

Mixing Practice Problems

1. A tank has a current chlorine concentration of 0.1 g/L and has a volume of 500 L. A more concentrated solution of chlorine (0.5 g/L) is added at rate of 5 L/min. Consider the two situations:
 - a. Water leaves the tank at the same rate of 5 L/min
 - b. Water is being drained from the tank slower at a rate of 2 L/min.

Write a differential equation for each situation and solve the differential equation in part A. Determine the amount of chlorine in the tank after 15 minutes for each case.

2. A population of insects would double every two months without any outside factors. If birds are eating the insects at a rate of 1000 insects/bird per day, then consider the following. (Assume 30-day months)
- The population of birds is constant at 100.
 - The population of birds grows due to migration at a rate of 10 new birds per month (after starting at 100)

Write a differential equation for each situation and solve part A. Determine the number of insects after 1 year if there were 10 million to start for each case.

3. If you plan to retire you want to know how much you need to save so that you can live off what you've saved and invested. Say you plan to retire at age 55 and expect to live for another 30 years being relatively active. You want to live off a comfortable \$100 000 a year and expect safe investments to return an annual interest rate of 4%.
- What is the steady state investment amount?
 - Determine the minimal you need to have by age 55 so that your savings will not be depleted until the 31st year of retirement.
 - At retirement you find you have saved 1 million dollars. How much can you afford to pay yourself for 30 years?