Math 124 K - Autumn 2008
Mid-Term Exam Number Two
November 18, 2008

Name: _____

Student ID number: _____ Section: _____

1	15	
2	10	
3	15	
4	15	
5	10	
6	20	
Total	85	

- 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.

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1. For each of the following expressions, find $\frac{dy}{dx}$.

   (a) $y = \ln(\cos(\tan(x)))$

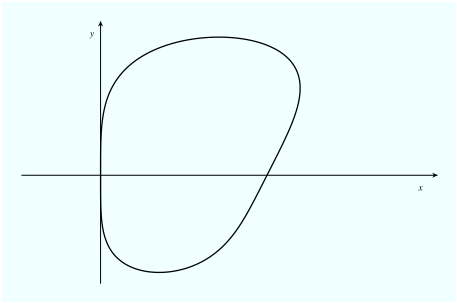
   (b) $y = \sec 2x \tan 3x$

   (c) $\dfrac{x}{y} + x^y = 5$

2. Consider the curve given by the equation

$$x^2 + y^4 - \frac{1}{2}xy - x = 0$$

It looks like this:



(a) Find the equation of the tangent line to the curve at each point where it crosses the x-axis.

(b) Using a linear approximation, estimate the value of y for a point $(1.1, y)$ on the curve.

3. Let $f(x) = x^2 e^{-x}$.

   (a) Find the x coordinates of all local extrema. Determine whether each is a local maximum or local minimum.

   (b) Find the x coordinates of all inflection points.

   (c) Find all asymptotes of the curve $y = f(x)$.

4. Evaluate the following limits. Be sure to indicate where you are applying L'Hospital's rule by writing $0/0$ or ∞/∞ over the equals sign.

   (a) $\lim_{x\to\infty} xe^{-\sqrt{x}}$

   (b) $\lim_{x\to 0} \dfrac{e^{2x} - 1 - \sin(x)}{x}$

   (c) $\lim_{x\to 0} \dfrac{\cos x - 1}{\ln \sec x}$

5. Sand is falling onto a growing conical pile at the rate of 2.7 cubic meters per minute. At the instant when the height of the pile is 4 meters and the radius is 3 meters, the radius is growing at half the rate that the height is growing. At that instant, at what rate is the area of the base of the cone growing?

6. Consider the function $f(x) = \ln x + e^x$.

   (a) Show that the equation $f(x) = 0$ has exactly one solution.

   (b) Does the curve $y = f(x)$ have any inflection points? Explain.

   (c) Use Newton's method to estimate the solution to the equation $f(x) = 0$ to six decimal places.