PROBLEM 2: DEER POPULATION

Because of limitations in habitat and food sources, populations do not typically grow exponentially. Suppose that, based on experience, officials estimate that the size of a herd of deer *t* years from now can be estimated by the expression $\frac{10(5+3t)}{1+0.04t}$.

A. Find the size of the herd after 5 years, after 10 years, and after 50 years.

B. When does the rate of growth of the deer population appear to be greatest? Why do you think the rate of growth of the deer herd slows down? Explain your reasoning.

C. What appears to be the maximum number of deer this area can support? Explain your reasoning.

REFERENCE: *Precalculus, Third Edition,* by Larson and Hostetler, D.C. Heath and Company, 1993.

ONE SOLUTION TO PROBLEM 2: DEER POPULATION

A. **Find the size of the herd after 5 years, after 10 years, and after 50 years.**

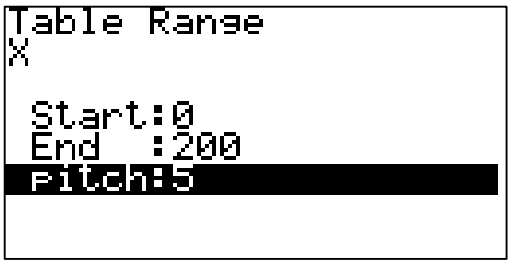
This problem can be solved in several ways. In this solution, a table is used. From the MAIN MENU, select "Table." Then,

- Clear any functions by highlighting them and pressing [F2] and [F1] .

  Alternatively, de-select them by highlighting them and pressing [F1] .

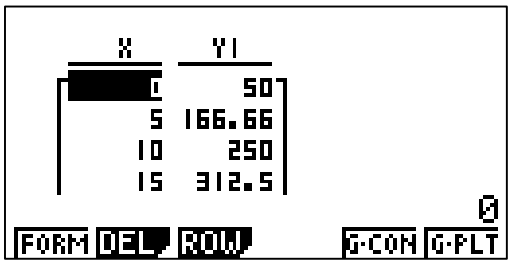
- Type in the formula and press [EXE] . See below left.

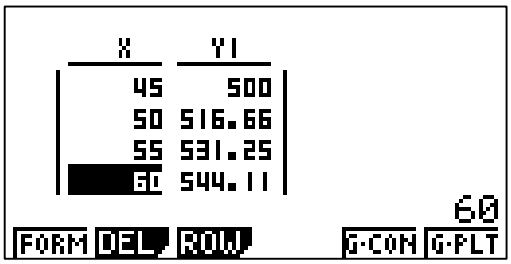
- Press [F5] to set the range of the table and view the table. You may wish to investigate from 0 to 200 years, incrementing by 5 years, as shown below right. Press [EXE] after each entry.



- To return to the previous screen, press [EXIT] . Press [F6] to see the table.

After 5 years there are approximately 166 deer in the herd, after 10 years there are approximately 250 deer in the herd, and after 50 years there are approximately 516 deer in the herd. Note that at the beginning of this study, there were 50 deer. See below.

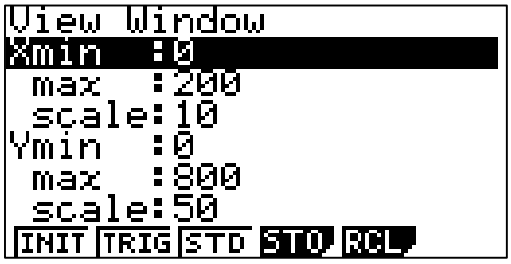


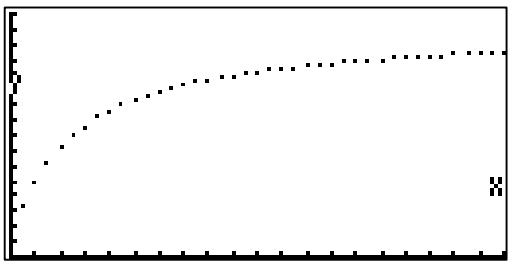


B. When does the rate of growth of the deer population appear to be greatest? Why do you think the rate of growth of the deer herd slows down? Explain your reasoning.

We'll draw a scatterplot of the data to investigate this.

- First, check the viewing window by pressing [SHIFT] [F3] . Based on the table information, one possible window is shown below left. Press [EXE] after each entry and [EXIT] when finished.
- Press [F6] to return to the table and [F6] again to create the scatterplot. See below right. Press [F1] and the arrow keys to trace through the points.





The rate of growth appears to be greatest between 0 and 50 years, as the slope of the curve is greatest between these years. One possible explanation for a slowing in the rate of growth is that the amount of food available to each animal decreases as the population increases.

C. What appears to be the maximum number of deer this area can support? Explain your reasoning.

The maximum number of deer that can be supported in this are appears to be approximately 670. The curve flattens out and becomes almost horizontal indicating a slope nearing zero, indicating little to no growth. In other words, the function appears to have a horizontal asymptote. Either by exploring a greater domain or by computing the algebra, this asymptote is actually at 750 deer. Of course, many factors will affect the deer population over such a long time period.