Math 124 F Autumn 2012
Mid-Term Exam Number Two
November 20, 2012

Name: ______________________ Student ID no. : ______________

Signature: ______________________ Section: ______________

1	10	
2	10	
3	10	
4	10	
5	10	
6	10	
Total	60	

- 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. Determine the absolute minimum and absolute maximum of the function

$$f(x) = x^{(x^2)}$$

on the interval $\frac{1}{4} \leq x \leq \frac{3}{4}$.

2. A conical paper cup is 6 cm across at the top and 9 cm deep. Water is pouring into the cup at the rate of 3 cm^3 per second. How fast is the depth of the water in the cup rising when it is 2 cm deep?

3. You are watching a rocket launch. The rocket starts with a height of zero, will rise vertically, and will have height

$$0.1t^2$$

meters t seconds after launch. From a point on the ground 10 meters from the rocket, you measure the angle from the ground up to the rocket. Call this angle θ.

   (a) How fast is θ changing 3 seconds after launch?

   (b) When is θ changing fastest?

4. (a) Use a linearization to approximate the value of $\ln 54$. Give a decimal value with at least 5 decimal places for your approximation.

(b) Use a linearization to approximate the y-coordinate of a point with x-coordinate equal to -0.02 on the curve

$$y \cos x - x + \sin y = 0.$$

5. Find the slope of the tangent lines to the curve

$$(x^2 + y)^2 + xy = 16$$

at all points where the curve crosses the x-axis.

6. Let $f(x) = xe^{-x^2}$.

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

(b) Find all intervals on which $f(x)$ is increasing.

(c) Find all intervals on which $f(x)$ is decreasing.

(d) Give the x-coordinates of, and classify, all local extrema of $f(x)$.

(e) Give the x-coordinate of all inflection points of $f(x)$.