With $\bar{x} = 60.7$ and $E = 2.60503$, we construct the confidence interval as follows:

$$\bar{x} - E < \mu < \bar{x} + E$$

$$60.7 - 2.60503 < \mu < 60.7 + 2.60503$$

$$58.1 < \mu < 63.3$$ (rounded to one decimal place more than the original sample values)

Interpretation

This result could also be expressed in the format of (58.1, 63.3) or the format of 60.7 ± 2.6. We are 95% confident that the limits of 58.1 mi/h and 63.3 mi/h actually do contain the value of the population mean μ. It appears that the mean speed is below the speed limit of 65 mi/h.

Because σ is rarely known, confidence interval estimates of a population mean μ almost always use the Student t distribution instead of the standard normal distribution. Here are some important properties of the Student t distribution.

Important Properties of the Student *t* Distribution

1. The Student t distribution is different for different sample sizes. (See Figure 7-5 for the cases $n = 3$ and $n = 12$.)
2. The Student t distribution has the same general symmetric bell shape as the standard normal distribution, but has more variability (with wider distributions) as we expect with small samples.
3. The Student t distribution has a mean of $t = 0$ (just as the standard normal distribution has a mean of $z = 0$).
4. The standard deviation of the Student t distribution varies with the sample size, but it is greater than 1 (unlike the standard normal distribution, which has $\sigma = 1$).
5. As the sample size n gets larger, the Student t distribution gets closer to the standard normal distribution.

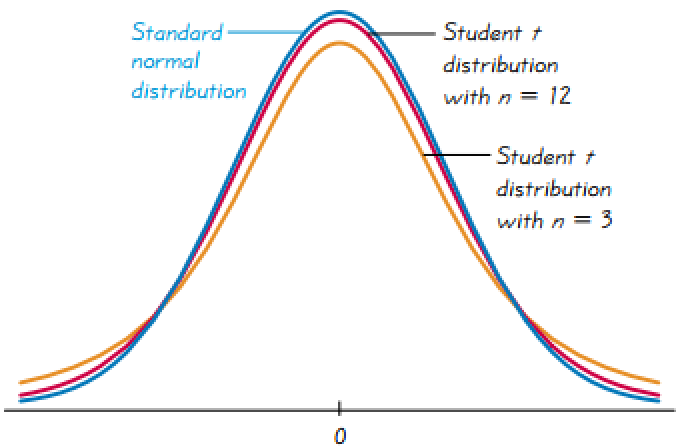

Figure 7-5 Student *t* Distributions for $n = 3$ and $n = 12$

The Student t distribution has the same general shape and symmetry as the standard normal distribution, but it reflects the greater variability that is expected with small samples.

Estimating Sugar in Oranges

In Florida, members of the citrus industry make extensive use of statistical methods. One particular application involves the way in which growers are paid for oranges used to make orange juice. An arriving truckload of oranges is first weighed at the receiving plant, then a sample of about a dozen oranges is randomly selected. The sample is weighed and then squeezed, and the amount of sugar in the juice is measured. Based on the sample results, an estimate is made of the total amount of sugar in the entire truckload. Payment for the load of oranges is based on the estimate of the amount of sugar because sweeter oranges are more valuable than those less sweet, even though the amounts of juice may be the same.