Exam 2 Review
Spring 2014
Calculus 2

1. Partial fractions
   a. \( \int \frac{x^2 - 3x - 10}{2x + 1} \, dx \)
   b. \( \int \frac{1}{(x^2 + 1)(x - 4)} \, dx \)
   c. \( \int \frac{x^3 + 4x^2}{x^3} \, dx \)
   d. \( \int \frac{x^3}{(x^2 - 2)} \, dx \)

2. Approximate \( \int_0^3 f(x) \, dx \) given

<table>
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<tr>
<th>x</th>
<th>0</th>
<th>0.5</th>
<th>1</th>
<th>1.5</th>
<th>2</th>
<th>2.5</th>
<th>3</th>
<th>3.5</th>
<th>4</th>
<th>4.5</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>f(x)</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>-1</td>
<td>-2</td>
<td>-2</td>
<td>-1</td>
<td>0</td>
</tr>
</tbody>
</table>

   a. Use trapezoid method with n=3
   b. Use midpoint method with n=3
   c. Use Simpson’s method with n=3
   d. Find value of n so that trapezoid rule integration of \( \int_0^\pi \sin(x) \, dx \) has error less than \( \epsilon = 0.001 \).

3. Write the integral for area:
   a. inside the inner loop of \( r = 1 + 2 \cos(\theta) \)
   b. inside \( r = 4 - 4 \cos(\theta) \) and left of y-axis
   c. inside the outer loop of \( r = 1 - 2 \cos(\theta) \) and below the x-axis
   d. inside both \( r = 3 \) and \( r = 6 \cos(\theta) \)
   e. inside one petal of \( r = \cos(3\theta) \)

4. a. Find the equation of the normal line at point (4, 5) to the curve

   \[
   \begin{align*}
   x(t) &= t^2 + 3x \\
y(t) &= 2t + 3
   \end{align*}
   \]

   b. Find formula for the length of the curve

   \[
   \begin{align*}
   x(t) &= \frac{t^2}{2} \\
y(t) &= 4t - 5 \\
t &\in [0, 3]
   \end{align*}
   \]

   c. Find formula for the arclength of the inner loop of \( r = 2 + 4 \sin(\theta) \)
   d. Find formula for the arclength of \( f(x) = \ln(x) \) for \( x \in [e^{-10}, e^{10}] \)
5. a. Determine whether the set \( \{ x : x^2 < 10 \} \) is bounded below/above. Find its greatest lower bound/lowest upper bound if they exist.

   b. Is sequence given by \( a_n = \cos(\frac{\pi}{2}n) \) monotone? Is it bounded?

   c. Is sequence given by \( a_n = \cos(\frac{\pi}{n}) \) monotone? Is it bounded?

6. Does the sequence converge or diverge? If converges, find limit. If diverges, explain why.

   a. \( \{ \frac{3^n}{2^n + 3} \} \)

   b. \( \{ \frac{4n^5}{5n^4 + 3n^3 + n^2 - 10} \} \)

   c. \( \{ \sin(\frac{\pi n}{4n + 1}) \} \)

   d. \( \{ \frac{1}{\sqrt{n^2 + 10}} \} \)

   e. \( \{ 0.8^{-n} \} \)

   f. \( \{ \frac{\ln(n^2 + 10)}{\sqrt{n}} \} \)

   g. \( \{ \sqrt{9 - \frac{1}{n}} \} \)

   h. \( \{ \ln(\frac{3n}{2n + 3}) \} \)

   g. \( \{ \tan \frac{n\pi}{n + 2} \} \)