Math002A Assignment 1.3 Last Name:____________________1st__________

DIRECTIONS To receive full credit, you must provide complete legible solutions to the following problems in the space provided. Be sure to supply all the necessary steps that lead to your answers.

1. The population of bacteria in a culture grows at a rate proportional to the number of bacteria present at time t. After 3 hours it is observed that 500 bacteria are present. After 10 hours 4000 bacteria are present. What was the initial number of bacteria?

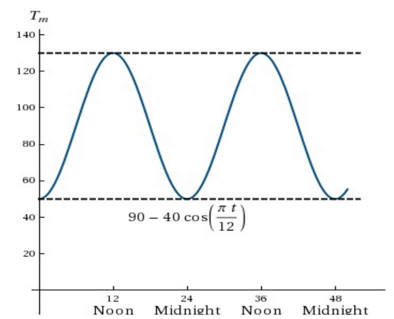
2. The number N(t) of people in a community who are exposed to a particular advertisement is governed by the logistic equation. Initially, N(0) = 300, and it is observed that N(1) = 600. Solve for N(t) if it is predicted that the limiting number of people in the community who will see the advertisement is 30,000.

3. A tank initially has 120 liters of pure water. A mixture containing a concentration of 3 grams per liter of salt enters the tank at a rate of 2 liters per minute, and the well-stirred mixture leaves the tank at the same rate. Find the amount of salt in the tank at any time t, and the limiting value of the amount of salt in the tank as t approaches infinity.

4. The ambient temperature Tm in (3) in Section 1.3

$$\frac{dT}{dt} \propto T - T_m \quad or \quad \frac{dT}{dt} = k\left(T - T_m\right) \quad (3)$$

could be a function of time t. Suppose that in an artificially controlled environment, Tm(t) is periodic with a 24-hour period, as illustrated in the figure. Devise a mathematical model for the temperature T(t) of a body within this environment.



5. A series circuit contains a resistor and an inductor as shown in the figure. Determine a differential equation for the current i(t) if the resistance is R, the inductance is L, and the impressed voltage is E(t). (Use i for i(t)and E for E(t)).