Epidemic

An Introduction to Logistic Functions

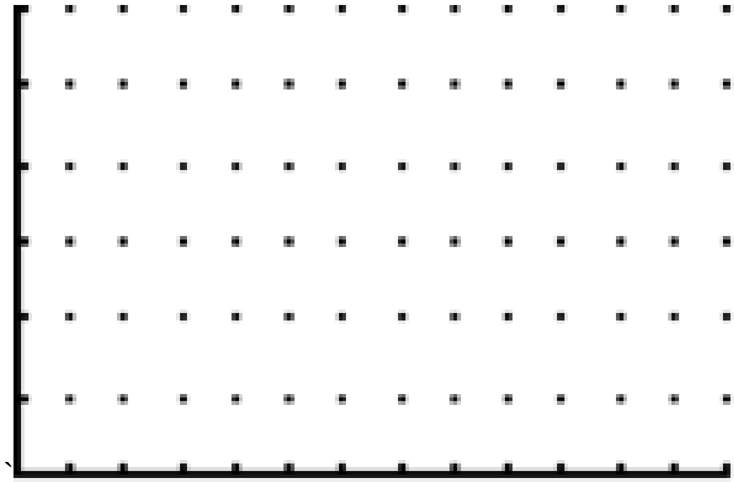
This exploration models the spread of a disease through a community with a finite population.

Introduction

Many times we attempt to model the behavior of an event through an artificial simulation. This exploration will mimic the spread of a disease such as a cold. The model assumes that a person with the disease will pass it on to two other people each day.

Procedure

1. Assign a number to each student in the class.
2. Using a TI-84 calculator, choose a student a random using the command **RandInt(1,N)** where N represents the number of students in the class.
3. The person selected is the index case. Have that person stand.
4. Keep track of the number of people standing after each iteration.
5. This demonstration assumes that each infected person can pass the disease to two other people each day. Press ENTER twice as many times as the number of people standing on the previous turn. Continue until all students are standing.
6. Create a scatter plot with the number of days required to infect all student in List1 and the total number of students infected through that day in List2. Manually set the window wide enough to see a few extra days on the right side.
7. Copy the results of your StatPlot onto the graph on the next page.



Part 1. Graphical Analysis

1. For which x-values does the graph seem to flatten out?

2. Circle the location on the plot where the graph seems to be growing fastest.

3. Using your calculator, find a good curve fit. Which model seems to fit best? Store your model in Y_1.

4. Graph your equation over the top of the data points. How well does the curve fit your data?

Example 2. A population of rabbits in a large field is given by the formula $P(t) = \frac{1000}{1 + 121.51e^{-0.7t}}$, where t is the number of months after some rabbits were released into the field.

a) Determine the maximum number of rabbits this field can maintain.

b) What is the value of k?

c) What is the population when $t = 0$?

d) What is the population when the rate of growth is greatest?

e) Use your calculator to determine when the population reaches the value found in part d).