

Name: _____

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

1. A population of four million bacteria is introduced into petri dish and grows exponentially, doubling in size every seven hours. Write down the size of the culture as a function of time. When will the colony reach fifty million?
2. The level of a hormone varies according to $s(t) = 3 + 2 \sin(0.5t)$ where time t is measured in months. Find and illustrate on a graph
 - (a) Initial size and the size after a month.
 - (b) The instantaneous rates of change at those two times.
 - (c) The average rate of change during that period of time.
3. Find the derivatives of

(a) 2^{2^t}
(b) 2^{t^2}
4. Find the second derivative of $f(t) = te^{-t}$ and use it to describe the curvature of the graph of f for $t \geq 0$.
5. A population x_t has *per capita* production $0.5x_t$. Write down the discrete dynamical system for x_t . Find equilibria and use the slope criterion to determine their stability. Describe in words what happens in the long run.

Hint: $x_{t+1} = f(x_t)$, where the updating function f is the per capita production times the size.

1	2	3	4	5	total (50)	%

Prelim. course grade: %