Book #1 of 1

Name: ____________________________

ID# (last 4 digits): ___________________ Section: _______________________

Unless stated otherwise, you must show all work clearly using proper notation and explain your reasoning in English where appropriate. Answers must be justified using techniques that have been taught in this course, and answers without such justification may receive less than full credit – or no credit at all – even if the answer is correct.

This exam is closed book. Calculators, electronic devices, notes, books, formula sheets, and other outside materials are not allowed. Phones must be turned off and put away.

Unless otherwise stated, give exact answers: e.g., write $\pi$ and $\sqrt{2}$ instead of 3.14 and 1.41. However, when an expression simplifies to a well-known value, you must use that value. For example, you must write 1 instead of $e^0$, and you must write $\frac{1}{2}$ instead of $\cos\left(\frac{\pi}{3}\right)$.

Any expression with an inverse trigonometric function nested within a trigonometric function (e.g., $\cos(\sin^{-1}(x))$) must be simplified so neither special function appears. The same rule applies for hyperbolic functions and their inverses.

You must justify all uses of L’Hospital’s Rule (LR). If you use LR for any calculation, you must indicate why LR is applicable. It is also preferred, but not necessary, that you use the symbol “$H$” instead of a normal equals sign to indicate the exact step in which you use LR.

This exam has 10 questions, printed in 1 booklet(s), for a total of 100 points.

<table>
<thead>
<tr>
<th>Question</th>
<th>Points</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Total:</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
1. Evaluate $\int x^2 \ln(x) \, dx$.

answer: 

2. Evaluate $\int \tan(x)^3 \sec(x)^6 \, dx$.

answer:
3. Let \( C \) be the curve \( y = \frac{1}{3}x^3 \) for \( 0 \leq x \leq 2 \). Find the area of the surface obtained by revolving \( C \) about the \( x \)-axis.

\[ \text{surface area: } \] 

4. Let \( R \) be the region bounded by the \( x \)-axis, the \( y \)-axis, and the line \( y = 2 - 2x \). Find the volume of the solid whose base is \( R \), and whose cross sections perpendicular to the \( x \)-axis are squares.

\[ \text{volume: } \]
5. Let $\mathcal{R}$ be the region below the curve $y = x^2 - 2x + 2$ and above the $x$-axis on the interval $0 \leq x \leq 1$. Find the volume of the solid obtained by revolving $\mathcal{R}$ about the $y$-axis.

volume: ________________

6. Evaluate \[ \int \frac{1}{(16 - x^2)^{3/2}} \, dx. \]

answer: __________________________
7. Evaluate \( \int \frac{5x + 5}{(x - 1)(x^2 + 4)} \, dx \).

answer: ______________________________________

8. Evaluate \( \int e^{2x} \sin(3x) \, dx \).

answer: ______________________________________
9. Prove the reduction formula

\[ \int \sin(x)^n \, dx = -\frac{1}{n} \sin(x)^{n-1} \cos(x) + \frac{n-1}{n} \int \sin(x)^{n-2} \, dx \]

using integration by parts and trigonometric identities.
10 pts

10. Find the volume of the solid obtained by revolving, about the $x$-axis, the region between $y = 3 - x$ and $y = 2/x$.

volume: _____________________
This page is for scratch work. Do not detach this sheet.