1. Consider the differential equation

$$\frac{dy}{dt} + 3y = t^2 - t. \tag{1}$$

In this exercise you are to solve this equation, but **not** by using the method of finding an integrating factor.

a) There is a solution of the differential equation of the form

$$y(t) = c_2 t^2 + c_1 t + c_0.$$

where c_0, c_1, and c_2 are constants. Determine what the constants are.

b) Solve the associated homogeneous equation

$$\frac{dy}{dt} + 3y = 0.$$

c) Write down the general solution of equation 1.

2. A 400 gallon tank contains 100 gallons of brine containing 50 pounds of salt. Brine containing 1 pound of salt per gallon enters the tank at the rate of 5 gal/s and the (well-mixed) brine exits the tank at a rate of 3 gal/s. How much salt will be in the tank when the tank is full?

3. A toxic chemical is leaching into a pond at a constant rate. It is being removed at a rate that is proportional to the concentration of the chemical in the pond.

a) Write down a differential equation that describes this situation. Be sure to identify the meanings of any variables or constants that you introduce and what their units are.

b) What will be the long term quantity of the chemical in the pond? What will be the long term concentration?