MA 341 Sec 007 Spring 2007 TEST 1

February 8, 2007
Name: _____

Neatly work out the following problems on separate paper. Make sure to write solutions in an organized manner, and keep problems in order. SHOW ALL WORK! Unsupported answers will not receive full credit. Circle your final answer.

1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

(1) Use Euler's method with step size $h = 0.1$ to approximate the solution to the initial value problem

$$y' = x - y^2, \quad y(1) = 0$$

at the points $x = 1.1,\ 1.2$ and 1.3. Show all work. In particular, make sure to state what formulas you are using. Place answers in a table.

(2) Classify the differential equation

$$\frac{dy}{dx} - \frac{y}{x} = 2x + 1$$

as separable, linear, or exact. Solve this differential equation.

(3) Classify the differential equation

$$(2x + y)dx + (x - 2y)dy = 0$$

as separable, linear, or exact. Solve this differential equation using the initial condition $y(0) = 0$.

(4) Assume the rate of decay of a radioactive substance is proportional to the amount of the substance present. Let $p(t)$ represent the amount of substance (in grams) present at time t (in years). Let k be the proportionality constant. If initially there are 300 grams of this substance and after 5 years there are 200 grams remaining, how much time must elapse before only 10 grams remain? In your solution, be sure to show the following for full credit:

- State differential equation modeling this situation along with initial conditions.
- Solve the IVP model, giving an equation for the amount of substance remaining after t years.
- Calculate how much time must elapse before only 10 grams of the substance remains.

(5) Find a general solution to the following two differential equations:

(a) $6y'' + y' - 2y = 0$
(b) $4y'' - 4y' + y = 0$