**Example 5 Bone Density Test**

A bone density test reading between −1.00 and −2.50 indicates that the subject has osteopenia, which is some bone loss. Find the probability that a randomly selected subject has a reading between −1.00 and −2.50.

**Solution**

We are again dealing with normally distributed values having a mean of 0 and a standard deviation of 1. The values between −1.00 and −2.50 correspond to the shaded region at the far right in Figure 6-7. Table A-2 cannot be used to find that area directly, but we can use it to find the following:

1. The area to the left of $z = -2.50$ is 0.0062.
2. The area to the left of $z = -1.00$ is 0.1587.
3. The area *between* $z = -2.50$ and $z = -1.00$ (the shaded area at the far right in Figure 6-7) is the difference between the areas found in the preceding two steps:

$$0.1587 - 0.0062 = 0.1525$$

This area 0.1587 — minus this area −0.0062 — equals this area. = 0.1525

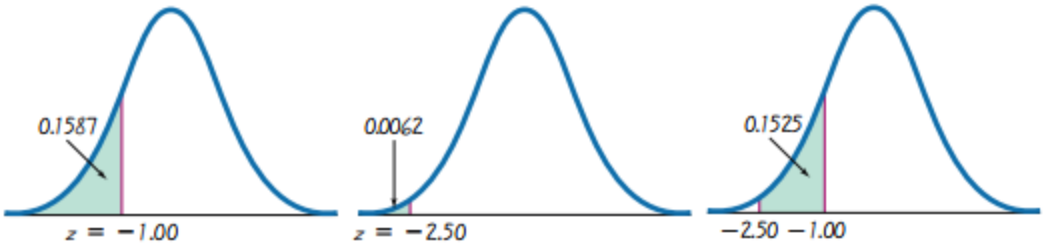


**Figure 6-7 Finding the Area between Two z Scores**

**Interpretation**

Using the correspondence between probability and area, we conclude that there is a probability of 0.1525 that a randomly selected subject has a bone density reading between −1.00 and −2.50. Another way to interpret this result is to state that 15.25% of people have osteopenia, with bone density readings between −1.00 and −2.50.

Example 5 can be generalized as the following rule: **The area corresponding to the region *between* two *z* scores can be found by finding the difference between the two areas found in Table A-2.** Figure 6-8 illustrates this general rule. The shaded region *B* can be found by calculating the *difference* between two areas found from Table A-2.

*Learning hint:* Don't try to memorize a rule or formula for this case. Focus on *understanding* that Table A-2 gives cumulative areas from the left only. Draw a graph, shade the desired area, then think of a way to find the desired area given the condition that Table A-2 provides only cumulative areas from the left.