

- 1) A tank contains 20 gallons of a solution consisting of 85% water and 15% alcohol. If a mixture of 60% water and 40% alcohol is added at the rate of 5 gal/min and the tank is also being drained at the rate of 2 gal/min, set up a DE with initial condition for $A(t)$, the amount of alcohol in the tank at time t .

- 2) A tank originally contains 600 gallons of water with 80 lb of salt in solution. Water containing 5 lb of salt per gallon is entering the tank at a rate of 4 gal/min, and the stirred mixture is allowed to flow out of the tank at a rate of 6 gal/min. Set up a DE with initial condition for $S(t)$, the amount of salt in the tank at time t .

- 3) Suppose a lake is stocked with 200 fish, and after 8 months there are 300 fish. If the number of fish obeys the logistic growth model, and if a study of the ecology of the lake predicts that it can support 1200 fish, find when there will be 600 fish.

- 4) A wildlife park can support a maximum of 300 foxes, and the population of foxes increases according to the law of logistic growth. If there are 60 foxes initially and 100 foxes after 7 years, find the number of foxes after 21 years (and simplify your answer).

- 5) Suppose the rate of growth of a cell depends on the flow of nutrients through its surface, so the rate of change of the volume of the cell is proportional to its surface area. Assuming that the square root of the surface area is proportional to the cube root of the volume, find the volume V at any time t if $V=8$ when $t=0$ and $V=27$ when $t=5$.

- 6) A drug is given intravenously to a patient at the continuous rate of 6 mg/hr, and the patient's body removes the drug from the bloodstream at a rate proportional to the amount of drug in the blood. If there was no drug in the patient's blood initially, and if the amount of drug in the bloodstream has a limiting value of 3 mg as time increases, find the amount of drug in the patient's blood after 4 hours.