

YOUR NAME: \_\_\_\_\_

George Voutsadakis

Read each problem **very carefully** before starting to solve it. Each problem is worth 5 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. A small tank contains initially 4 gallons of pure water. A mixture containing  $2e^{-9t/8}$  gr/gal of salt is poured into the tank at the rate of  $\frac{1}{2}$  gal/min and the resulting mixture is flowing out at the same rate.

(a) Write an initial value problem for the amount  $y(t)$  of salt in the tank at time  $t$ .

(b) Solve the differential equation to obtain an explicit expression for  $y(t)$ .

2. Consider

$$xy^2 + 2 + (x^2y - 3)\frac{dy}{dx} = 0, \quad y(-1) = 8.$$

(a) Verify that the given equation is exact.

(b) Find  $\psi(x, y)$  so that  $\psi(x, y) = c$  is a general solution of the given differential equation.

(c) Find the particular solution of the initial value problem.