PEEBEDU

Population Growth Calculator

Name: _____ **Period:** _____ **Date:** _____

> Open **peebedu.com** and navigate to **Population Growth Calculator**. Read through the **Introduction** slides, which cover population growth basics, exponential growth, carrying capacity, and logistic growth. Click **Get Started** to begin.

Part 1 — Model Evaluation (MAPP Framework)

Scientific models are simplified representations of complex biological phenomena. Use the MAPP framework below to evaluate the Population Growth Calculator as a scientific model.

M — Mode

What type of model is the Population Growth Calculator? Describe how this computational simulation represents population dynamics.

A — Accuracy

(a) Identify two things this simulation represents **accurately** about how populations grow and are regulated. For each, name the specific simulation feature and explain what aspect of population ecology it demonstrates.

(b) Identify two things this simulation **oversimplifies or leaves out** about real-world population growth. Consider what biological or environmental factors beyond birth rate, death rate, and carrying capacity would influence how a population actually changes over time.

P — Purpose

What is the learning goal of this simulation? Explain how the Population Growth Calculator is designed to help you understand the relationship between birth rate, death rate, carrying capacity, and population size.

P — Permanency

Could this model change with new scientific evidence? Describe one way that new discoveries about population ecology might change or improve a simulation like the Population Growth Calculator. Explain why mathematical models of population growth are revised as new evidence becomes available.

Small-Group Discussion

With your group, discuss the following:

- What are the strengths of this simulation as a model for understanding population growth?
- What are its limitations?
- If you could add one feature to improve this simulation, what would it be and why?
- How does switching between exponential and logistic growth help you understand how resource limitations shape population dynamics?

Part 2 — Free Response Questions

Conceptual Analysis

Question 1 — Exponential Growth and Resource Limitation

> *Simulation Task: Select the **Exponential Growth** equation. Set the initial population to a low value and the maximum per capita growth rate to 0.5. Observe the shape of the population curve on the graph. Then switch to the **Logistic Growth** equation using the same initial population and growth rate. Adjust the carrying capacity slider and observe how the curve changes at different carrying capacity values.*

(A) (1 pt) **Describe** the process by which birth rate, death rate, and population size determine population growth.

(B) (1 pt) **Explain** why reproduction without constraints results in exponential growth.

(C) (1 pt) **Predict** what would happen to a population of organisms growing exponentially in a closed ecosystem if a sudden reduction in a key resource cut the environment's carrying capacity in half.

(D) (1 pt) **Justify** your prediction.

EK 8.3.A.2 (i, ii), 8.4.A.1, 8.4.A.2

Analyze Model / Visual Representation

Question 2 — Density-Dependent Factors and the Logistic Growth Curve

> *Simulation Task: Select the **Logistic Growth** equation. Set the carrying capacity to 1000 and the initial population to 10. Use a growth rate of 0.3. Click on the **(K–N)/K** term in the equation to read its description. Now slowly increase the initial population slider from 10 toward 1000 and observe how the growth rate curve (dN/dt) changes. Note where dN/dt is highest and what happens as N approaches K.*

(A) (1 pt) **Describe** the process by which density-dependent and density-independent factors limit population growth.

(B) (1 pt) **Explain** the relationship between population size and growth rate in the logistic model.

(C) (1 pt) **Represent** the relationship between population size (N) and time (t) for a population undergoing logistic growth. Label the carrying capacity, the point of maximum growth rate, and the region where density-dependent factors are most strongly limiting growth.

Draw your graph here.

(D) (1 pt) **Explain** how changes in the availability of resources within an ecosystem could act as a selective pressure on a population.

EK 8.4.A.1, 8.4.A.2, 7.2.A.2