Chapter 20-Curved Patterns

37. Cellular Phones in the United States Cellular (or mobile) phones are everywhere these days, but it has not always been so. These data from CTIA, an organization representing the wireless communications industry, track the number of cellular subscribers in the United States. The data are semiannual, from 1985 through mid-2011

- (a) From what you have observed about the use of cellular telephones, what do you expect the trend in the number of subscribers to look like?
- (b) Create a scatterplot for the number of subscribers on the date of the measurement. Does the trend look as you would have expected?
- (c) Fit a linear equation with the number of subscribers as the response and the date as the explanatory variable. What do the slope and intercept tell you, if you accept this equation's description of the pattern in the data?
- (d) Create a scatterplot for the same data shown in the scatterplot done in part (b), but for this plot, put the response on a log scale. Does the scatterplot suggest that a curve of the form

$$\textit{Estimated } \log_e(\text{Number of Subscribers}) = b_0 + b_1 \text{ Date}$$

is a good summary?

- (e) Create a scatterplot for the percentage change in the number of subscribers versus the year minus 1984. (That's like treating 1984 as the start of the cellular industry in the United States.) Does this plot suggest any problem with the use of the equation of the log of the number of subscribers on the date? What should this plot look like for a log equation as in part (d) to be a good summary?
- (f) Summarize the curve in this scatterplot using a curve of the form

$$\textit{Estimated } \text{Percentage Growth} = b_0 + b_1 \, 1/(\text{Date} - 1984)$$

  Is this curve a better summary of the pattern of growth in the domestic cellular industry?

- (g) What's the interpretation of the estimated intercept b0 in the curve fit in part (f)?
- (h) Use the equation from part (f) to predict the number of subscribers in the next period. Do you think this will be a better estimate than that offered by the linear equation or logarithmic curve?