

**Math 1A Midterm 2 2009 Nov 3 12:30pm-2:00pm**

You are allowed 1 sheet of notes. Calculators are not allowed. Each question is worth 3 marks, which will only be given for correct working and a clear and correct answer in simplified form. Write the final answer to each question on the cover-sheet, and attach the cover-sheet to your bluebook.

1. Differentiate  $e^{\cos(\ln(x))}$ .
2. Find the equation of the tangent line to the curve  $y = \ln(x)/x$  at the point  $(1, 0)$ .
3. Find  $dy/dx$  by implicit differentiation if  $e^{x/y} = x - y$ .
4. The concentration  $y$  of a chemical at time  $t$  satisfies the equation  $dy/dt = -.0005y$ . Find a formula for  $y$  in terms of  $t$  given that  $y = 1$  at time  $t = 0$ .
5. Use differentials or a linear approximation to estimate  $\sqrt{4.1}$ .
6. Find the absolute maximum and absolute minimum values of  $f(x) = x^3 - 12x$  on the interval  $[-3, 5]$ .
7. Show that the equation  $e^x = -x$  has exactly one real root.
8. Find the limit  $\lim_{x \rightarrow 0} (\tan(x) - x)/x^3$ .

In questions 9 and 10 your sketch should show the domain of the function, local maxima and minima, where the function is increasing or decreasing, any zeros of the function, the behavior for large values of  $|x|$ , and the behavior near  $x = 0$  and points where the function is not differentiable. You need not show convexity or points of inflection.

9. Sketch the curve  $y = \sqrt[3]{x^3 - x}$ .
10. Sketch the curve  $y = x^{1/x}$  for  $x > 0$ .