MATH 1310 Programming Project #12
The Predator-Prey Model

1. Consider the predator-prey equations from §5.5 of your textbook:

$$db/dt = (\lambda - \epsilon p)b$$

$$dp/dt = (-\delta + \eta b)p$$

where p represents the population of predators and b represents the population of prey. Write a program to plot the graphs of the variables p and b. Use $\lambda = 0.05, \epsilon = 0.0002, \delta = 0.06, \eta = 0.0003$, and use initial values $b_0 = 320$, $p_0 = 120$, and run the the program from $t = 0$ days to $t = 300$ days with $\Delta t = 1$ day. Hint: The Euler's method program should be a good starting model for this program; however, in that program, you only needed to keep track of one dependent variable while this program requires you to track two dependent variables.

2. Run your program and make sure the window size is appropriate (this might take a few trials). Sketch the graphs you get. Be sure to clearly label the axes to reflect your chosen window size, and label the p and b curves. Explain in words what is happening (and when) to the two populations.

3. Modify your program so that it plots only the p curve.

   (a) Add a FOR loop to your program so that it plots the graphs of p corresponding to $\delta = 0.04, 0.05, 0.06, 0.07, 0.08$ without clearing the screen between plots. Sketch the output with each curve clearly labeled. Explain the role of the parameter δ in determining the population of predators.

   (b) Repeat part (b) except with δ fixed at 0.06 and η varying over the values $\eta = 0.0001$, 0.0002, 0.0003, 0.0004, 0.0005. Again, sketch the five-curve output with each curve clearly labeled. Explain the role of the parameter η in determining the population of predators.