

Assignment 3
Math 302 - Fall 2006
Prof. J. A. Pelesko
Due September 25, 2006

- (1) (25 points) It began to snow on a certain morning and the snow continued to fall steadily throughout the day. At noon a snowplow started to clear a road at a constant rate in terms of the volume of snow removed per hour. The snowplow cleared 2 miles by 2 P.M. and 1 more mile by 4 P.M. When did it start snowing?
- (2) (25 points) A spherical raindrop, starting from rest, falls under the influence of gravity. If it gathers water vapor (assumed at rest) at a rate proportional to its surface, and if its initial radius is zero, show that it falls with a constant acceleration $g/4$.
- (3) (25 points) Consider a tank used in certain hydrodynamic experiments. After one experiment the tank contains 100 liters of dye solution with a concentration of 1 gram per liter. To prepare for the next experiment, the tank is to be rinsed out with fresh water flowing in at a rate of 1.5 liters per minute, the well stirred solution flowing out at the same rate. Find the time it takes for the concentration of dye in the tank to reach one percent of its original value.
- (4) (25 points) A tank contains 100 gallons of water and 25 ounces of salt. Water containing a salt concentration of $2 + \sin(2t)$ ounces per gallon flows into the tank at a rate of 2 gallons per minute. The mixture in the tank flows out at the same rate. Find the amount of salt in the tank as a function of time and plot your solution.