This chapter introduces the statistical tools that are basic to good ergonomic design. After completing this chapter, we will be able to solve problems in a wide variety of different disciplines as well. We will be able to answer questions such as these:

- What percentages of men and women can easily navigate in an area with the height clearance of 80 in. that is stipulated in the Americans with Disabilities Act?
- What percentages of men and women satisfy the flight cabin crew requirement of having a height between 5 ft 2 in. and 6 ft 1 in.?
- What percentage of women are eligible for membership in Tall Clubs International because they are at least 5 ft 10 in. tall?
- Current doorways are typically 6 ft 8 in. tall, but if we were to redesign doorways to accommodate 99% of the population, what should the height be?

## 6-1 Review and Preview

The preceding chapters introduced some extremely important characteristics of data. In Chapter 2 we considered the distribution of data, and in Chapter 3 we considered some important measures of data sets, including measures of center (such as the mean) and measures of variation (such as the standard deviation). In Chapter 4 we discussed basic principles of probability, and in Chapter 5 we presented the concept of a probability distribution. In Chapter 5 we considered only *discrete* probability distributions, but in this chapter we introduce *continuous* probability distributions. To illustrate the correspondence between area and probability, we begin with a *uniform distribution*, but most of this chapter focuses on *normal distributions.* Normal distributions occur often in real applications, and they play an important role in methods of inferential statistics. Here we present concepts of normal distributions that will be used often in the remaining chapters. Several of the statistical methods discussed in later chapters are based on concepts related to the central limit theorem discussed in Section 6-5. Many other sections require normally distributed populations, and Section 6-6 presents methods for analyzing sample data to determine whether the sample appears to be from a normally distributed population.

**DEFINITION** If a continuous random variable has a distribution with a graph that is symmetric and bell-shaped, as in Figure 6-1, and it can be described by the equation given as Formula 6-1, we say that it has a **normal distribution.**

**Formula 6-1**

$$y = \frac{e^{-\frac{1}{2}\left(\frac{x-\mu}{\sigma}\right)^2}}{\sigma\sqrt{2\pi}}$$

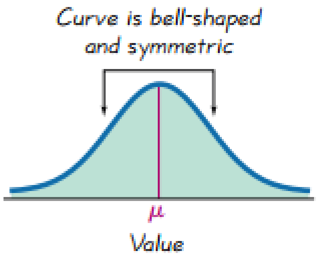


**Figure 6-1**
**The Normal Distribution**

We won't actually use Formula 6-1, and we include it only to illustrate that any particular normal distribution is determined by two parameters: the mean, $\mu$, and standard deviation, $\sigma$. In that formula, the letter $\pi$ represents the constant value 3.14159 . . . and $e$ represents the constant value 2.71828 . . . . The symbols $\mu$ and $\sigma$ represent