



# Permutations

**Permutation** and **combination** are both counting techniques, useful in determining the number of possible outcomes in order to calculate probability. Each is a method for calculating the number of ways a subgroup of size  $r$  can be chosen from a group of  $n$  items.

## Permutations

- There are  **$n$  different** items from which to choose.
- We are selecting  **$r$  items** without replacement.
- Different arrangements (orderings) of the items are considered to be different selections; i.e., **order is important**.

Permutations can be calculated using this formula or in a calculator

$${}^n P_r = \frac{n!}{(n-r)!}$$

## Permutation Example

A barbecue competition has 10 entrants, and judges will determine 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> place winners. How many different ways can 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> places be awarded?

**Solution:** This problem is an application of **permutations**, and we know this because **order is important**. Awarding Bob 1<sup>st</sup> place, Sally 2<sup>nd</sup> place, and Jim 3<sup>rd</sup> place would be different than awarding Sally 1<sup>st</sup> place, Jim 2<sup>nd</sup> place, and Bob 3<sup>rd</sup> place, even though the same three people were chosen.

**To calculate the result**, we use  $n = 10$  (total number of entrants) and  $r = 3$  (the number of place values to be awarded)

## Entering on a TI 83+ or 84+ Calculator

1. Enter the value of  $n$ .
2. Press the **MATH** key, then use the **right arrow** to go to the *PRB* menu, use the **down arrow** to choose the second selection,  ${}^n P_r$ , and press **ENTER**.
3. Enter the value of  $r$ . Press **ENTER** to execute the command.

```
MATH NUM CPX 12:35
1:rand
2: nPr
3: nCr
4: !
5: randInt(
6: randNorm(
7: randBin(
```

```
10 nPr 3
720
```



The key difference between permutations and combinations is whether order is important or not. Permutations are to be used when order is important, while combinations are to be used when order is not important.

# Combinations

**Permutation** and **combination** are both counting techniques, useful in determining the number of possible outcomes in order to calculate probability. Each is a method for calculating the number of ways a subgroup of size  $r$  can be chosen from a group of  $n$  items.

## Combinations

- There are  **$n$  different** items from which to choose.
- We are selecting  **$r$  items** without replacement.
- Different arrangements (orderings) are NOT considered to be different selections; i.e., **order is not important**.

Combinations can be calculated using this formula or in a calculator

$${}^n C_r = \frac{n!}{(n-r)! r!}$$

## Combination Example

A manager must select 4 of his 9 employees to serve on a committee. How many different committees of 4 can be formed from his 9 employees?

**Solution:** This problem is an application of **combinations**, and we know this because **order is not important**. The committee will be the same regardless of the order in which its members are picked.

**To calculate the result**, we use  $n = 9$  (total number of employees) and  $r = 4$  (the number of employees on the committee)

## Entering on a TI 83+ or 84+ Calculator

1. Enter the value of  $n$ .
2. Press the **MATH** key, then use the **right arrow** to go to the **PRB** menu, use the **down arrow** to choose the third selection,  $nCr$ , and press **ENTER**.
3. Enter the value of  $r$ . Press **ENTER** to execute the command.

```
MATH NUM CPX PRB
1:rand
2:nPr
3:nCr
4:!
5:randInt(
6:randNorm(
7:randBin(
```

```
9 nCr 4
126
```



The key difference between permutations and combinations is whether order is important or not. Permutations are to be used when order is important, while combinations are to be used when order is not important.