DEPARTMENT FINAL EXAMINATION
MATH 166
ANALYTIC GEOMETRY &
CALCULUS II
FALL 2014

Mark your section here

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<tr>
<th>Section</th>
<th>Time</th>
<th>Instructor</th>
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<tr>
<td>26993</td>
<td>MWF 9:00A-10:15A</td>
<td>Miller, J.</td>
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<td>26994</td>
<td>MWF 12:00P-1:15P</td>
<td>Ji, R.</td>
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<td>26995</td>
<td>TR 3:00P - 4:50P</td>
<td>Rubchinsky, L.</td>
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<td>26996</td>
<td>TR 6:00P - 7:50PM</td>
<td>Rathnayake, S</td>
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Directions
1. Place your name and student ID number on this cover sheet, and put a check beside your section number.
2. You will have 2 hours to complete this examination.
3. NO CALCULATORS.
4. Cell phones and PDAs may not be turned on or used during the final.
5. No scrap paper, notes, or books are permitted.

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Last Name

First Name

10-Digit University ID
MATH 16600 Final Exam

Exam is 7 pages plus cover page. Follow the instructions for each question. Show enough of your work that we can understand what you are doing.

1. (14 points) Find the derivative of \( f \)
   (a) \( f(x) = \sin^{-1}(\tan x) \)

   (b) \( f(x) = x \ln(x + 1) \)
2 (8 points) Find the exact length of the curve $y = 1 + 6x^{3/2}$, $0 \leq x \leq 1$.

3 (8 points) Determine if the following integral is convergent or divergent and if it is convergent find its value

$$\int_{1}^{\infty} \frac{1}{x(x+2)} \, dx$$
4 (21 points) Evaluate

(a) \[ \int \frac{\sqrt{1-x^2}}{4x^2} \, dx \]

(b) \[ \int \sin x - \sin^3 x \, dx \]

(c) \[ \int 3x^2 \ln(x) \, dx \]
5 (8 points) Find the area of the surface obtained by rotating the curve \( y = \frac{1}{2}x^2, 1 \leq x \leq 2 \), about the \( y \)-axis.

6 (8 points) Sketch the polar curve \( r = 1 - \cos \theta \) and find the area that it encloses.
7 (9 points) Find the Taylor series for \( f(x) = \frac{1}{1+x} \) at \( a = 1 \) and determine the associated radius of convergence.

8 (8 points) Test the series for convergence or divergence:

\[
\sum_{n=1}^{\infty} \frac{1}{2 + \sin n}
\]

Don’t forget to say which test are you using.
9 (8 points) Determine whether the series is convergent or divergent. If it is convergent, find its sum. \[ \sum_{n=1}^{\infty} (-1)^n \frac{3^n}{4^n} \]

10 (8 points) Find the radius of convergence and the interval of convergence of the series. If the interval is finite do not forget to test the end points.

\[ \sum_{n=1}^{\infty} \frac{(x - 2)^n}{n^2} \]
11 (4 points) Test the series for absolutely/conditionally convergence or divergence. \( \sum_{n=1}^{\infty} (-1)^n \frac{n}{n^2 + 1} \)

12 (4 points) Find a power series representation for the function and determine the radius of convergence. \( f(x) = \frac{x}{(1-x)^2} \).