Midterm 1 / 2006.3.9 / Biocalculus (Honors Calculus I) / MAT 1214.009

Name: ____

Please show all work and justify your statements. Make and label sketches, draw conclusions (using complete sentences and including units), and box the final answers as appropriate.

1. Five months after a tumor starts growing it is diagnosed and treated chemically. The tumor immediately responds to treatment and rapidly shrinks to one quarter its size in the following month, but then starts growing again and after another four months reaches its previous size at the time of the initial diagnosis. Graph the size of the tumor and the rate of the tumor's growth as functions of time. Are these functions continuous? Explain.

2. Find the derivatives of the following functions with respect to x. In part (a) use the definition of the derivative — using shortcuts (rules) alone is not sufficient there. Show all steps.

   (a) x^{-2} (b) $\pi^{x \cosh x}$ (c) $\arctan(x^e)$

3. On what intervals is the graph of $y = (\ln x)^2$ concave down?

4. Suppose $g(x)$ is differentiable at $x = 0$ and $g(0) = 1$. Find an equation for the tangent line at $x = 0$ to the graph of $y = x^2 g(x)$. Repeat the problem with $y = g(x^2)$.

5. The deer population on Angel Island is given in thousands as a function of time by $p(t) = 10 + t\sin(1/t)$. Describe the population in the long term by computing the limit of $p(t)$ as $t \to \infty$ (hint: let $u = 1/t$). Repeat the problem with $p(t) = 10 + \sin(t)/t$.

1	2	3	4	5	total (50)	%

Prelim. course grade: %