Differential Equations Exam One NAME:

1. Solve (explicitly) the separable Differential Equation
$\frac{dy}{dx} = \frac{y^2+1}{y(x+1)}$ with $y(0) = 2$.

2. Solve (implicitly) the Exact Differential Equation
$(2x + y^3 sec^2 x)dx + (1 + 3y^2 tan\ x)dy = 0$.

3. Use Euler's method with $h = .2$, for 3 steps, to find an approximate value $y(1.6)$ for the solution to the initial value problem $dy/dx = y - x$ with $y(1) = 3$.

4. Solve the equation $y' = y^2(y-2)(y-5)$ graphically.

(a) Find the critical values c such that $y = c$ is a solution.

(b) Find the sign of y' and the limiting value L on each interval.

(c) Sketch solutions with $y(0) = -1$, $y(0) = 1$, $y(0) = 3$, and $y(0) = 6$.

5. A packet dropped from a height of 400 meters with initial velocity 0 and air resistance $.7mv$, so that the velocity $v(t)$ is subject to the differential equation $v' = -.7v - 9.8$.

Solve for the velocity $v(t)$ and for the height $y(t)$, then find the approximate time of impact and the limiting velocity.

6. Solve (implicitly) the homogeneous differential equation $y' = \frac{2y^2}{xy-x^2}$. Simplify your answer.

Hint: You may want to use partial fractions.

7. A brine solution of salt with concentration .2 kg/L flows at a constant rate of 4 L/min into a tank that initially held 20 L of brine solution containing 5 kg of salt. The well-stirred solution flows out of the tank at the rate of 3 L/min. Find the mass $x(t)$ of salt in the tank at time t and also the concentration $y(t)$ and the limiting value of the concentration.