Name_____   Score_____

Directions: This is the take-home portion of the test. You must do all the problems contained here individually. You MAY NOT solicit help from anyone. You will get a grade of ZERO for this portion if you are caught cheating. Part one has 36 points and part two has 14 points making a total of 50 points on this test. Your grade will be based on a percentage of the total points.

1) A 500 liter (L) tank initially contains 10grams (g) of salt dissolved in 200L of water. Starting at $t = 0$ water containing 0.25g of salt per liter is poured into a tank at the rate of 4 liters per minute and the mixture is drained from the tank at a rate of 2 liters per minute. Find and solve a differential equation for the quantity $Q(t)$ (measured in grams) of salt in the tank at time t prior to the time when the tank overflows. Next, find the concentration $K(t)$ of salt (measured in grams per liter) of salt in the tank at any such time. (Hint: you may need to solve a first order linear differential equation)   (9 points)

2) Compute the indefinite integral $\displaystyle\int e^{\sin^{-1} x}\,dx$ (5 points)