Math 3301 **Homework Set 3** **10 Points**

Modeling, Part II

For these problems you MUST set up and solve the appropriate IVP(s) in order to receive any credit for the problem. Any decimals must be to at least the 4th decimal place.

1. A population of fish in a lake grows at a rate proportional to its population. There are originally 500 fish in the lake and in the absence of any outside factors the population will double in 2 months time (assume 4 weeks/month). Initially, each week there is a net migration of 40 fish into the lake and predators eat 60 fish. After 3 weeks a disease hits the lake that kills 20 fish/week. How many fish are there really after 2 months time?

2. An 80 kg person jumps out of a plane with a downward velocity of 3 m/s. The air resistance experienced by the skydiver at this time is given by 10*v*. After freefalling for 30m a parachute opens and the air resistance increases to 30*v*. If the skydiver lands 20 seconds after opening the parachute what was his/her velocity upon landing.

3. Let's go back to #2. 5 seconds after opening the parachute a second parachute opens that increases the air resistance to 60*v*. If the skydiver again lands 20 seconds after opening the second parachute what is the landing velocity of the skydiver?

Equilibrium Solutions

Find and classify the equilibrium solutions for each of the following differential equations.

4. $y' = 4 + 3y - y^2$

5. $y' = y^4 - 4y^2$

Euler's Method

6. Find the approximate value of the solution to the following IVP at $t = 1.8$ using both $h = 0.4$ and $h = 0.2$. All decimal work should be to at least the 4th decimal place.

$$y' + y\sin(2y) = t^2 \qquad y(1) = -2$$