in Data Set 12 along with the additional values of 33+, 21+, 17+, 9+, and 1+, what do we know about the mean? Do the two results differ by much?

35. Trimmed Mean Because the mean is very sensitive to extreme values, we say that it is not a *resistant* measure of center. By deleting some low values and high values, the **trimmed mean** is more resistant. To find the 10% trimmed mean for a data set, first arrange the data in order, then delete the bottom 10% of the values and delete the top 10% of the values, and then calculate the mean of the remaining values. Refer to the BMI values for females in Data Set 1 in Appendix B, and change the highest value from 47.24 to 472.4, so the value of 472.4 is an outlier. Find (a) the mean; (b) the 10% trimmed mean; (c) the 20% trimmed mean. How do the results compare?

36. Harmonic Mean The **harmonic mean** is often used as a measure of center for data sets consisting of rates of change, such as speeds. It is found by dividing the number of values n by the sum of the *reciprocals* of all values, expressed as

$$\frac{n}{\Sigma \frac{1}{x}}$$

(No value can be zero.) The author drove 1163 miles to a conference in Orlando, Florida. For the trip to the conference, the author stopped overnight, and the mean speed from start to finish was 38 mi/h. For the return trip, the author stopped only for food and fuel, and the mean speed from start to finish was 56 mi/h. Is the actual "average" speed for the round-trip the mean of 38 mi/h and 56 mi/h? Why or why not? What is the harmonic mean of 38 mi/h and 56 mi/h, and does this represent the true "average" speed?

37. Geometric Mean The **geometric mean** is often used in business and economics for finding average rates of change, average rates of growth, or average ratios. Given n values (all of which are positive), the geometric mean is the nth root of their product. Find the *average growth factor* for money deposited in annual certificates of deposit for the past 5 years (as of this writing) with annual interest rates of 1.7%, 3.7%, 5.2%, 5.1%, and 2.7% by computing the geometric mean of 1.017, 1.037, 1.052, 1.051, and 1.027. What single percentage growth rate would be the same as having the five given successive growth rates? Is that result the same as the mean of the five annual interest rates?

38. Quadratic Mean The **quadratic mean** (or **root mean square,** or **R.M.S.**) is usually used in physical applications. In power distribution systems, for example, voltages and currents are usually referred to in terms of their R.M.S. values. The quadratic mean of a set of values is obtained by squaring each value, adding those squares, dividing the sum by the number of values n, and then taking the square root of that result, as indicated below:

$$\text{Quadratic mean} = \sqrt{\frac{\Sigma x^2}{n}}$$

Find the R.M.S. of these voltages measured from household current: 0, 100, 162, 162, 100, 0, −100, −162, −162, −100, 0. How does the result compare to the mean?

39. Median When data are summarized in a frequency distribution, the median can be found by first identifying the *median class,* which is the class that contains the median. We then assume that the values in that class are evenly distributed and we interpolate. Letting n denote the sum of all class frequencies, and letting m denote the sum of the class frequencies that *precede* the median class, the median can be estimated as shown here:

$$(\text{lower limit of median class}) + (\text{class width})\left(\frac{\left(\frac{n+1}{2}\right) - (m+1)}{\text{frequency of median class}}\right)$$

Use this procedure to find the median of the frequency distribution given in Exercise 29. How does the result compare to the median found from the original list of data, which is 33.0 years? Which value of the median is better: the value computed using the frequency table or the value of 33.0 years?