Math 250 Exam #2 Fall '08	**Show all work** (and answers) on the blank paper provided. Write nothing on this paper other than your name.	**Name:**

1	**20**	
2	**20**	
3	**20**	
4	**20**	
5	**20**	
6	**20**	
total	**120**	
curve		
%		

1) Solve the initial value problem: $\left(e^t y + te^t y\right)dt + \left(te^t + 2\right)dy = 0, \quad y(0) = -1$

2) Solve the equation $(2xy)\,dx + \left(y^2 - 3x^2\right)dy = 0$.

3) Find an integrating factor of the form $x^n y^m$ (m & n not necessarily integers) and solve the differential equation $\left(2y^3 - 6xy\right)dx + \left(3xy^2 - 4x^2\right)dy = 0$.

4) Solve the Bernoulli Equation $\dfrac{dy}{dx} = \dfrac{2y}{x} - x^2y^2$.

5) Consider a tank used in certain hydrodynamic experiments. After one experiment the tank contains 200 liters of a dye solution with a concentration of 1 g/L (that is, 1 gram of dye per liter of solution). To prepare for the next experiment, the tank is to be rinsed with fresh water flowing in at a rate of 2 L/min, the well-stirred solution flowing out at the same rate. Find the time that will elapse before the concentration of dye in the tank reaches 1% of its original value.

6) If initially there are 450 grams of radioactive kaboomium-366 and after 24 hours there are 100 grams remaining, how much time must elapse before only 1 gram remains?

NOTE:

$M(x,y)\,dx + N(x,y)\,dy = 0$ is exact if and only if $\partial M / \partial y = \partial N / \partial x$. Then there's some F such that $\partial F / \partial x = M$ and $\partial F / \partial y = N$.

If $\dfrac{\partial M / \partial y - \partial N / \partial x}{N}$ depends only on x, then $\mu(x) = \exp\left[\int\left(\dfrac{\partial M / \partial y - \partial N / \partial x}{N}\right)dx\right]$.

If $\dfrac{\partial N / \partial x - \partial M / \partial y}{M}$ depends only on y, then $\mu(y) = \exp\left[\int\left(\dfrac{\partial N / \partial x - \partial M / \partial y}{M}\right)dy\right]$.