Lab Expectations – Lab 9: A "Predator-Prey" Problem

1. Find the equilibrium points for the system.

2. Plot in pplane with correct scale (scale w/ origin at center and other equilibrium at center of first quadrant)
   What is the significance for the populations of food fish and selachians of the fact that the orbits are closed loops?

3. Explain why, as a function of x, that equation is true.
   Plot this equation in dfield on the same range as above.
   Why must the top and bottom half each closed orbit be plotted separately?

4. Solve the diff eq dy/dx.

5. a. With x=1 and C= ½ , find y by plotting.
   b. Find the values of y corresponding to x = 2, 3, … 10.
      Why do you get two values, if any? Approximate the largest value x_0 (to 3 decimals) for which there is no y value. Why is there only one y-value corresponding to x_0?
   c. Approximate the smallest value x_1 (to three decimals) for which there is a corresponding y. Why is there only one y value corresponding to x_1?

6. Plot G(y) over $0 < y < 6$.
   Explain why – if there is a positive value for y, then there will be two. Why is $\lim_{x \to \inf} F(x) = 0$? Why is it that for large x, there are no y values and for small x, there is no such y.

7. Plot x and y as functions of t.
   Do they appear to be periodic? Does the period depend on the initial condition?

8. Give reasons for each step of the x integral evaluation. Evaluate the y integral yourself. Where does the point (xbar, ybar) appear?

9. Explain how the system describes the effect of fishing on the population. Plot orbits for alpha = .05. Are they still closed? Compute average selachian and food fish populations. Compare these to averages from #8. How does this result relate to the question of the last page?

Graphs – 2, 3, 5, 6, 7, 9