

Qualitative Solutions and Phase Lines

Introduction to Epidemiological Modeling

College of the Atlantic. April 4, 2023

1. Consider the following differential equation:

$$\frac{dN}{dt} = 0.5N, \quad (1)$$

for non-negative N .

- (a) Sketch the right-hand side of the equation.
- (b) Use this sketch to then sketch a few solutions of the differential equation.
- (c) What is the long-term fate of all starting values for N ?
- (d) To what situation might this equation apply?

2. Consider the differential equation

$$\frac{dP}{dt} = f(P), \quad (2)$$

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

- (a) Sketch the solution for the initial value $P(0) = 50$.
- (b) Sketch the solution for the initial value $P(0) = 125$.
- (c) Sketch the solution for the initial value $P(0) = 200$.
- (d) Sketch the solution for the initial value $P(0) = 400$.
- (e) To what situation(s) might this equation apply?

