Midterm 1 / 2012.10.11 / Calculus for the Biosciences / MAT 1193.006

Name: _____

Please show all work. Supply brief narration with your solutions and draw conclusions.

1. A researcher starts a bacterial culture in a petri dish. A day later the colony is 5 million strong. The next day it reaches 6 million. Assuming the growth is exponential, what will the size be on the day after next?

2. The level of medication for a while varies according to $s(t) = 20 + t - t^3$ where time t is measured in days. Compute the derivative of s with the respect to t using the definition of derivative. Find and illustrate on a graph

   (a) Initial level and after 2 days.
   (b) The instantaneous rates of change at those two times.
   (c) The average rate of change during that period of time.

3. Suppose $f(x) = 27 - 3x^2$.

   (a) Compute the derivative of f with the respect to x using the definition of derivative.
   (b) Find an equation for the tangent line to the curve $y = f(x)$ at $x = 2$. Sketch.

4. Evaluate the following limits. Justify your answers.

   (a) $\lim_{n\to\infty} \frac{n}{3n+2}$ (b) $\lim_{x\to 1} \frac{1-x}{1-x^2}$ (c) $\lim_{x\to 0} x^2 \cos\left(\frac{1}{x}\right)$ (d) $\lim_{x\to 0} \frac{x}{\sin(2x)}$

5. A population of wasps x_t satisfies the recursion $x_{t+1} = \sqrt{3x_t}$. Find fixed points of the recursion (equilibria) and do some cobwebbing on a graph or numerical experimentation to determine their stability (attracting vs. repelling). Describe what happens to the population in the long run, if $x_0 = 0$. Same, if $x_0 = 1$.

1	2	3	4	5	total (50)	%

Prelim. course grade: %