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 insects in a field grows at a rate proportional to its population. There are originally 300 insects in the field and in the absence of any outside factors there will be 1200 insects in 2 months time (assume 4 weeks/month). Each week there is a net migration of 30 insects into the field and the local bird population eats 40 insects. Will the insects survive? If not when do they die out?

2. Take the situation from **#1**. After 6 weeks a disease outbreak kills 120 insects per week. Do the insects now survive? Again, if not when do they die out?

3. A 20 kg object is dropped off a bridge with an initial velocity of 75 cm/sec downwards and the object experience air resistance in the form 30*v* as it falls. If the object hits the ground with a velocity of 5m/s how high was bridge off the ground?

Equilibrium Solutions

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

4. $y' = -3y^2\left(y^2 + 12y + 32\right)$

5. $y' = -3y\left(1 - \mathbf{e}^{4-2y}\right)$

Euler's Method

6. Find the approximate value of the solution to the following IVP at $t = 2.8$ using both $h = 0.4$ and $h = 0.2$. All decimal work should be to at least the 4th decimal place.

$$y' + \sin\left(y\right) = y + t^2 \qquad y\left(2\right) = 7$$