MATH 129-007
SOME WORD PROBLEMS

SPRING 2017

(1) A water reservoir holds 100 million gallons of water. It supplies a city with 1 million gallons of water a day. The reservoir is partly refilled by a spring which provides 0.9 million gallons a day and the remaining 0.1 million gallons comes from run-off from the surrounding land. The spring is comprised of pure water, but the run-off contains salt with a concentration of 0.0001 pounds per gallon. If there was no salt in the initially full reservoir, find the concentration of salt in the reservoir as a function of time. Assume that the water in the reservoir is well-mixed.

(2) Water leaks out of a barrel at a rate proportional to the square root of the depth $D(t)$ of the water at time t. Depth is measured in inches and time in hours.

a) Write a differential equation for the depth of the water in the barrel with a positive proportionality constant k; i.e. $k > 0$.

b) If the depth is initially 25 inches, find $D(t)$.

c) If the depth drops to 24 inches in 1 hour, how long will it take for all the water to leak out?

(3) A company's revenue is earned at a continuous annual rate of 5% of its net worth. At the same time, the company's payroll obligations amount to 200 million a year (paid out continuously).

a) Write a differential equation for the company's net worth $W(t)$. Assume $W(t)$ is in millions of dollars and time t is in years.

b) Solve this differential equation and plot the solutions corresponding to initial conditions: $W(0) = 3,000$, $W(0) = 4,000$, and $W(0) = 5,000$ respectively.