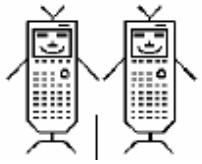
ALGEBRA II ACTIVITY 7:
POPULATION GROWTH WITH "CALCUMITES"

TIalgebra.com

ACTIVITY OVERVIEW:
In this activity we will

- Enter data about the ideal population growth of "calcumites"
- Set up a scatter plot and use regression to fit the data with an exponential model
- Enter data about the limited population growth of "calcumites"
- Set up a scatter plot and use regression to fit the data with a logistics model



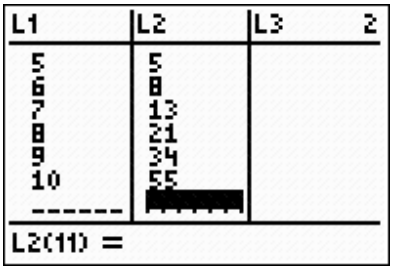
This is a pair of calcumites.

Calcumites are little creatures that threaten to take over the world. They come in pairs. Each pair mates after they are one year old. They mate once a year. Each year they produce one male/female pair. They never die.

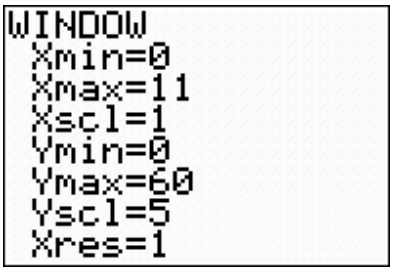
The table shows the number of pairs of calcumites over the first six years. How would this pattern continue?

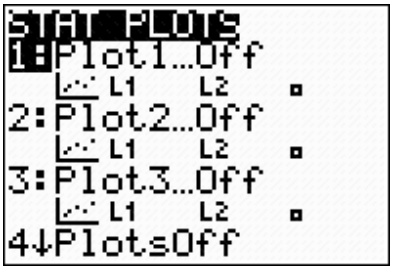
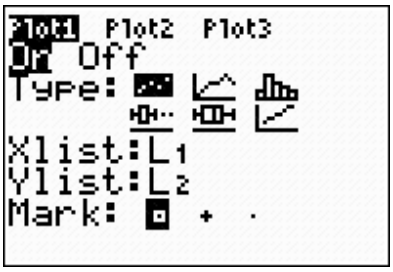
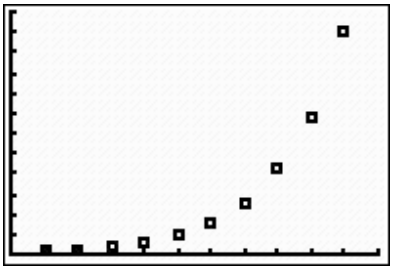
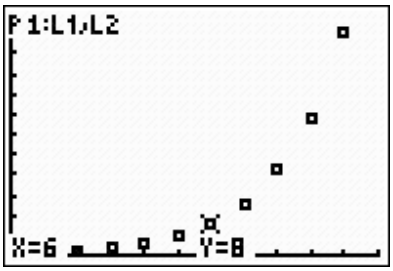
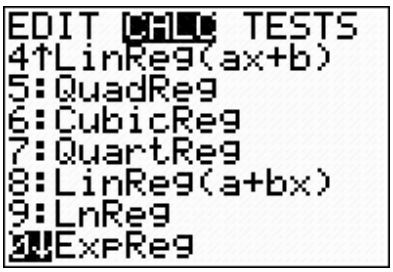
Year	Number of Pairs
1	1
2	1
3	2
4	3
5	5
6	8

