

## EXAMPLE 2 Use the fundamental counting principle

**PHOTOGRAPHY** You are framing a picture. The frames are available in 12 different styles. Each style is available in 55 different colors. You also want blue mat board, which is available in 11 different shades of blue. How many different ways can you frame the picture?

### Solution

You can use the fundamental counting principle to find the total number of ways to frame the picture. Multiply the number of frame styles (12), the number of frame colors (55), and the number of mat boards (11).

$$\text{Number of ways} = 12 \cdot 55 \cdot 11 = 7260$$

▶ The number of different ways you can frame the picture is 7260.

## EXAMPLE 3 Use the counting principle with repetition

**LICENSE PLATES** The standard configuration for a Texas license plate is 1 letter followed by 2 digits followed by 3 letters.



- How many different license plates are possible if letters and digits can be repeated?
- How many different license plates are possible if letters and digits cannot be repeated?

### Solution

- There are 26 choices for each letter and 10 choices for each digit. You can use the fundamental counting principle to find the number of different plates.

$$\text{Number of plates} = 26 \cdot 10 \cdot 10 \cdot 26 \cdot 26 \cdot 26 = 45,697,600$$

▶ With repetition, the number of different license plates is 45,697,600.

- If you cannot repeat letters there are still 26 choices for the first letter, but then only 25 remaining choices for the second letter, 24 choices for the third letter, and 23 choices for the fourth letter. Similarly, there are 10 choices for the first digit and 9 choices for the second digit. You can use the fundamental counting principle to find the number of different plates.

$$\text{Number of plates} = 26 \cdot 10 \cdot 9 \cdot 25 \cdot 24 \cdot 23 = 32,292,000$$

▶ Without repetition, the number of different license plates is 32,292,000.

### AVOID ERRORS

For a given situation, the number of choices without repetition is always less than the number of choices with repetition.



## GUIDED PRACTICE for Examples 1, 2, and 3

- SPORTING GOODS** The store in Example 1 also offers 3 different types of bicycles (mountain, racing, and BMX) and 3 different wheel sizes (20 in., 22 in., and 24 in.). How many bicycle choices does the store offer?
- WHAT IF?** In Example 3, how do the answers change for the standard configuration of a New York license plate, which is 3 letters followed by 4 numbers?