Week 8 Practice

October 15, 2019

1. A large tank is filled with 500 gallons of pure water. Brine containing 2 pounds of salt per gallon is pumped into the tank at a rate of 5 gal/min. The well-mixed solution is pumped out at the same rate.

    (a) Find the number $A(t)$ of pounds of salt in the tank at time t;
    (b) What is the concentration $c(t)$ of the salt in the tank at time t?

2. A large tank contains 200 gallon of fuild in which 30 grams of salk is dissolved. Brine containing 1 gram of salt per gallon is then pumped into the tank at a rate of 4 gallon per minute, the well-mixed solution is pumped out at a rate of 6 gallon per minute. Find the number $A(t)$ of grams of salt in the tank at time t.

3. A small metal bar, whose initial temperature was 20^oC, is dropped into a large container of boiling water(100^oC). How long will it take the bar to reach 90^oC if it is known that its temperature increases 2^oC in 1 second? (The rate of temperatire change is proportional to its current temperature).

4. Suppose a student carring a flu virus returns to an isolated ccollege campus of 2000 students. If it is assumed that the rate at which the virus spread is proportional not only to the number $P(t)$ of infected students but also to the number of students not infected, determine the number of infected students after 6 days if it is further observed that after 3 days $P(3) = 20$.

5. Two chemicals A and B are combined to form a chemical C. The rate, or velocity, of the reaction is proportional to the product of the instantaneous amounts of A and B not converted to chemical C. Initially, there are 40 grams of A and 50 grams of B, and for each gram of B, 2 grams of A is used. Let $X(t)$ be thhe amount of C is formed in $t$minues. Set up a D.E. of $X(t)$ and then solve it.

6. Find the charge $q(t)$ on the capacitor in an LRC-series circuit when $L = 0.25$ h, $R = 10\,\Omega$, $C = 0.001$ f, $E(t) = 0$, $q(0) = q_0$ C, and $i(0) = 0$.