

Biology Assignment:

Population

Student Learning Outcomes:

7.1.1	Recognize homogeneous and nonhomogeneous linear differential equations
7.1.3	Solve initial-value and boundary-value problems involving linear differential equations
7.2.1	Write the general solution to a nonhomogeneous differential equation

Assignment Overview

If the carrying capacity K and the growth rate r , of a given species is known, we can use the *logistic differential equation* to represent the population change:

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

Where $P(t)$ represents the population of the species with respect to time, and $P_0 = P(0)$ gives the initial population.

The wolf population in an area has a growth rate of about 27.11% per year. Assume the carrying capacity is 350 in the area, and the current population is 173.

Exercise 1: Write the logistic equation for the described scenario. Include the initial condition.

Exercise 2: Solve the initial value problem to get a formula for $P(t)$.

Exercise 3: What does the model predict the population to be in 5 years?

Exercise 4: Based on the model, what happens if the population reaches 380 wolves?