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 200
fish in the lake and in the absence of any outside factors the population will triple in 2 months time
(assume 4 weeks/month). Initially, each week there is a net migration of 22 fish into the lake and
predators eat 36 fish. After 3 weeks a disease hits the lake that kills 19 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 $8v$. After freefalling for 40 m a parachute opens and
the air resistance increases to $30v$. If the skydiver lands 60 seconds after opening the parachute what
was his/her velocity upon landing.

3. Let’s go back to #2. 10 seconds after opening the parachute the skydiver realizes that it hasn’t really
diminished his/her speed all that much and opens another parachute and now has a total air resistance
of $90v$. What is the landing velocity of the skydiver now? Note that the skydiver no longer lands after
60 seconds.....

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

4. $y' = -y^2 (y + 2)(y - 4)$

5. $y' = 2y - by^2$, $b > 0$

Euler’s Method
6. Find the approximate value of the solution to the following IVP at $t = 0.4$ using both $h = 0.2$ and
$h = 0.1$. All decimal work should be to at least the 4th decimal place.

$$y' + 4 \cos(1 - y) = ty$$

$y(0) = 1$