Math 124 K - Autumn 2009
Mid-Term Exam Number Two
November 24, 2009

Name: _____

Student ID number: _____ Section: _____

1	10	
2	10	
3	10	
4	10	
5	10	
6	20	
Total	70	

- 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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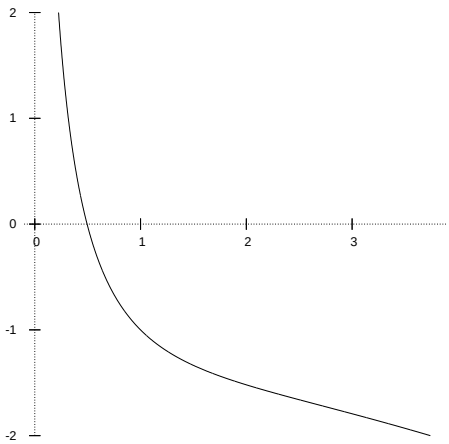
1. For each of the following, determine $\frac{dy}{dx}$. You do not need to simplify your results.

   (a) $y = \sec(x^2 + \sin x)\cos(e^x)$

   (b) $y = x^{x^x} = x^{(x^x)}$

2. Consider the function $f(x) = (\ln x)^2 - x$. Here is a piece of the graph of $y = f(x)$.



Use Newton's Method to approximate the solution of the equation $f(x) = 0$. Give your initial approximation and show the result of each iteration of Newton's Method. Your final approximate should have at least 6 correct digits.

3. You are flying a kite. You are holding on to the kite via a string, which you have wound on a roll. As you let string out, the kite moves away from you. The kite is 80 meters above the ground and moving horizontally away from you at 0.5 meters per second. How fast is the angle the kite string makes with the ground changing when there is 250 meters of string between you and the kite?

4. Verify that the two families of curves,

$$x^2 + ky^2 = 1 \text{ and } x^2 + y^2 = 2\ln x + c$$

are orthogonal.

5. Determine the absolute minimum and the absolute maximum values of

$$g(x) = x^{2/3} - \frac{x^2}{4}$$

on the interval $[-1, 2]$.

6. Let $f(x) = x^2 \ln x$.

   (a) Find all critical points of $f(x)$.

   (b) Determine all intervals on which $f(x)$ is increasing, and all intervals on which $f(x)$ is decreasing.

   (c) Find and classify all local extrema of $f(x)$.

   (d) Find all inflection points of $f(x)$.