Questions 1 – 10 are multiple choice questions. Enter your answer for each question on the omr sheet. You will NOT be penalized for incorrect answers.

The omr sheet will not be returned so record your multiple choice responses on this test as well as the omr sheet.

In order to receive full credit for questions 11 - 15, you must

1. Give the exact representation instead of an approximation using a decimal when asked to write an answer as an exact value. For example the exact value for $\pi$ is $\pi$ and not 3.14159…

2. Show legible and logical (relevant) justification which supports your final answer.

3. Use correct and complete notation.

4. Present the answer in a COMPLETE summary sentence (mathematical or verbal).

If you are unaware of a question’s meaning, please raise your hand and your instructor will try to clear up any confusion.

On my honor, I have neither given nor received inappropriate information during this exam.

SIGNATURE:_________________________________________ 

<table>
<thead>
<tr>
<th>Problem Number</th>
<th>11a</th>
<th>11b</th>
<th>11c</th>
<th>12</th>
<th>13</th>
<th>14a</th>
<th>14b</th>
<th>15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Possible Points</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Points Earned</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MULTIPLE CHOICE_________ (out of 40) FREE RESPONSE: ___________ (out of 60)

TOTAL ___________
1. Find **ONE** of the partial fractions when \( \frac{35 - 2x}{x^3 + x - 20} \) is decomposed.

   a. \( \frac{5}{x - 4} \)
   
   b. \( \frac{x + 3}{x - 4} \)
   
   c. \( \frac{3}{x + 5} \)
   
   d. \( \frac{5}{x + 5} \)
   
   e. \( \frac{3}{x - 4} \)

2. Evaluate \( \int \sec \theta \tan^3 \theta \, d\theta \).

   a. \( \frac{\tan^4 \theta}{4} + C \)
   
   b. \( \frac{\tan^2 \theta \cdot \sec^2 \theta}{2} + C \)
   
   c. \( \frac{\sec^3 \theta}{3} - \sec \theta + C \)
   
   d. \( \frac{\tan^3 \theta}{3} + C \)
   
   e. \( \frac{\tan^3 \theta}{3} + \frac{\sec^2 \theta}{2} + C \)

3. Evaluate \( \int \sin^3 x \cos^2 x \, dx \).

   a. \( \frac{\cos^5 x + \cos^3 x}{5} + C \)
   
   b. \( \frac{\sin^5 x - \sin^3 x}{3} + C \)
   
   c. \( \frac{3 \cos^5 x - 5 \cos^3 x}{3} + C \)
   
   d. \( \frac{\cos^5 x - \cos^3 x}{5} + C \)
   
   e. \( \frac{\sin^5 x - \sin^3 x}{3} + C \)
4. To handle an integral involving $\sqrt{x^2 - 9}$, make the substitution
   a. $x = \sin 3t$
   b. $x = 3 \sec t$
   c. $x = \sec 3t$
   d. $x = 9 \sin t$
   e. $x = 3 \sin t$

5. Evaluate $\int \frac{x + 1}{x(x + 2)} \, dx$.
   a. $\frac{1}{2} \ln |x| + \ln |x + 2| + C$
   b. $\ln |x| + \ln |x + 2| + C$
   c. $\frac{1}{2} \ln \left| \frac{x - 2}{x} \right| + C$
   d. $\frac{1}{2} \ln |x(x + 2)| + C$
   e. $\ln |x(x + 2)| + C$

6. Evaluate $\int xe^{-x} \, dx$.
   a. $-e^{-x}(x + 1) + C$
   b. $-\frac{x^2}{2}e^{-x} + C$
   c. $-e^{-x}(1 - x) + C$
   d. $\frac{x^2}{2e^x} + C$
   e. $\frac{e^{1-x}}{1-x} + C$
7. Given that \( \lim_{x \to a} f(x) = 0, \lim_{x \to a} g(x) = 0, \lim_{x \to a} h(x) = 1, \lim_{x \to a} p(x) = \infty, \lim_{x \to a} s(x) = \infty \), which of the following limits are indeterminate forms?

(1) \( \lim_{x \to a} \frac{f(x)}{p(x)} \)  
(2) \( \lim_{x \to a} f(x) \cdot p(x) \)  
(3) \( \lim_{x \to a} \frac{f(x)}{g(x)} \)  
(4) \( \lim_{x \to a} h(x) \cdot p(x) \)  
(5) \( \lim_{x \to a} [p(x)]^{f(x)} \)

a. 3, 5  
b. 2, 3, 5  
c. 1, 3  
d. 2, 3  
e. 2, 3, 4, 5

8. Find the limit. \( \lim_{x \to 0} \frac{e^x - 1}{2x} \)

a. 1  
b. e  
c. 0  
d. \( \infty \)  
e. \( \frac{1}{2} \)

9. Find the limit. \( \lim_{x \to 0} \frac{\sin^{-1}9x}{4x} \)

a. \( \frac{9}{4} \)  
b. 1  
c. \( \pi \)  
d. \( \frac{1}{4} \)  
e. \( -\infty \)

10. To handle an integral involving \( \sqrt{4 - x^2} \), make the substitution

a. \( x = 2\sin t \)  
b. \( x = 4\sec t \)  
c. \( x = 4\sin t \)  
d. \( x = \sin 2t \)  
e. \( x = 2\sec t \)
11. Evaluate the integrals. Show your work.

a. \( \int \sin x \ln \cos x \, dx \) (8 pts)

b. \( \int \frac{t^2}{t^2 + 1} \, dt \) (8 pts)
c. \[ \int x^2 \cos(2x) \, dx \] (8 pts)

12. The graph to the right shows the function \( y = \frac{\sqrt{x^2 - 1}}{x} \) for \( x \geq 1 \).

Set up and evaluate an integral to find the area between the curve and the x-axis on the interval [1, 2].

(8 pts)
13. Find the volume of the solid formed by rotating the region bounded by $y = e^x$, $x = 0$, $y = 0$, and $x = 3$ about the y-axis. Use the method of cylindrical shells. (8 pts)

14. Evaluate the following limits. Identify any indeterminate forms.

a. $\lim_{x \to \infty} \frac{7x}{\ln(2 + 3e^x)}$ (6 pts)
b. \( \lim_{x \to 0} (\tan 3x)^x \) (8 pts)

15. Write out the form of the partial fraction decomposition for the following function. \( \text{DO NOT} \) determine the numerical value of the coefficients. (6 pts)

\[ \frac{x + 3}{x^4 + 5x^2} \]