Meta-Analysis

The term *meta-analysis* refers to a technique of doing a study that essentially combines results of other studies. It has the advantage that separate smaller samples can be combined into one big sample, making the collective results more meaningful. It also has the advantage of using work that has already been done. Meta-analysis has the disadvantage of being only as good as the studies that are used. If the previous studies are flawed, the "garbage in, garbage out" phenomenon can occur. The use of meta-analysis is currently popular in medical research and psychological research. As an example, a study of migraine headache treatments was based on data from 46 other studies. (See "Meta-Analysis of Migraine Headache Treatments: Combining Information from Heterogeneous Designs," by Dominici et al., *Journal of the American Statistical Association,* Vol. 94, No. 445.)

Because this P-value is less than the significance level of 0.01, we reject the null hypothesis and support the claim that supermodels have heights with a standard deviation that is less than 2.6 in. for the population of women.

If technology is not available, the P-value method of testing hypotheses is a little challenging because Table A-4 allows us to find only a range of values for the P-value. Let's proceed instead with the critical value method of testing hypotheses as outlined in Figure 8-2 from Section 8-2.

Step 1: The claim that "the standard deviation is less than 2.6 in." is expressed in symbolic form as $\sigma < 2.6$ in.

Step 2: If the original claim is false, then $\sigma \geq 2.6$ in.

Step 3: The expression $\sigma < 2.6$ in. does not contain equality, so it becomes the alternative hypothesis. The null hypothesis is the statement that $\sigma = 2.6$ in.

$$H_0: \sigma = 2.6 \text{ in.}$$
$$H_1: \sigma < 2.6 \text{ in.} \quad \text{(original claim)}$$

Step 4: The significance level is $\alpha = 0.01$.

Step 5: Because the claim is made about σ, we use the χ^2 (chi-square) distribution.

Step 6: The test statistic is calculated by using $\sigma = 2.6$ in. (as assumed in the above null hypothesis), $n = 10$, and $s = 0.7997395$ in., which is the unrounded standard deviation computed from the original list of 10 heights. We get this result:

$$\chi^2 = \frac{(n-1)s^2}{\sigma^2} = \frac{(10-1)(0.7997395)^2}{2.6^2} = 0.852$$

The critical value of $\chi^2 = 2.088$ is found from Table A-4, and it corresponds to 9 degrees of freedom and an "area to the right" of 0.99 (based on the significance level of 0.01 for a left-tailed test). See Figure 8-11.

Step 7: Because the test statistic is in the critical region, we reject the null hypothesis.

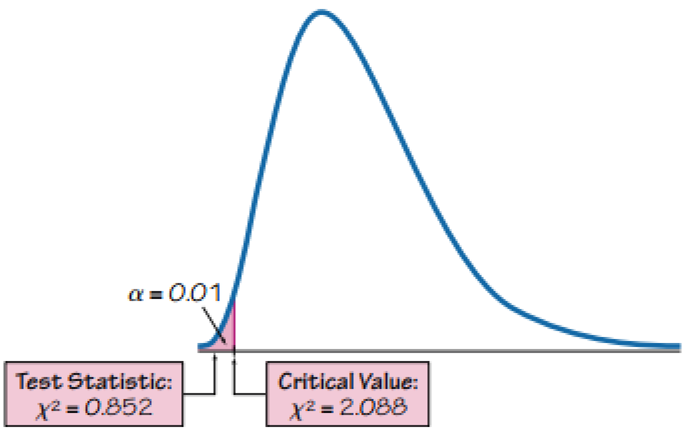

Figure 8-11 **Testing the Claim that $\sigma < 2.6$ in.**

Interpretation

There is sufficient evidence to support the claim that supermodels have heights with a standard deviation that is less than 2.6 in. for the population of women. Heights of supermodels have much less variation than heights of women in the general population.