

# 14-1 Counting Outcomes (Pages 754–758)

Tree diagrams and the Fundamental Counting Principle are two methods of calculating the total number of possible outcomes for any situation. A **tree diagram** is a picture that creates a list of every possible outcome. This list is called a **sample space** and each individual element of the sample space is called an **event**. The **Fundamental Counting Principle** uses multiplication to find the total number of outcomes.

<b>Fundamental Counting Principle</b>	If an event M can occur in $m$ ways and is followed by event N that can occur in $n$ ways, then the event M followed by event N can occur in $m \cdot n$ ways.
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A **factorial** may be used to find the total number of outcomes of a scenario with descending amounts of choices. The factorial of  $n$ , written as  $n!$ , is calculated by  $n \cdot (n - 1) \cdot (n - 2) \cdot \dots \cdot 3 \cdot 2 \cdot 1$ .

### Examples

- a. How many lunches can you choose from 3 different drinks and 4 different sandwiches?**

Letter the different sandwiches A, B, C, and D.

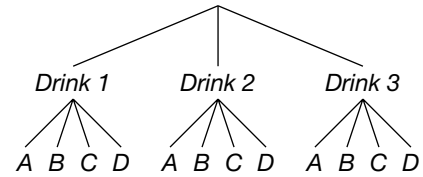
A tree diagram shows 12 as the number of outcomes.

You could also use the Fundamental Counting Principle.

$$\begin{array}{r} \text{number of} \\ \text{types of drinks} \end{array} \times \begin{array}{r} \text{number of types} \\ \text{of sandwiches} \end{array} = \begin{array}{r} \text{number of} \\ \text{possible outcomes} \end{array}$$

$$3 \times 4 = 12$$

There are 12 possible outcomes.



- b. Find the value of 5!.**

$$5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$$

$$5! = 120$$

- c. How many ways can you place 8 books on a shelf?**

$$8! = 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$$

$$8! = 40,320$$

### Practice

Use a tree diagram or the Fundamental Counting Principle to find the total number of outcomes.

- A restaurant menu has a special where you can select from 3 meats, 2 vegetables and 2 drinks.
- A soccer team's kit consists of 2 jerseys, 2 pairs of shorts, and 2 pairs of socks.
- A pizza shop offers 10-inch, 12-inch, and 16-inch sizes with thin, thick, deep dish, or garlic crust. Also, the customer can choose a topping from extra cheese, pepperoni, sausage, mushroom, and green pepper.
- Standardized Test Practice** In how many ways can a group of 10 people form a line for an amusement park ride?

**A** 100,000

**B** 3,628,800

**C** 1,814,400

**D** 403,200

Answers: 1. 12 2. 8 3. 60 4. B
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