

EXAM 1 - MATH 310

Thursday, February 6

YOUR NAME: _____

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Read each problem **very carefully** before starting to solve it. Each problem is worth 10 points. It is necessary to show **all** your work. Correct answers without explanations are worth 0 points. GOOD LUCK!!

1. Solve the initial value problem

$$t \frac{dy}{dt} + ty = 1 - y, \quad y(1) = 0.$$

(Caution: There is a y on the right!)

2. Solve the differential equation and write your answer in explicit form

$$\frac{dy}{dx} = 3 - 6x + y - 2xy, \quad y > 0.$$

(Hint: Factor first.)

3. A 50 gallon tank initially contains 1 pound of salt dissolved in 10 gallons of water. Incoming at the rate of 3 gallons per minute is a solution containing 0.5 pounds of salt per gallon. The tank is drained at the rate of 2 gallons per minute.

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

(b) Solve it to find an equation for $Q(t)$. Mention for which values of t your equation would be valid.

4. Consider the differential equation

$$\frac{dy}{dx} = -\frac{2xy + y^2 + 1}{x^2 + 2xy + 3y^2}.$$

If it is exact, find its general solution. If it is not exact, find a $\mu(x)$ so as to make it exact, but do not solve it.

(Hint: Begin by writing it in the standard form so as to find M and N .)

5. Solve the initial value problem

$$2y'' + 7y' - 4y = 0, \quad y(0) = 0, \quad y'(0) = 9.$$