the slopes of the two tangent lines to the curve at the origin?

\[
\text{ANSWER:}
\]
(c) Find the equation of the form $y = mx + b$ for the tangent at $t = \frac{\pi}{6}$.

**ANSWER:**
3. (20 points)

Find the arc-length of the parametric curve

\[ x = 3 \cos t - \cos 3t, \quad y = 3 \sin t - \sin 3t, \quad 0 \leq t \leq \pi. \]
4. (20 points)

(a) Calculate the arc-length of the curve \( r = \cos^2(\theta/2) \).

ANSWER:

(b) Calculate the area enclosed by the curve \( r^2 = \sin(2\theta) \).

ANSWER:
5. (20 points)

(a) (5 points) Does the sequence \( \{a_n : n \geq 1 \} \) with \( a_n = \frac{1}{\sqrt{n}} \) converge? Why or why not?

ANSWER:

(b) (5 points) Use L’Hospital’s Rule to show that for \( k > 0 \),

\[
\lim_{x \to \infty} x^k e^{-x} = k \lim_{x \to \infty} x^{k-1} e^{-x}.
\]

ANSWER:
c) (5 points) Let $a_n = n^4 e^{-n}$. Show that the sequence $\{a_n : n \geq 1\}$ converges. What is the limit?

\begin{center}
\text{ANSWER:}
\end{center}

(d) (5 points) Does the sequence $\{b_n : n \geq 1\}$ with $b_n = \sin\left(\frac{n\pi}{2}\right)(-\frac{1}{3})^n$ converge? Why or why not?

\begin{center}
\text{ANSWER:}
\end{center}