Notesheet. Section 9.3: Applications of Separable Differential Equations

Math 1220

Challenge 1. Suppose a country's population $P(t)$ at time t is modeled by

$$\frac{dP}{dt} = 2P + 10$$

Find an expression for $P(t)$ if $P(0) = 1,000,000$.

Challenge 2. Suppose that the population $Q(t)$ of fruit flies in a controlled environment is increasing by the rule

$$\frac{dQ}{dt} = kQ(500 - Q)$$

If the initial population is 10 and it grows to 100 after 2 days, find the population after 10 days.

Challenge 3. Solve the IVP
$$\frac{dx}{dt} = k(L - x), x(0) = x_0$$
where k, L, x_0 are constant and $x = x(t)$ is a function in t.

Challenge 4. A tank contains 20kg of salt dissolved in 5000L of water. Brine that contains 0.03kg of salt per liter of water enters the tank at a rate of 25L/min. The solution is kept thoroughly mixed and drains from the tank at the same rate. How much salt remains in the tank after half an hour?