The Counting Principle

You are ordering an ice cream float. You will choose a flavor of ice cream and a flavor of soda. The choices are:

ICE CREAM: vanilla, chocolate (2)

SODA: cola, root beer, orange, strawberry (4)

How many different ways could you order in your float?

2 · 4 = 8

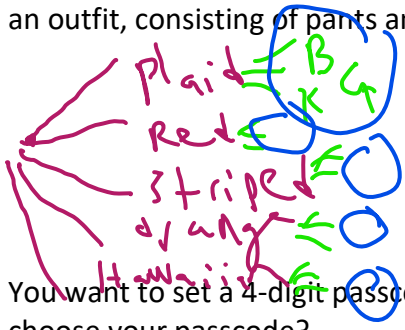
vC chC
vR chR
vO chO
vS chJ

8 combination

This scenario describes _independent_ events, in which the outcome of one event does not affect the outcome of the other. If event M can occur in m ways, and event N can occur in n ways, then event M followed by event N can occur in _N·M_ ways. You simply _multiply_ the number of choices, or possible outcomes, for each event to find the total number of possible outcomes. This is called the _fundamental counting principal_

Sometimes it is helpful to organize your possible outcomes using a _tree_ diagram.

You have five shirts: plaid, red, striped, orange and Hawaiian print. You have three pair of pants: blue, green and khaki. Use a tree diagram to determine how many ways you could make an outfit, consisting of pants and a shirt.



5 · 3 = 15 combinations

You want to set a 4-digit passcode on your cell phone. How many different ways could you choose your passcode?

0-9

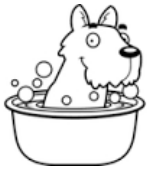
10 · 10 · 10 · 10 = 10,000 possible codes

Your little sister likes even numbers. Using flashcards numbered 0-9, how many 2-digit even numbers could you create?

0 5
x 1

0 1 2 3 4
5 6 7 8 9

9 · 5 = 45 total ways
options



You plan to spend your day completing a chore, eating lunch out and then doing a fun activity. Your chores could be sweeping the house or washing the dog. Nearby restaurants are Bob's Burgers, Sally's Salads, Paula's Pizzeria and Wally's Wings. Your activity choices are a movie, bowling, mini golf or the trampoline park. How many different ways could you spend your day?

2 · 4 · 4 = 32 different ways
chores lunch activities

Sometimes the outcome of one event affects the outcome of another event. In this case, those events are said to be dependent events. The Fundamental Counting Principle still applies, and we will multiply the number of possible outcomes, or choices, for each event.

no replacement

You are guessing the answer on your state assessment. You are asked to drag and drop from a box containing the digits 1, 2, 3, 5, and 7 into 4 answer blanks. How many ways could you submit your answer?

5 · 4 · 3 · 2 = 5·4·3·2 = 120 ways

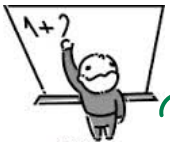
Notice that once you have chosen an option from the box, it is not available as a choice for the next answer blank. The outcome of the first event (blank 1) left you with fewer choices for the next event (blank 2), and so on. These events are dependent events.

You are going to hang three pictures in a row on the wall. In how many ways can you arrange them?

3 · 2 · 1 = 6 ways

You are planning to run six errands today. In how many ways could they be ordered?

6 · 5 · 4 · 3 · 2 · 1 = 720 ways



Your teacher asks for three volunteers to work problems on the board. There are 21 students in the class. In how many different ways could the student volunteers be chosen?

21 · 20 · 19 = 7980 ways

You and four other classmates walk into the office and sit down in a row of five chairs. In how many ways could you be ordered?

5 · 4 · 3 · 2 · 1 = 120 ways

Create a scenario describing independent events. Then determine the number of possible outcomes for the events.

with replacement

flavors of soda

coke
sprite
tea

ice or no ice

3 · 2 = 6 options

Now, create a scenario describing dependent events. Then determine the number of possible outcomes for the events.

without replacement

4 football players in locker room with 5 helmets

How many ways can they put on helmet

5 · 4 · 3 · 2 = 120 ways