

Class 11

Important Formulas

Permutations and Combinations

Permutations:

- The continued product of first n natural numbers is called the " n factorial" and is denoted by $n!$ or $n!$.
Thus, $n! = 1 \times 2 \times 3 \times 4 \times \dots \times (n-1) \times n$
Factorials of proper fractions and negative integers are not defined.
- $\frac{(2n)!}{n!} = 1 \cdot 3 \cdot 5 \dots (2n-1) 2^n$
- $n! + 1$ is not divisible by any natural number between 2 and n .
- Let p be a prime number and n be a natural number, if $E_p(n)$ denotes the exponent of p in n , then

$$E_p(n!) = \left[\frac{n}{p} \right] + \left[\frac{n}{p^2} \right] + \dots + \left[\frac{n}{p^s} \right]$$

Combinations:

- If n is a natural number and r is a non-negative integer such that $0 \leq r \leq n$, then
 - ${}^nC_r = \frac{n!}{(n-r)!r!}$
 - ${}^nC_r \times r! = {}^nP_r$
 - ${}^nC_r = {}^nC_{n-r}$
 - ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$
 - ${}^nC_r = \frac{n}{r} {}^{n-1}C_{r-1} = \frac{n}{r} \times \frac{n-1}{r-1} \cdot {}^{n-2}C_{r-2} = \dots = \frac{n}{r} \times \frac{n-1}{r-1} \times \frac{n-2}{r-2} \times \dots \times \frac{n-(r-1)}{1}$
 - ${}^nC_x = {}^nC_y \Rightarrow x = y$ or, $x + y = n$
 - If n is an even natural number, then the greatest among ${}^nC_0, {}^nC_1, {}^nC_2, \dots, {}^nC_n$ is ${}^nC_{\frac{n}{2}}$.
If n is an odd natural number, then the greatest among ${}^nC_0, {}^nC_1, {}^nC_2, \dots, {}^nC_n$ is ${}^nC_{\frac{n-1}{2}}$ or, ${}^nC_{\frac{n+1}{2}}$.
- The number of ways of selecting r items or objects from a group of n distinct items or objects is $\frac{n!}{(n-r)!r!} = {}^nC_r$.