

PERMUTATION AND COMBINATION

What's the Difference?



"My fruit salad is a combination of apples, grapes and bananas" We don't care what order the fruits are in, they could also be "bananas, grapes and apples" or "grapes, apples and bananas", its the same fruit salad.



"The combination to the safe was 472". Now we **do** care about the order. "724" would not work, nor would "247". It has to be exactly **4-7-2**.

So, in Mathematics we use more *precise* language:

- If the order doesn't matter, it is a _____.
- If the order **does** matter it is a _____.

Permutations

Permutation is an arrangement of objects chosen from a given set. In this section we will discuss ways of finding the total number of permutations of a set of objects under various conditions.

There are basically two types of permutation:

1. **Repetition is Allowed**: such as the lock above. It could be "333".
2. **No Repetition**: for example the first three people in a running race. You can't be first *and* second

The numbers of permutations or arrangements of n different objects.

Example 1

- a) Find the number of arrangements of 8 items on a shopping list.
- b) Find the number of different ways in which the letters from the word NUMBERS can be arranged.

The numbers of permutations or arrangements of r different objects chosen from a set of n objects.

Example 2

A lady has 8 house plants. In how many ways can she arrange 6 of them in a line on a window sill?

The numbers of permutations of n objects, where p objects are identical, q objects are identical and so forth.

Example 3

Find the number of different ways in which the letters from the word STATISTICS can be arranged.

Combinations

In some problems the order in which objects are arranged is not important. Combination is a selection of objects from a given set irrespective of order.

There are also two types of combinations (remember the order does **not** matter now):

1. **Repetition is Allowed:** such as coins in your pocket (5,5,5,10,10)
2. **No Repetition:** such as lottery numbers (2,14,15,27,30,33)

The number of ways of selecting r objects from n different objects.

Example 4

A committee of 5 is to be formed from 12 men and 8 women. In how many ways can the committee be chosen so that there are 3 men and 2 women on it?

Restriction

- ➔ Where restrictions are given for an arrangement or selection, they must be satisfied first before the number of permutation or combination is calculated.
- ➔ The problem may be broken down into separate cases, calculated separately, and the corresponding numbers are added or subtracted.

Example 5

Find how many different arrangements can be made using all the letters of the word CHOCOLATE if

- a) The vowels must be together,
- b) The 2 letters O must be separated.

Example 6

Find the number of different ways to arrange 5 person standing in a line, if

- a) Two particular persons must stand next to each other,
- b) Two particular persons must not stand next to each other.

Example 7

A team of 4 is to be selected from 5 boys and 4 girls. How many of such teams contain at least 1 boy and at least one girl?

Example 8

How many three digit even numbers greater than 400 can be formed from the digits 1, 2, 3, 4, and 5, if repetition is not allowed?

Example 9

In how many ways can a group of three men be selected from seven men? How many ways of selection are there if one of two particular men must not be included?

Permutation and Combination with Probability

Example 10

Four letters are chosen at random from the letters in the word RANDOMLY. Find the probability that all letters are consonants.

Example 11

A team of 5 pupils is chosen from a class of 7 girls and 8 boys. Find the probability that the team consists of 3 girls and 2 boys.