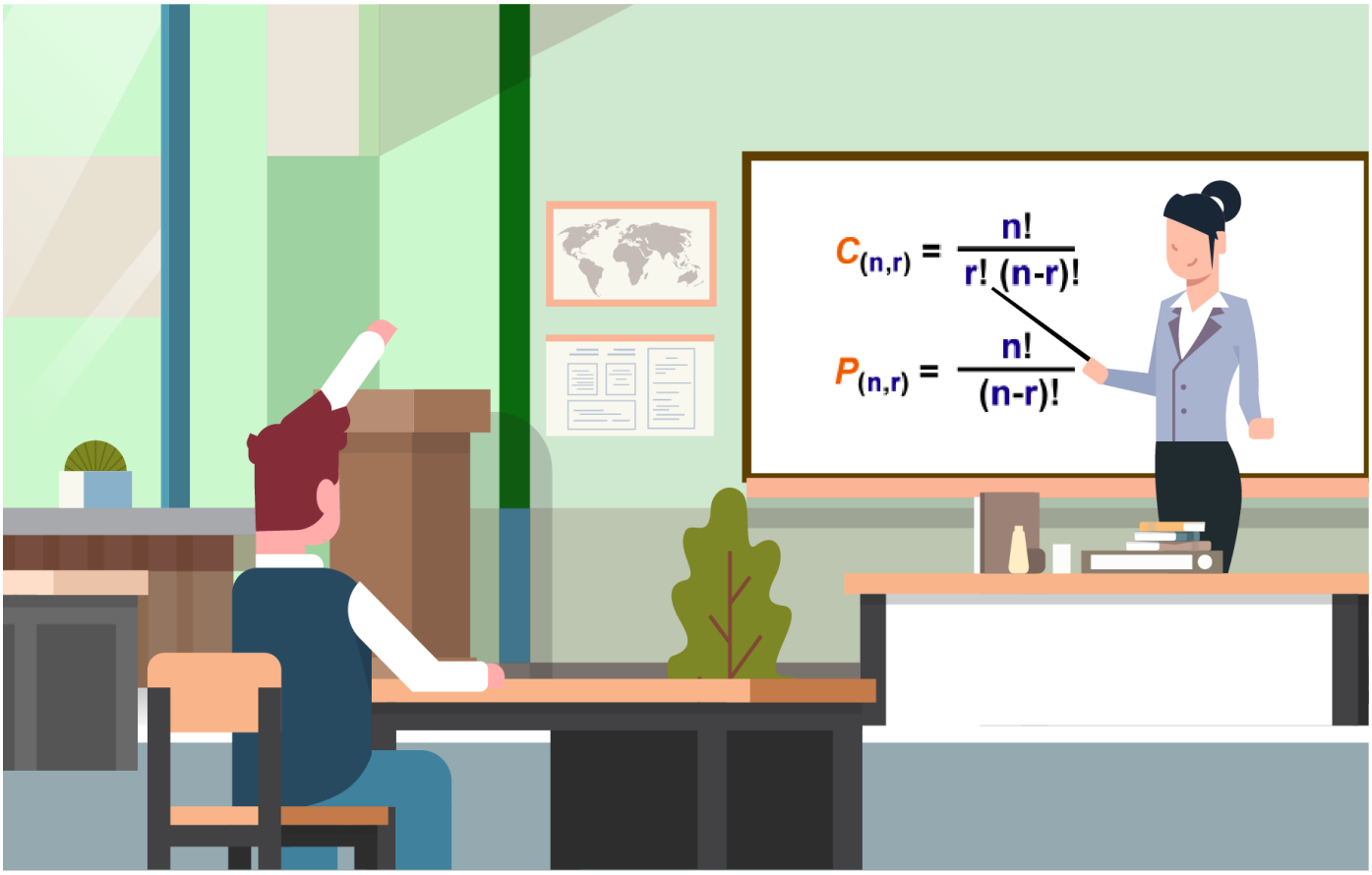
Permutation and Combination



1) Factorial:

The factorial can be defined as the product of the number (for which we have to find factorial) by its successor till it reaches to one.

We can write it as, **n! (Factorial of n) = n (n-1) (n-2)….1**

For example: The factorial of 3:

3! = 3*2*1 = 6

2) Permutation: It refers to the number of ways a particular set can be arranged, where order of the arrangement matters. A combination lock can be called a permutation lock.

For example:

i) Let we have three letters a, b, and c and we have to arrange two letters at a time.

So, in this case, the permutations of the two letters = ab, ba, bc, cb, ac, and ca.

ii) If we have to arrange all letters (a, b, c) simultaneously, the permutation would be: abc, acb, bac, bca, cab, and cba.

Formula for calculating number of possible permutations of r things, from a set of n at a time is as follows:

$^{n}P_{r} = n(n - 1)(n - 2)(n - 3)... (n - r + 1) = \frac{n!}{(n - r)!}$

For example:

i. $^{8}P_{3} = \frac{8!}{(8 - 3)!} = \frac{8 * 7 * 6 * 5!}{5!} = (8*7*6) = 336$

ii. $^{7}P_{5}$ $\frac{7!}{(7 - 5)!} = \frac{7!}{2!} = \frac{7 * 6 * 5 * 4 * 3 * 2!}{2!} = 2520$

iv. The number of permutations or arrangements of all n things at a time = n! (Factorial of n).
i.e., n = 3, so 3! = 3*2*1 = 6 (the number of permutations = 6)

3) Combinations:

It refers to the number of ways a particular set can be arranged, where order of the arrangement does not matter which means for a combination of the n number of things there may be different orders.

Formula for calculating the possible combination for r things, from a set of n objects at a time is as follows:

$$^{n}C_{r} = \frac{n!}{r!\,(n-r)!} = \frac{n\,(n-1)\,(n-2)\ldots(n-r+1)}{r!}$$

For examples:

i. $^{8}C_{3} = \frac{8!}{3!\,(8-3)!} = \frac{8*7*6*5!}{3!\;5!} = \frac{8*7*6}{3*2*1} = (8*7) = 56$

Or, $^{8}C_{3} = {}^{8}C_{(8-3)} = {}^{8}C_{5} = \frac{8*7*6*5*4}{5*4*3*2*1} = 8*7 = 56$

ii. $^{7}C_{5} = {}^{7}C_{(7-5)} = {}^{7}C_{2} = \frac{7*6}{2*1} = 21$

Note:

- When the number of things is x, y, and z then the number of combinations taking two at a time will be xy, yz, and zx.
- The combination of all things at a time is xyz.

Formulas for Permutations-Combinations

1. nPr = n!/(n-r)!
2. nPn = n!
3. $nP_1 = n$
4. nCr = n!/(r! (n-r)!)
5. $nC_1 = n$
6. $nC_0 = 1 = nCn$
7. nCr = nCn-r
8. nCr = nPr/r!
9. Number of diagonals in a geometric figure of n sides = nC_2-n