Goal: To study the effect of various levels of harvesting on the steady state fish population gotten from the modified logistic equation:

\[ \frac{dP}{dt} = kP(1 - \frac{P}{N}) - C = f(P) \]

The value of C denotes how many fished per year are caught. When C = 0, no fish are caught and the model reduces to the standard logistic model. To simplify our analysis, we will set k=1 and N =1 so that

\[ \frac{dP}{dt} = P(1 - P) - C = f(P) \]

Directions: Each person in the group will examine the equation for a different value of C.

Person 1: C = 0, Person 2: C = .05, Person 3: C = 1/8, Person 4: C = .2

On Monday, you will hand in your draft write up, I will randomly shuffle them and redistribute them to the class. Put a pseudonym on the paper. Each person will read another person’s paper and give them feedback on their write up. You will then revise it for Wednesday’s class.

Guidelines:

1. Calculate the equilibrium solutions for your equation. Include a graph of the function f(P) in the (P, f(P)) space. Show your calculation clearly. Explain how the equilibrium solutions are related to the graph.

2. Draw a phase line diagram for your equation. Explain the relationship between the phase line diagram and the (P, f(P)) graph.

3. Draw various solutions to your equation on a slope field diagram. How do you know whether a solution increases or decreases?

4. For the solution with initial condition \( P(t = 0) = .75 \) units of fish, describe the long term behavior of the solution.