Name: _____

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

1. An exponentially growing yeast culture doubles in 7 days. How long would it take it to quadruple in size?

2. A population of bacteria grows exponentially according to $b(t) = e^{2t}$. Find and illustrate on a graph

   (a) Population at $t = 0$ and $t = 1$.
   (b) The average rate of change between $t = 0$ and $t = 1$.
   (c) The instantaneous rates of change at $t = 0$ and $t = 1$.

3. Find the derivatives of
$$\text{(a) } \cos(1 + e^{2x}) \qquad \text{(b) } \ln(\ln x)$$

4. Find the second derivative of the Hill function $x^2/(1 + x^2)$ and use it to describe the curvature of the Hill function's graph.

5. The amount of medication M_t in the bloodstream of a patient on an intravenous drip is governed by the discrete dynamical system $M_{t+1} = M_t - f(M_t)M_t + d$, where d is the rate of delivery through the drip and $f(M_t)$ is the fraction of the medication absorbed by the patient. If $f(M_t) = M_t/(2 + M_t)$ and $d = 1$, find the biologically significant equilibrium and determine its stability.

1	2	3	4	5	total (50)	%

Prelim. course grade: %