DIFFERENTIAL EQUATIONS TEST I

9:00-10:25

NAME _____ STUDENT NUMBER _____

Each problem is worth 20 points. Show all work. Be neat and use equal signs where applicable. Remember, you are not only trying to find the answer, but you are also trying to convince me that you know what you are doing! No calculators.

1. (a) Show that $x^3+3xy^2 = 1$ is an implicit soultion of the differential equation

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

on the interval $x \in (0, 1)$.

(b) Show that $y = 4e^{2x} + 2e^{-3x}$ is a solution of the initial value problem

$$\begin{aligned} \frac{d^2y}{dx^2} + \frac{dy}{dx} - 6y &= 0, \\ y(0) &= 6, \\ y'(0) &= 2. \end{aligned}$$

2. Solve the equation $(3x^2 + 4xy)\,dx + (2x^2 + 2y)\,dy = 0$.

3. Solve the equation $xy^4\,dx + (y^2 + 2)e^{-3x}\,dy = 0$.

4. Solve the equation $y^2\,dx + (3xy - 1)\,dy = 0$. HINT: The equation is *not* exact, seperable, or homogeneous.

5. Solve the equation

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