Math 124 K - Autumn 2007
Mid-Term Exam Number Two
November 20, 2007

Name: ________________________________

Signature: ________________________________

Student ID number: ___________________________ Section: __________

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>7</td>
<td>10</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
</tr>
</tbody>
</table>

- Complete all questions.
- You may use a scientific calculator during this examination; graphing calculators and other electronic devices are not allowed and should be turned off for the duration of the exam.
- If you use trial-and-error, a guess-and-check method, or numerical approximation when an exact method is available, you will not receive full credit.
- You may use one double-sided, hand-written, 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 80 minutes to complete the exam.
1. Find the derivative of each of the following functions. You need not simplify your results.

(a) $f(x) = x^3 \cos (2x + e^x)$

(b) $g(x) = \frac{x + x^3}{x - \sin x}$
2. For each of the following, find $\frac{dy}{dx}$. You need not simplify your results.

(a) $y = (x^3 + 1)^{x^4 - 1}$

(b) $\frac{x}{y} + \sin y + \cos x = 1$
3. Find the coordinates of the points on the curve defined by

$$\frac{4}{3}x^3 - x + y^2 = 1$$

at which the tangent line is horizontal.
4. Use a linear approximation at $x = 0.75$ to approximate the nearby solution of the equation

$$\ln x + x^2 = 0.$$ 

(That is, apply Newton’s method to this equation with a starting value of 0.75, but just do one iteration.)
5. Find the points on the curve

\[ x^3 + y^3 = 1 \]

which have a tangent line that passes through the point (2, 0).
6. A radioactive slice of pizza is changing shape. It is always a circular sector, but the radius $r$ is increasing at 3 cm per hour and the angle $\theta$ is increasing at 1.5 radians per hour.

How fast is the area of the pizza slice changing when the radius is 8 cm and the angle is 2 radians?
7. Find the maximum and minimum values of the function

\[ f(x) = \frac{(\ln x)^2}{x^3} \]

on the interval \([\frac{1}{2}, 3]\).