Class 11

Important Formulas

Permutations and Combinations

Permutations:

1. The continued product of first n natural numbers is called the "n factorial" and is denoted by $\lfloor n$ or $n!$.

   Thus, $n! = 1 \times 2 \times 3 \times 4 \times \ldots \times (n-1) \times n$

   Factorials of proper fractions and negative integers are not defined.

2. $\dfrac{(2n)!}{n!} = 1 \cdot 3 \cdot 5 \ldots (2n-1)\, 2^n$

3. $n! + 1$ is not divisible by any natural number between 2 and n.

4. Let p be a prime number and n be a natural number, if $E_p(n)$ denotes the exponent of p in n, then

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

Combinations:

1. If n is a natural number and r is a non-negative integer such that $0 \le r \le n$, then

   (i) $^nC_r = \dfrac{n!}{(n-r)!\,r!}$ 　　　　　(ii) $^nC_r \times r! = \,^nP_r$

   (iii) $^nC_r = \,^nC_{n-r}$ 　　　　　(iv) $^nC_r + \,^nC_{r-1} = \,^{n+1}C_r$

   (v) $^nC_r = \dfrac{n}{r}\,^{n-1}C_{r-1} = \dfrac{n}{r} \times \dfrac{n-1}{r-1} \cdot \,^{n-2}C_{r-2} = \ldots = \dfrac{n}{r} \times \dfrac{n-1}{r-1} \times \dfrac{n-2}{r-2} \times \ldots \times \dfrac{n-(r-1)}{1}$

   (vi) $^nC_x = \,^nC_y \Rightarrow x = y$ 　or,　 $x + y = n$

   (vii) If n is an even natural number, then the greatest among $^nC_0,\,^nC_1,\,^nC_2,\ldots,\,^nC_n$ is $^nC_{\frac{n}{2}}$.

   If n is an odd natural number, then the greatest among $^nC_0,\,^nC_1,\,^nC_2,\ldots,\,^nC_n$ is $^nC_{\frac{n-1}{2}}$ or, $^nC_{\frac{n+1}{2}}$.

2. The number of ways of selecting r items or objects from a group of n distinct items or objects is $\dfrac{n!}{(n-r)!\,r!} = \,^nC_r$.