## EXAM 1 - MATH 310 YOUR NAME:

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 differential equation  $\frac{dy}{dx} = \frac{1 + \cos x}{2 - \sin y}$ , subject to  $y(0) = \pi$ .

2. Solve the differential equation  $\frac{dy}{dt} - \frac{3}{2}y = 3t + 2e^t$ , subject to y(0) = 7.

3. Solve the differential equation  $\frac{dy}{dx} = \frac{2x+y}{3+3y^2-x}$ , subject to y(0) = 0.

4. A container contains 10 gallons of an alcoholic beverage with alcohol concentration 20% per volume. The container is filled at the rate of 1 gal/hour with a 5% alcoholic mixture and it is also emptied at the rate of 2 gal/hour. Find what is the amount of alcohol in the container t hours after the beginning of the process, for  $0 \le t \le 10$ .

5. Suppose that Jerry borrows \$100,000 to buy a house in the Soo. If his annual interest rate is 5% compounded continuously and his annual payment is (fixed) \$ p paid continuously, write a differential equation for the amount owed after t years. How much should the annual payment be to pay off the loan in 20 years?