# Practice Exam 1 for Math 325

Wednesday - September 22, 2004

**Student's Name:** ______________________________

**Instructions:** Show all your work for full credit. Indicate your answers clearly.

**Problem # 1.** Show that any separable equation $M(x) + N(y)y' = 0$ is also exact.

**Problem # 2.** Find a solution of the initial value problem

$$y' + \frac{2}{t}y = \frac{\cos t}{t^2}, \quad y(\pi) = 0, \quad t > 0.$$

**Problem # 3.** Solve the initial value problem $y' = 2y^2 + xy^2$, $y(0) = 1$ and determine where the solution attains its minimal value.

**Problem # 4.** Solve the equation $y + (2x - ye^y)y' = 0$.

**Problem # 5.** Determine whether the following equation is exact:

$$ye^{xy}\cos(2x) - 2e^{xy}\sin(2x) + 2x + (xe^{xy}\cos(2x) - 3)y' = 0.$$

**Problem # 6.** Determine the values of $r$ for which the equation $t^2y'' - 4ty' + 4y = 0$ has a solution of the form $y(t) = t^r$ for $t > 0$.

**Problem # 7.** Consider a population $p$ of field mice that grows at a rate proportional to the current population, that is $\frac{dp}{dt} = rp$. Find the constant rate $r$ if the population doubles in 30 days.

**Problem # 8.** True or False

(a) $\dfrac{dy}{dt} + ty^2 = 0$ is second order differential equation.

(b) $\dfrac{d^3y}{dt^3} + \dfrac{d^2y}{dt^2} + 1 = 0$ is linear differential equation.

(c) $u(x, y) = \ln(x^2 + y^2)$ is a solution of the partial differential equation $u_{xx} + u_{yy} = 0$.

(d) A solution to the initial value problem $y' + \dfrac{1}{\ln t}y = \dfrac{\cot t}{\ln t}$, $y(2) = 3$, exists on the interval $(0, \pi)$.

(e) $\mu(x) = xe^x$ is an integrating factor for $(x + 2)\sin y + (x\cos y)y' = 0$.