Homework 2 - Sections 2.3

Last name: _____

First name: _____

Due at the beginning of the class on Wednesday October 12th, 2016.

You may use a calculator or a computer to solve the problems numerically.

Exercise 1. Beginning at time $t = 0$, fresh water is pumped at the rate of 3 gal/min into a tank initially filled with 60 gal of brine solution in which 2lb of salt was dissolve. The resulting less-and-less salty mixture overflows at the same rate into a second 60-gal tank that initially contained only pure water, and from there it eventually spills onto the ground. Assuming perfect mixing in both tanks, when will the water in the second tank taste the saltiest? And exactly how salty can it be?

Exercise 2. A mass of 0.3 kg is released from rest. As the object falls, air provided a resistance proportional to the velocity ($R(v) = -0.1v$), where the velocity v is measured in m/s. If the mass is dropped from a height of 100m, what is the velocity when it hits the ground?

Exercise 3. A snowball melts in such a way that the rate of change in its volume is proportional to its surface area. If the snowball was initially 4 in. in diameter and after 30 minutes its diameter is 3 in., when will its diameter be 2 in.? Mathematically speaking, when will the snowball disappear?

Exercise 4. A parachutist whose mass is 75kg drops from an helicopter hovering 2000m above the ground and falls toward the ground under the influence of gravity. Assume that the force due to air resistance is proportional to the velocity of the parachutist, with the proportionality constants $b_1 = 30$ Ns/m when the parachute is closed and $b_2 = 90$ Ns/m when the parachute is open. If the parachute does not open until the velocity of the parachutist reaches 20m/s, after how many seconds will he reach reach the ground?