

EXAM 1 - MATH 310

Thursday, September 19

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

$$\frac{dy}{dt} + ty = 5t, \quad y(0) = 1.$$

2. Find the general solution of the differential equation

$$t^3 y' + 3t^2 y = e^t, \quad t > 0.$$

3. A tank initially contains $\frac{35}{2}$ grams of salt dissolved in 5 liters of water. A solution that contains $\frac{3}{2}$ grams of salt per liter is poured into the tank at the rate of 2 liters per minute and the mixture is drained from the tank at the rate of 1 liter per minute. Find the amount of salt $Q(t)$ in the tank at time t before the tank overflows.

4. Check whether the given equation is exact. If it is, solve it. If it is not, make it exact. (In this case, you do not have to solve it.)

$$(y^2 + 3) + (2xy - 4)\frac{dy}{dx} = 0.$$

5. Check whether the given equation is exact. If it is, solve it. If it is not, make it exact. (In this case, you do not have to solve it.)

$$\frac{x^2 + y^2}{x + 1} + 2y\frac{dy}{dx} = 0.$$