but the original population of weights of males has a normal distribution, so samples of *any* size will yield means that are normally distributed.

Because we are now dealing with a distribution of sample means, we must use the parameters $\mu_{\bar{x}}$ and $\sigma_{\bar{x}}$, which are evaluated as follows:

$$\mu_{\bar{x}} = \mu = 182.9$$

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}} = \frac{40.8}{\sqrt{16}} = 10.2$$

We want to find the green-shaded area shown in Figure 6-16(b). If using technology, the green-shaded area in Figure 6-16(b) is 0.9955. If using Table A-2, we convert the value of $\bar{x} = 156.25$ lb to the corresponding z score of $z = -2.61$ as shown here:

$$z = \frac{\bar{x} - \mu_{\bar{x}}}{\sigma_{\bar{x}}} = \frac{156.25 - 182.9}{\frac{40.8}{\sqrt{16}}} = \frac{-26.65}{10.2} = -2.61$$

From Table A-2 we find that the cumulative area to the *left* of $z = -2.61$ is 0.0045, so the green-shaded area if Figure 6-16(b) is $1 - 0.0045 = 0.9955$ (which happens to be the same result obtained using technology). The probability that 16 randomly selected males have a mean weight greater than 156.25 lb is 0.9955.

Interpretation

There is a 0.7432 probability that an individual male will weigh more than 156.25 lb, and there is a 0.9955 probability that 16 randomly selected males will have a mean weight of more than 156.25 lb. Given that the safe capacity of the elevator is 2500 lb, there is a very good chance (with probability 0.9955) that it will be overweight if is filled with 16 randomly selected males. Given that the elevator was crammed with 24 passengers, it is very likely that the safe weight capacity was exceeded.

The calculations used here are exactly the type of calculations used by engineers when they design ski lifts, escalators, airplanes, boats, amusement park rides, and other devices that carry people.

Example 3 Designing Desks for Kindergarten Children

You need to obtain new desks for an incoming class of 25 kindergarten students who are all 5 years of age. An important characteristic of the desks is that they must accommodate the sitting heights of those students. (The sitting height is the height of a seated student from the bottom of the feet to the top of the knee.) Table 6-9 lists the parameters for sitting heights of 5-year-old children (based on data from "Nationwide Age References for Sitting Height, Leg Length, and Sitting Height/Height Ratio, and Their Diagnostic Value for Disproportionate Growth Disorders," by Fredriks et al., *Archives of Disease in Childhood,* Vol. 90, No. 8).

a. What sitting height will accommodate 95% of the boys?

b. What sitting height is greater than 95% of the means of sitting heights from random samples of 25 boys?

c. Based on the preceding results, what single value should be the minimum sitting height accommodated by the desks? Why are the sitting heights of girls not included in the calculations?