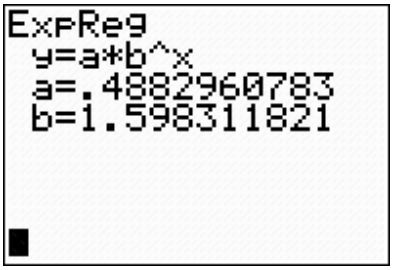
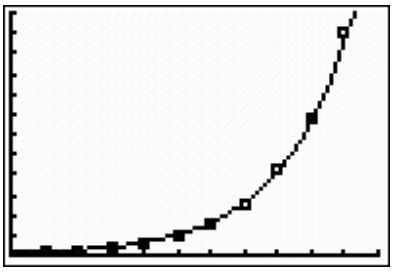
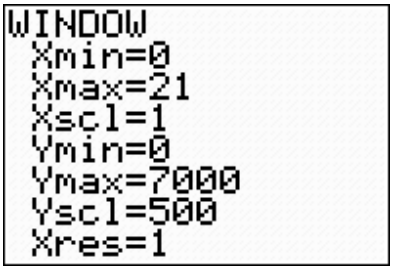
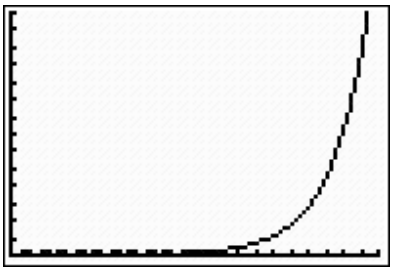
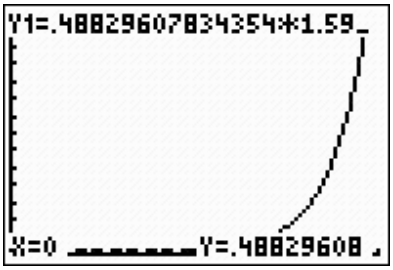
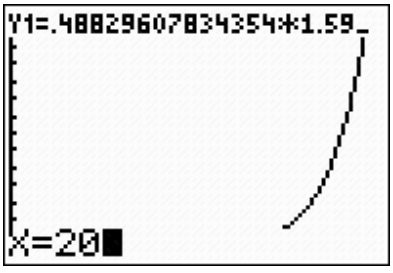
Press [STAT] [ENTER]. Type in the years 1-10 in **L1** and the number of pairs of calcumites in **L2**.



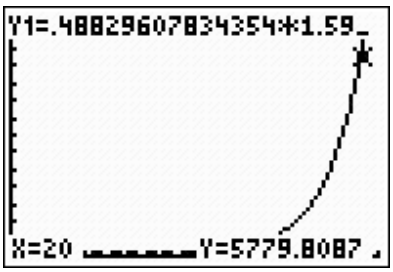
Press [WINDOW]. Set the window as shown.



Press [2nd][Y=] to prepare to set up a plot. Press [ENTER] or [1] to access **Plot 1**.	
Press [ENTER] to turn the plot **On**. Use the defaults for the remaining choices.	
Press [GRAPH]. Examine the plot.	
Press [TRACE]. Pick two points and calculate the slope between them. Pick another pair of points and calculate the slope. Do the slopes lead you to think a linear model will be appropriate for this data? What model might be appropriate?	
Press [STAT][▸] to access the CALC menu. Select **ExpReg** by pressing [0] or by moving the cursor to it and pressing [ENTER]. This will paste the command on the home screen.	
To instruct the calculator to run the regression on **L1** and **L2** and to put the resulting equation into $\mathbf{Y_1}$, press [2nd][1][,][2nd][2][,][VARS][▸][1][1].	

Press [ENTER] to execute.	
Press [GRAPH].	
Press [WINDOW]. Set the window as shown. This will allow examination of what happens over the first 20 years.	
Press [GRAPH]. What is happening to the population?	
Press [TRACE]. Press [▲] to trace **Y1** instead of **Plot 1**.	
Type [2][0] to instruct the calculator to jump to the point where $x = 20$.	

Press [ENTER] to execute. What will happen if the population continues to grow with no limitations?

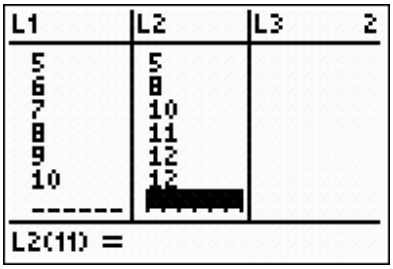


The calcumites cannot continue to grow like this! Eventually some of them begin to acquire diseases or viruses. Some starve. Some are eaten by TI-84+ Silver Editions. As in real populations, their growth is limited by resources and other environmental factors.

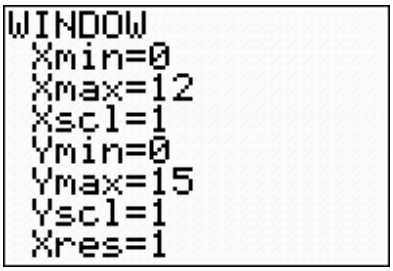
The table shows what the calcumite population might look like with such limits.

