Math 189 – Assignment #1 Name: _____

1. State the order and degree of the following differential equations.

   a) $x^4\left(y'''\right)^2 - x^3y'' + \left(y'\right)^5 = y^4$

   b) $\dfrac{d^2x}{dt^2} = -5xe^{-2t}$

2. Is the equation $x^2 + y^2 = cx$ a solution to the following DE? Justify your answer by showing your work.

$$2xyy' + x^2 = y^2$$

3. Solve the following DE. You may leave your answer in implicit form.

$$\sqrt{1+4x^2}\ dy = y^3 x dx$$

4. Solve, giving an explicit solution.

$$e^{x+y}\left(dx+dy\right)+4xdx=0$$

5. Solve the following linear differential equation under the given conditions. Give an explicit answer.

$\frac{dv}{dt} - \frac{v}{t} = \ln t$ given that when $t = 1$, $v = 8$

6. Consider the following differential equation:

$$\frac{dy}{dx} = \sqrt{1+xy}$$

a) Use Euler's method to approximate the solution to the following differential equation for $x = 0$ to $x = 0.2$ using a step size of $\Delta x = 0.05$. The point (0,1) lies upon the curve. Report your y-values to at least four decimal points.

b) If you were not impressed with the accuracy of your calculation in part (a) but wanted to keep using the same method, what might you change to improve the accuracy?

c) If you really wanted to do a good job, what method would you use instead? What is it about the Euler method that makes this second method a better choice? (Please explain, but be brief!)

7. The magnitude of the velocity v of a meteor approaching the earth is given by

$$v\frac{dv}{dr} = -\frac{GM}{r^2}$$

where r is the distance from the centre of the earth, M is the mass of the earth, and G is the universal gravitational constant. If $v = 0$ for $r = r_o$, solve for v as a function of r.

8. Consider the differential equation $y'' + 6y' + ky = 0$.

   Solve it for (a) $k = 8$ (b) $k = 9$ (c) $k = 10$.