Differential Equations in Biology

Your Name

1 Introduction

This document covers the application of differential equations in biology.

2 Population Dynamics

2.1 Logistic Growth Model

2.2 Example Problem

Solve the logistic growth model given by $\frac{dP}{dt} = rP\left(1 - \frac{P}{K}\right)$, where $r = 0.1$ and $K = 1000$, for an initial population of $P(0) = 100$.

Solution

The logistic growth equation is:

$$\frac{dP}{dt} = rP\left(1 - \frac{P}{K}\right).$$

Separating variables and integrating, we get:

$$\int \frac{1}{P\left(1 - \frac{P}{K}\right)} dP = \int r\, dt.$$

Solving this integral, we find:

$$P(t) = \frac{K}{1 + \left(\frac{K - P_0}{P_0}\right) e^{-rt}}.$$

Substituting $r = 0.1$, $K = 1000$, and $P_0 = 100$, we get:

$$P(t) = \frac{1000}{1 + 9e^{-0.1t}}.$$