Mixing

Goal: • Can solve problems involving multiple rates of change using linear differential equations. • Can use steady states to verify solutions and build equations
Terminology: • Concentration

Discussion question: A population of deer reproduce at a rate where their population would grow at a per capita rate of 15% per year if there were no outside factors. The deer are hunted at a controlled rate of 1200 deer per year. What will happen to the population if there are initially 5000 deer? 10 000 deer?

When analyzing problems like this we can set our work up in one of two ways.

Method 1

Method 2

Example: A fish tank has a volume of 200 L of fresh water. You want to raise the concentration of salt slowly and begin dripping in a concentrated saline solution of 50 g/L at a rate of 4 L/hour. Water is removed from the tank at the same rate. Make a differential equation that models the situation.

Practice: A 100 L tank of fresh water has fertilizer being pumped in with a concentration of 0.1 kg/L at a rate of 2 L/min. Water is leaving the tank at:

a. A rate of 2 L/min
b. A rate of 4 L/min

Write a differential equation for the amount of fertilizer in the tank for both parts and solve the equation for part "a", and predict the amount of fertilizer in the tank after 30 minutes.

Practice: A TFSA earns 6% interest annually (per capita continuously). You deposit $2000 each month into the account and you made an initial invesment of $5000. Write a differential equation if

a. You withdrawl $0 each month
b. You withdrawl 1% of your account each month.
c. You add $10 each month than the month before. So the first month you add $2000, the next $2010, the next $2020 and so on.

Write a differential equation for the above and make a solution where possible. Predict the amount of money in the account after 25 years.

Practice Problems: 9.5 # 1-4 (do what you need) 5, 6, 8
Mixing Practice Problems.