

## FUNDAMENTAL COUNTING PRINCIPLE

The Fundamental Counting Principle is used to count the number of ways a task can occur given a series of events.

Suppose that a task involves a sequence of  $k$  choices. Let  $n_1$  be the number of ways the first event can occur and  $n_2$  be the number of ways the second event can occur after the first stage has occurred. Continuing in this way, let  $n_k$  be the number of ways the  $k$ th event can occur after the first  $k - 1$  events have occurred. The Fundamental Counting Principle states that the total number of different ways this task can occur is:

$$n_1 \cdot n_2 \cdot n_3 \cdot \dots \cdot n_k$$

Essentially, the number of different ways each event can occur are multiplied against one another to determine the total number of ways the event as a whole can occur.

### Concept Example:

The following problem introduces the concept reviewed within this module. Use this content as a primer for the subsequent material.

A certain State's Vehicle department wants to determine how many license plates will be available if a license plate number consists of three letters followed by three numbers (0 through 9)

### Solution:

This problem is made of 6 tasks, or events; the events make up the letters/numbers on the license plate as defined in the problem. In the first, second, and third event, the result can be 1 of 26 letters (26 possible letters). In the fourth, fifth, and sixth events, the number can be anything between 0 and 9 (10 possible numbers). Therefore:

$$n_1 = 26$$

$$n_2 = 26$$

$$n_3 = 26$$

$$n_4 = 10$$

$$n_5 = 10$$

$$n_6 = 10$$

The Fundamental Counting Principle states that the total number of different ways this task can occur is:

$$n_1 \cdot n_2 \cdot n_3 \cdot \dots \cdot n_k$$

So:

$$26 \cdot 26 \cdot 26 \cdot 10 \cdot 10 \cdot 10 = 17,576,000$$

The total number of possible unique license plates is 17,576,000.