Sections 3.1 and 3.2

1. (3.1 Linear Models) The population of bacteria in a culture grows at a rate proportional to the number present at time \( t \). After 3 hours it is observed that 400 bacteria are present. After 10 hours 2000 bacteria are present. What was the initial number of bacteria.
2. (3.1 Linear Models) Initially 100 milligrams of a radioactive substance was present. After 6 hours the mass had decreased by 3%. If the rate of decay is proportional to the amount of the substance present at time $t$, find the half life of the radioactive substance.
3. (3.1 Linear Models) A small metal bar whose initial temperature was 20 Celsius is dropped into a large container of boiling water. How long will it take the bar to reach 90 Celsius if it is known that its temperature increased by 2 degrees in the first second?
4. (3.1 Linear Models) A tank contains 200 liters of fluid in which 30 grams of salt is dissolved. Brine containing 1 gram of salt per liter is then pumped into the tank at a rate of 4 L/min; the well-mixed solution is pumped out at the same rate. Write the I.V.P. that models the number $A(t)$ of grams of salt in the tank at time $t$. 
5. (3.2 Nonlinear models) Suppose a student carrying a flu virus returns to an isolated college campus of 1000 students. If it is assumed that the rate at which the virus spreads at time $t$ is proportional to the product of the number of students infected and the number not infected, write the I.V.P. that models the number $x(t)$ of infected students at time $t$. 