QUIZ 3 - MATH 310 Thursday, January 30

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

1. [6 points] A tank contains initially 10 pounds of salt mixed into 100 gallons of water. A mixture containing 0.4 pounds of salt per gallon of water is entering the tank at the rate of 5 gallons per hour. Simultaneously the tank is being drained at the rate of 7 gallons per hour.

   (a) Write an initial value problem (differential equation plus initial condition) for the amount of salt $Q(t)$ in the tank at time t.

   (b) Solve the initial value problem to find the amount of salt $Q(t)$ in the tank at time t.

2. [6 points] Consider the differential equation

$$\left(\frac{1}{3}x^2y^3 - \frac{1}{2}xe^{2y} + \sin x \sin y\right) + \left(y^3 + \frac{1}{3}x^3y^2 - \frac{1}{2}x^2e^{2y} - \cos x \cos y\right)\frac{dy}{dx} = 0.$$

(a) Check whether the equation is exact.

(b) If it is, find a solution. (You may, of course, leave your answer in implicit form.)