Homework One

Introduction to Epidemiological Modeling

College of the Atlantic

Due Friday, April 7, 2023

Here are some instructions for how to submit this part of the assignment.

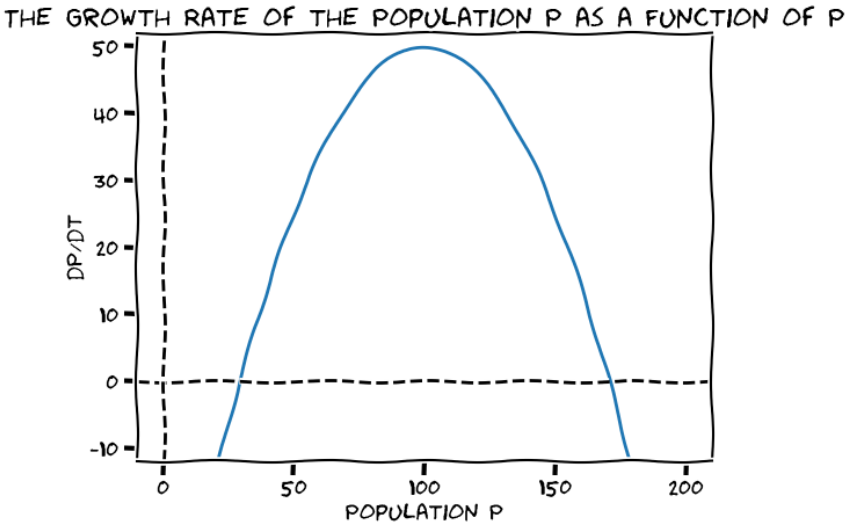
- Do the problems by hand using pencil (or pen) and paper. There is no need to type this assignment.
- If you like working on a tablet, go for it.
- Make a pdf scan of your work using genius scan or some similar scanning app. Please make the homework into a single pdf, not multiple pdfs or pngs.
- Submit the assignment on google classroom. Please don't email it to me. Thanks.
- If you want, you can do these problems in pairs and submit one assignment for the two of you.

1. Consider the differential equation

$$\frac{dP}{dt} = f(P)\,, \tag{1}$$

where $f(P)$ is shown in the figure. We will only consider non-negative P.

(a) Sketch the solution for the initial value $P(0) = 25$.
(b) Sketch the solution for the initial value $P(0) = 50$.
(c) Sketch the solution for the initial value $P(0) = 125$.
(d) Sketch the solution for the initial value $P(0) = 200$.
(e) To what situation(s) might this equation apply?



2. Consider the differential equation

$$\frac{dP}{dt} = -2P \, . \tag{2}$$

(a) Write down a solution to this equation.

(b) What happens to the solution for large t?

3. Consider the differential equation

$$\frac{dy}{dt} = 5y - 3 \, . \tag{3}$$

(a) Is $y(t) = 2e^{5t}$ a solution?

(b) Is $y(t) = 2e^{5t} + \frac{3}{5}$ a solution?

For this problem, please be sure to show your work.