Mathematics 121-A **Exam 3** **Spring 2006**

March 30, 2006

____
Name

Directions:

- **Only write on one side of each page.**
- **Use terminology correctly.**
- **Show all your work: partial credit depends on it**

Work This Problem on this Sheet

(5 points each) Differentiate the following. Do **not** simplify.

1. $f(x) = \frac{e^{2x+7}}{\cos(x)}$
2. $y = e^{(\arctan(x))}$
3. $f(x) = \ln\left(\sec\left(x^2+7\right)\right)$
4. $\frac{d}{dx}[x\frac{d}{dx}(\cos(x))]$
5. Find $\frac{dy}{dx}$ if $y = u^3 - 1 \quad$ and $u = \ln(x)$

Do any five (5) of the following.

1. (7, 8 points) Use implicit or logarithmic differentiation to find $\frac{dy}{dx}$ for each of the following.

   (a) $y = \frac{\left(x^2+1\right)^3(x+1)^5}{(x-4)^7\left(x^2+x\right)^{11}}$

   (b) $x^3y + \cos(x+y) = 2x$

2. (15 points) A block of ice in the shape of a cube originally having volume 1,000 cm^3 is melting in such a way that the length of each of its edges is changing at the rate of 1 cm/hr. At what rate is its surface area decreasing at the time its volume is 27 cm^3? Assume the block of ice maintains its cubical shape.

3. (15 points) Do **one** (1) of the following.

   (a) Use differentials to approximate $\cos\left(\frac{101\pi}{600}\right)$

   (b) Use differentials to estimate the change in the volume of a cone if the height of the cone is increased from 10 cm to 10.01 cm while the radius of the base stays fixed at 2 cm.

4. (15 points) The absolute maximum and absolute minimum of the following function might or might not exist. If they do not, explain why. If they do, use the methods from Section 1 of Chapter 4 to find them.

$$f(x) = \sqrt{x}\,(x-5)^{1/3} \quad \text{on } [0,4]$$

5. (15 points) Use the quotient rule to show $\frac{d}{dx}\cot(x) = -\csc^2(x)$.

6. (15 points) An object moves along a coordinate line with position at time t given by $x(t) = t - 2\sin(t)$. Find those times t from 0 to 2π when the object is slowing down.