

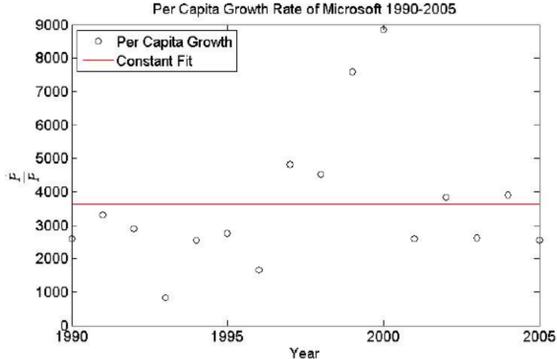
Disease Lab

Laboratory Experiences in Mathematical Biology



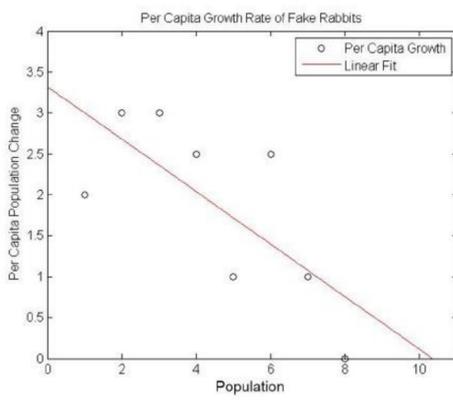
Assessment Items: Primary assessment of student learning is taken from students' written reports. Additional assessment items targeting lab objectives are included here along with their targeted learning levels (see Pedagogical Resources for additional discussion of leaning levels).

- (Discover-a-Relation, Construct-a-Concept) John is studying how some businesses flourish over time. Using the reported per capita employee growth of Microsoft from 1990-2005, John calculates and draws the line of best fit. He then conjectures that Microsoft experienced exponential employee growth over that interval. Explain why you either agree or disagree with John's assessment.



Plot for test item 1 displays percapita growth data of Microsoft employees from 1990 to 2005 along with the line of best fit.

- (Creative-Thinking, Comprehension-and-Communication) Given data describing the population, P over time, list three different plots (or ways of arranging the data) that may help you develop a model and and give reasons for your choices.
- (Discover-a-Relation, Comprehension-and-Communication) On the virtual farm, the virtual farmer has been simulating a new breed of digital rabbits. His observations are presented in the plot below. Use the virtual farmer's data to develop a population model. Be sure to give a biological description of any parameters you may introduce along with a description of their units.



Plot for test item 3. Percapita growth of a fictional rabbit population is displayed along with the line of best fit.

- (Algorithmic Skill) Tumors are cellular populations, T , growing in a confined space where the availability of nutrients is limited. The Gompertz curve has been successfully fit to data of growth of tumors. The Gompertz differential equation is of the form

$$\frac{dT}{dt} = rT \log\left(\frac{K}{T}\right)$$

where r is the intrinsic growth rate. What are the equilibrium solutions of the Gompertz equation?

(Comprehension-and-Communication) Sketch a few solution curves that illustrate the dynamics of the model.

- (Appreciation) In your opinion what is the role of mathematics in the study of disease? Mathematics is (circle one)
 - of fundamental importance as the study of disease is a quantitative science
 - useful to some scientists in solving problems of limited use to a few scientists working in theoretical areas
 - irrelevant

Write a sentence or two explaining your choice above.