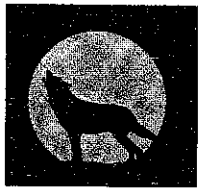
Linear Functions versus Exponential Functions

The aim of this investigation is to develop students' ability in recognizing data patterns likely to be modeled well by exponential growth functions. A further goal is to utilize graphing calculator experimentation to find a good regression model. Students should think analytically about the data being modeled as well as to use estimation and calculator-based tools.

Wolf Populations in the Midwest



Suppose that census counts of Midwest wolves began in 1980 and produced these estimates for several different years:

Time Since 1980 (in years)	0	2	5	7	10	13
Estimated Wolf Population	100	300	500	900	1,500	3,100

1) Plot the wolf population data on paper and decide whether a linear or exponential function seems likely to match the pattern of growth well. For the function type of your choice, experiment with different rules to see which rule provides a good model of the growth pattern. Provide your final rule here.

2) Use your graphing calculator to find both linear and exponential regression models for the given data pattern. Compare the fit of each function to the function you developed by experimentation in part 1.

3) What do the numbers in the linear and exponential function rules from part 2 suggest about the pattern of change in the wolf population?

4) Which model do you think best fits the data? Why?

5) Use the model for wolf population growth that you believe to be best to calculate population estimates for the missing years (1981, 1983, 1984, 1986, 1988, 1989, 1991, and 1992).

6) Use your model to give population estimates for the year 2000, 2005, and 2010. When will the population reach an estimated 500,000 wolves?

Alaskan Bowhead Whales

Suppose that census counts of Alaskan Bowhead Whales began in 1970 and produced these estimates for several different years:

Time Since 1970 (in years)	0	5	15	20	26	31
Estimated Whale Population	5,040	5,800	7,900	9,000	11,000	12,600

7. Plot the given whale population data on paper and decide which type of function seems likely to match the pattern of growth well. For the function type of your choice, experiment with different rules to see which provides a good model of the growth pattern. Provide your equation here.

8. Use your calculator to find both linear and exponential regression models for the data pattern. Compare the fit of each function to that of the function you developed by experimentation in problem 7.

9. Which model do you think best fits the data? Why?

10. What do the numbers in the linear and exponential function rules from problem 8 suggest about patterns of change in the whale population?

11. Use the model for whale population growth that you believe to be the best to calculate population estimates for the years 2002, 2005, and 2010.

12. When will the whale population reach 25,000?