

Find the  $\alpha$  value at the top of Table G, and find the corresponding degrees of freedom in the left column. The critical value is located where the two columns meet—in this case, 24.996. See Figure 8–31.

**Figure 8–31**  
Locating the Critical Value in Table G for Example 8–21

| Degrees of freedom | $\alpha$ |      |       |      |      |      |        |       |      |       |
|--------------------|----------|------|-------|------|------|------|--------|-------|------|-------|
|                    | 0.995    | 0.99 | 0.975 | 0.95 | 0.90 | 0.10 | 0.05   | 0.025 | 0.01 | 0.005 |
| 1                  |          |      |       |      |      |      |        |       |      |       |
| 2                  |          |      |       |      |      |      |        |       |      |       |
| ⋮                  |          |      |       |      |      |      |        |       |      |       |
| 15                 |          |      |       |      |      |      | 24.996 |       |      |       |
| 16                 |          |      |       |      |      |      |        |       |      |       |
| ⋮                  |          |      |       |      |      |      |        |       |      |       |

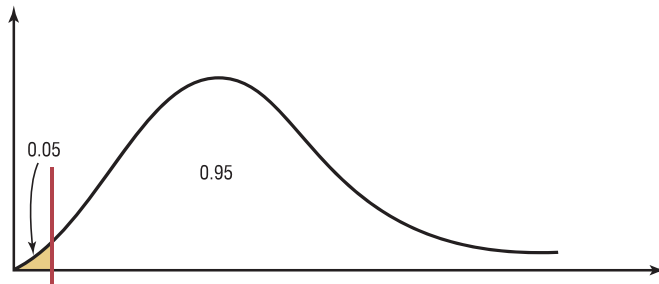
**Example 8–22**

Find the critical chi-square value for 10 degrees of freedom when  $\alpha = 0.05$  and the test is left-tailed.

**Solution**

This distribution is shown in Figure 8–32.

**Figure 8–32**  
Chi-Square Distribution for Example 8–22



When the test is left-tailed, the  $\alpha$  value must be subtracted from 1, that is,  $1 - 0.05 = 0.95$ . The left side of the table is used, because the chi-square table gives the area to the right of the critical value, and the chi-square statistic cannot be negative. The table is set up so that it gives the values for the area to the right of the critical value. In this case, 95% of the area will be to the right of the value.

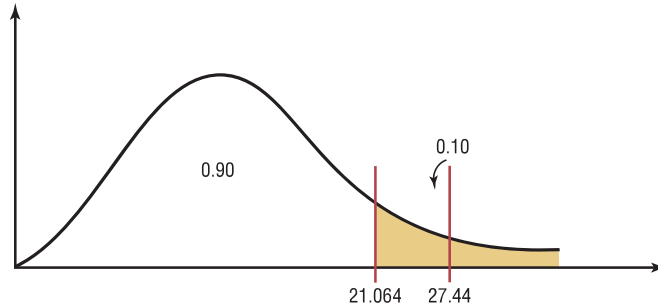
For 0.95 and 10 degrees of freedom, the critical value is 3.940. See Figure 8–33.

**Figure 8–33**  
Locating the Critical Value in Table G for Example 8–22

| Degrees of freedom | $\alpha$ |      |       |       |      |      |      |       |      |       |
|--------------------|----------|------|-------|-------|------|------|------|-------|------|-------|
|                    | 0.995    | 0.99 | 0.975 | 0.95  | 0.90 | 0.10 | 0.05 | 0.025 | 0.01 | 0.005 |
| 1                  |          |      |       |       |      |      |      |       |      |       |
| 2                  |          |      |       |       |      |      |      |       |      |       |
| ⋮                  |          |      |       |       |      |      |      |       |      |       |
| 10                 |          |      |       | 3.940 |      |      |      |       |      |       |
| ⋮                  |          |      |       |       |      |      |      |       |      |       |

**Step 4** Make the decision. The decision is to reject the null hypothesis since the test value, 27.44, is greater than the critical value, 21.064, and falls in the critical region. See Figure 8–37.

**Figure 8–37**  
Critical and Test Value  
for Example 8–25



**Step 5** Summarize the results. There is enough evidence to support the claim that the standard deviation is greater than 8.

**Example 8–26**

**Nicotine Content of Cigarettes**

A cigarette manufacturer wishes to test the claim that the variance of the nicotine content of its cigarettes is 0.644. Nicotine content is measured in milligrams, and assume that it is normally distributed. A sample of 20 cigarettes has a standard deviation of 1.00 milligram. At  $\alpha = 0.05$ , is there enough evidence to reject the manufacturer’s claim?

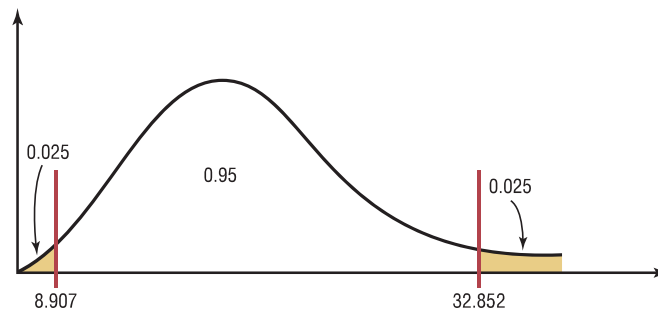
**Solution**

**Step 1** State the hypotheses and identify the claim.

$$H_0: \sigma^2 = 0.644 \text{ (claim)} \quad \text{and} \quad H_1: \sigma^2 \neq 0.644$$

**Step 2** Find the critical values. Since this test is a two-tailed test at  $\alpha = 0.05$ , the critical values for 0.025 and 0.975 must be found. The degrees of freedom are 19; hence, the critical values are 32.852 and 8.907, respectively. The critical or rejection regions are shown in Figure 8–38.

**Figure 8–38**  
Critical Values for  
Example 8–26



**Step 3** Compute the test value.

$$\chi^2 = \frac{(n - 1)s^2}{\sigma^2} = \frac{(20 - 1)(1.0)^2}{0.644} = 29.5$$

Since the standard deviation  $s$  is given in the problem, it must be squared for the formula.

**Step 4** Make the decision. Do not reject the null hypothesis, since the test value falls between the critical values ( $8.907 < 29.5 < 32.852$ ) and in the noncritical region, as shown in Figure 8–39.