

Name: _____

Date: _____ Pd: _____

AP Statistics: Modeling Non-Linear Data (2)

1. Biological populations can grow exponentially if not restrained by predators or lack of food. The gypsy moth outbreaks that occasionally devastate the forests of the Northeast illustrate approximate exponential growth. It is easier to count the number of acres defoliated by the moths than to count the moths themselves. Here are data on an outbreak in Massachusetts.

Year	1978	1979	1980	1981
Acres	63,042	226,260	907,075	2,826,095

- Plot the number of acres defoliated y against the year x .
- Verify that the pattern of growth appears exponential by finding a common ratio.
- Take the logarithm of the acres and plot the logarithms against the year. What does this scatterplot reveal?
- Find the least-squares regression line for the re-expressed data.
- Construct and interpret a residual plot for $\log(\hat{acre})$ on year.

f. Perform the inverse transformation to express \hat{y} as an exponential equation.

g. Display a scatterplot of the original data with the exponential curve model superimposed. Is your exponential function a satisfactory model for the data?

2. The U.S. Department of Health and Human Services characterizes adults as “seriously overweight” if they meet a certain weight criterion for their height as shown in the table below (only a portion of the chart is reproduced here).

Height	58	60	62	64	66	68	72	74	76	78
Pounds	138	148	158	169	179	190	213	225	238	250

Weights are given in pounds, without clothes. Height is measured without shoes. There is no distinction between men and women. Despite any reservations you may have about the department’s common standard for both genders, do the following:

- a. Which is the explanatory variable? Make a scatterplot of the data.

b. Perform a transformation to linearize the data. Do a least-squares regression on the transformed data and check the correlation coefficient.

c. Construct a residual plot of the transformed data. Interpret the residual plot.

d. Perform the inverse transformation and write the equation for your model.

e. Use your model to predict how many pounds a 5'10" adult would have to weigh in order to be classified by the department as "seriously overweight."