

Math 311  
 Fall 2008  
 35 points total

**Graded Homework 1**

Name: \_\_\_\_\_

1) If  $y'' + (ty')^2 + y = y \cos(t)$

- a. What order is the D.E.?
- b. Is it linear or non-linear?

2) If  $y' + \sin(t)y = t^4$

- a. What order is the D.E.?
- b. Is it linear or non-linear?

3) Given  $\cos(t)y' + ty = 0$  with the initial condition  $y\left(\frac{\pi}{4}\right) = 2$

- a. Put the equation in standard form
- b. What is the largest t-interval on which you are guaranteed a unique solution exists for this equation.

4) Solve the initial value problem  $y' = \frac{2t}{y(1-y)}$  and  $y(0) = 1$ .

5) Find the general solution to  $y' + \frac{5}{t}y = -3t^3$  when  $t > 0$ .

6) For the differential equation  $y' = \alpha y(1-y)$ ,  $\alpha > 0$ ,  $-\infty < y_0 < \infty$

- a. Graph  $f(y)$  versus  $y$ .
- b. Find the equilibrium points and determine whether each is asymptotically stable or unstable.

7) Write the initial value problem that models the following problem:

Last year the number of bobcats was estimated to be 25 bobcats in the mostly isolated region of Thompson's Valley, Virginia. Bobcat densities are limited due to overlapping home ranges and the carrying capacity was estimated to be 32 bobcats. Also, biologists estimated that on average 7 yearling males emigrate to other regions

with only 4 yearlings immigrating into the valley. The birth rate minus the death rate was estimated to be 0.021.

8) Match the differential equation with the direction field.

a)  $y' = y + t$

b)  $y' = t(t - 2)$

c)  $y' = y(t - 1)^2$

d)  $y' = y^2 - 1$

