## Example

In a population, 5% of individuals have a certain genetic condition. The test for this condition has a false negative rate of 8% and a false positive rate of 2%. What is the probability that an individual who tests positive for the condition actually has it?

$$P(\text{genetic}_{\text{condition}}) = FALSE \text{ NEGATIVE: } P(\text{negative} \mid \text{genetic}_{\text{condition}}) = FALSE \text{ POSITIVE: } P(\text{positive} \mid \text{no}_{\text{genetic}}) = P(\text{positive} \mid \text{genetic}_{\text{condition}}) = P(\text{genetic}_{\text{condition}}) = P(\text{ge$$

#### Example

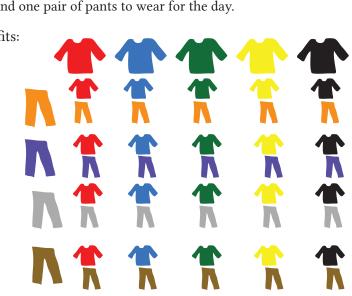
Suppose you have 5 different colored shirts (red, blue, green, yellow, and black) and 4 different colored pants

(orange, purple, gray, and brown) in your wardrobe.

You want to select one shirt and one pair of pants to wear for the day.

Total number of different outfits: #(shirts)·#(pants)

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### BASIC COUNTING RULE

If we are asked to choose one item from each of two separate categories where there are m items in the first category and n items in the second category, then the total number of available choices is  $\mathbf{m} \cdot \mathbf{n}$ .

# This is sometimes called the **multiplication rule for probabilities**.

#### Example

Let's consider a scenario where you're organizing a sports event with different activities and teams.

Suppose you have the following options:

3 types of activities (football, basketball, volleyball)4 teams (Team A, Team B, Team C, Team D)2 time slots (morning, afternoon)

Total number of different combinations: #(options for activities) × #(options for teams) × #(options for time slots)

Therefore, there are \_\_\_\_ different combinations considering the type of activity, team, and time slot.

Question	Question
You roll a dice 3 three times. how many possibilities are there in total?	How many combinations are there of a four digit numeric code?
	Question
Question	You draw a card from a standard deck of 52 cards 2 times, with replacement. How many possible outcomes are there in total?
You flip a coin 4 times. How many possible outcomes are there in total?	Question
	You spin a spinner with 8 equal sections 5 times. How many possible outcomes are there in total?
Question	FACTORIAL
how many different ways can we order the numbers 1 2 3 4 5 ?	$= n \cdot (n - 1) \cdot (n - 2) \cdots 3 \cdot 2 \cdot 1$

Question Suppose there are 5 different tasks (A, B, C, D, E) to be assigned to 5 employees (Alice, Bob, Charlie, David, Emma) in a company. How many ways can the tasks be assigned to the employees?	Question Suppose there are 5 different seats in a row, and 5 friends need to sit in those seats. How many ways can the friends be seated?
Question	Question
Suppose there are 7 different books to be placed on 7	Suppose there are 6 different colored balls (red, blue, green,
different shelves in a library.	yellow, purple, orange) to be placed into 6 distinct boxes.
How many ways can the books be arranged on the shelves?	How many ways can the balls be placed in the boxes?
$nPr=n \cdot (n-1) \cdot (n-2) \cdots (n-r+1)$	Question
We say that there areofthat may be selected from among n choices without replacement when order matters.	How many different ways can 3 students
It turns out that we can express this result more simply using factorials.	be chosen and arranged from a group of 5
$nPr = \frac{n!}{(n-r)!}$	students?

#### Question

A restaurant has 7 different types of desserts, and the chef wants to create a special dessert platter with 3 different desserts. How many different ways can the chef arrange these desserts?

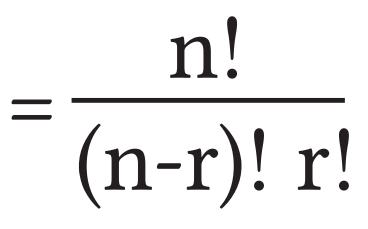
#### Question

A music festival features 9 different bands, and the organizer wants to schedule 4 of these bands to perform in a specific order. How many different ways can the organizer arrange these 4 bands?

## Question

I have twelve different types of plants, and I want to arrange only five of them in a row on my garden bed. How many different ways could I do this?

## COMBINATIONS



### Question

How many ways can I choose 3 socks from a drawer containing 23 socks?

#### Question

In a group of 10 students, how many different ways can we choose a committee of 3 students to represent the class?

## Question

A pizza restaurant offers 10 different toppings. How many different combinations of 5 toppings can a customer choose for their pizza?

## Question

A sports team has 15 players, and the coach needs to select 4 players to represent the team in a tournament. How many different ways can the coach choose the players?