Final Exam  
MAT 296  
Spring 2015

Circle your instructor's name:

Fatica  Meyer  Roy  Shaw  Stangle  Ucci

READ THIS BEFORE YOU BEGIN

This examination contains 11 problems on 11 pages (including this cover page). Point values are indicated. It is your responsibility to make sure that all problems and pages are present. No calculators, books, or notes are allowed on this exam. Cell phones and other similar devices may not be out during the exam. Please silence them and put them away now. Your solutions must be written legibly and contain all of the necessary steps which enabled you to arrive at your answer to receive full credit for the problem. Unsupported answers will receive little or no credit. Circle your final answer.

DO NOT WRITE IN THE TABLE BELOW

<table>
<thead>
<tr>
<th>Problem</th>
<th>possible</th>
<th>actual</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>5</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>5</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>11</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
1. Evaluate the following integral.

\[ \int x^2 \ln x \, dx \]

(10 points)
2. Evaluate the following integral.

\[ \int x^3 \sqrt{1 + x^2} \, dx \]

(10 points)
3. Evaluate the following integral.

$$\int \frac{x - 17}{(x - 2)(x + 3)} \, dx$$

(10 points)
4. Let $R$ be the region enclosed by the curves $y = x^3$ and $y = \sqrt{x}$. Find the volume of the solid formed by revolving $R$ about the $y$-axis. 

(10 points)
5. Set up, but don’t evaluate, an integral that gives the area of the surface formed by revolving the curve \( y = \sqrt{2x + 3} \) from \( x = 0 \) to \( x = 5 \) around the \( x \)-axis. You do not need to simplify the integral. Circle your final integral.

(5 points)

6. For the following geometric series, determine whether it converges or diverges. If the series converges, give the sum.

\[
\sum_{n=0}^{\infty} \frac{(-3)^n 2^{n+1}}{11^{n+1}}
\]

(5 points)
7. Determine whether the following improper integral converges or diverges. If it converges, give the value of the integral.

\[ \int_{e}^{\infty} \frac{1}{x(\ln x)^3} \, dx \]

(10 points)
8. Determine whether each series is convergent or divergent. Say which and state the name of each test you use and show that it applies.

(5 points each part)

a) 
\[ \sum_{n=0}^{\infty} \frac{n^3 3^n}{n!} \]

b) 
\[ \sum_{n=0}^{\infty} \frac{(-1)^n(3n + 1)}{4n - 5} \]
9. Find the interval of convergence for the power series

\[ \sum_{n=1}^{\infty} \frac{1}{n 4^n} (x - 3)^n. \]

Circle your answer.

(10 points)
10. Find the first four nonzero terms of the Maclaurin series generated by

\[ f(x) = (x + 1)^{3/2}. \]

You may write your answer in the form

\[
\text{term}_1 + \text{term}_2 + \text{term}_3 + \text{term}_4 + \ldots
\]

or with summation notation.

Simplify the coefficients.

(10 points)
11. Use an integral to find the area inside one of the loops of 

\[ r = 2 \sin 2\theta. \]

You must show your work, including the calculus necessary to justify a correct answer.

(10 points)