Year	Number of Pairs
1	1
2	1
3	2
4	3
5	5
6	8
7	10
8	11
9	12
10	12

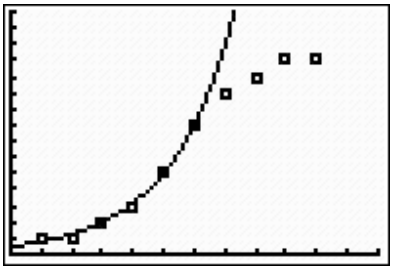
Enter the new data into **L1** and **L2**.



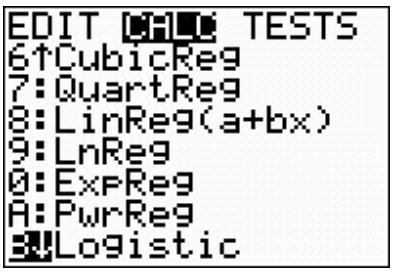
Press [WINDOW]. Set the window as shown.



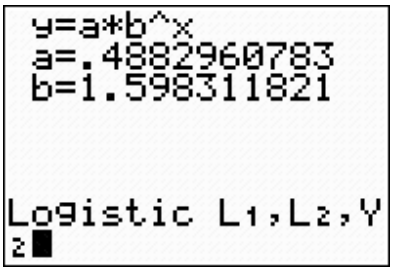
Press [GRAPH]. Why doesn't the exponential model fit this data? What kind of model might? Logistics models model population growth with limitations.



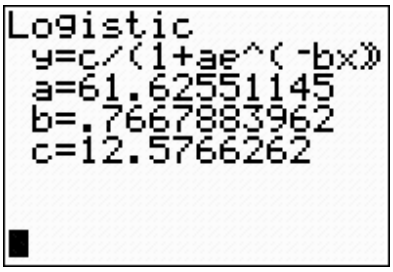
Press [STAT] [▶] to access the CALC menu. Select **Logistic** by pressing [ALPHA] [APPS] (to access the letter "B") or by moving the cursor to it and pressing [ENTER]. This will paste the command on the home screen.



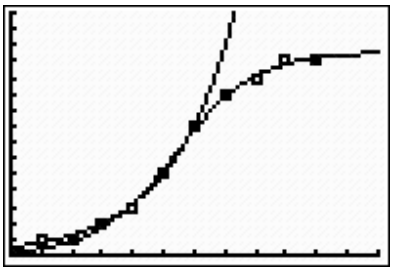
To instruct the calculator to run the regression on **L1** and **L2** and to put the resulting equation into $\mathbf{Y_2}$, press [2nd] [1] [,] [2nd] [2] [,] [VARS] [▶] [1] [2].



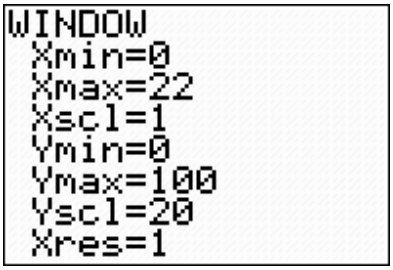
Press [ENTER] to execute.



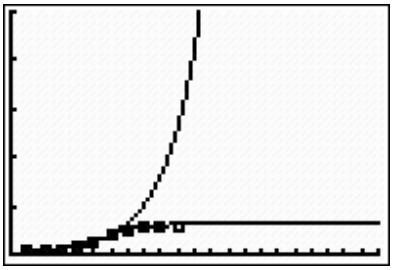
Press [GRAPH]. How do you think the population growth will continue past 10 years? Why do you think the population growth slows down before it levels off instead of just ascending quickly and suddenly leveling off?



Press [WINDOW]. Set the window as shown. This will allow examination of what happens over the first 20 years.



Press GRAPH. Describe the difference between the *ideal* growth (growth without limitations) and the *limited* growth.



Press TRACE. Press ▲ to trace **Y2** instead of **Plot 1**. Type 2 0 to instruct the calculator to jump to the point where $x = 20$. Press ENTER to execute. The maximum that a population can achieve with limitations is called its *carrying capacity*. What is the *carrying capacity* for this population?