BALABHADRA SKILL DEVELOPMENT ACADEMY
MATHS FORMULA - 20

PERMUTATIONS AND COMBINATIONS

Sl	Situation	Formula
1	Product of first n natural numbers is denoted by n ! and read as 'factorial n'	n!=n(n-1) (n-2)......3.2.1
2	0!	1
3	Factorials of ____ and ____ are not defined.	Negative integers, fractions
4	$\frac{n!}{r!}$	$n(n-1)(n-2)\ldots\ldots(r+1)$
5	$\frac{n!}{(n-r)!}$	$n(n-1)(n-2)\ldots(n-r+1)$
6	Properties of ^nP_r	$^nP_0=1$, $^nP_1=n$ and $^nP_{n-1}=n!$ $^nP_r=n\ ^{n-1}P_{r-1}$ $^{n-1}P_r=(n-r)\ ^{n-1}P_{r-1}$ $^nP_r=r\times\ ^{n-1}P_{r-1}+\ ^{n-1}P_r$
7	Number of permutations of n distinct objects taking r at time is denoted by ^nP_r	$^nP_r=\frac{n!}{(n-r)!}=n(n-1)(n-2)\ldots(n-r+1)$ where $0\leq r\leq n$
9	The number of permutations of n things of which p are alike of one kind, q are alike of second kind, r are alike of third kind and remaining are distinct, is	$\frac{n!}{p!\,q!\,r!}$
10	Number of permutations of n different things, taken r at a time, when p particular things are to be always included in each arrangement is	$p!\,(r-p+1)\times\ ^{n-p}P_{r-p}$
11	Number of permutations of n different things taken r at a time, when P particular things are never taken in any arrangement is	$^{n-p}P_r$

12	Number of permutations of n different things, taken all at a time, when m specified things never come together is	$n! - m! \times (n - m + 1)!$
13	Properties of ${}^nC_r$	(i) ${}^nC_r$ is a natural number
		(ii) ${}^nC_0 = {}^nC_n = 1$, ${}^nC_1 = n$
		(iii) ${}^nC_r = {}^nC_{n-r}$
		(iv) ${}^nC_r + {}^nC_{r-1} = {}^{n+1}C_r$
		(v) ${}^nC_x = {}^nC_y$, then $x=y$ or $x+y=n$
		(vi) $n \times {}^{n-1}C_{r-1} = (n-r+1)\ {}^nC_{r-1}$
	If n is even, then the greatest value of ${}^nC_r$ is	(vii) ${}^nC_{n/2}$
	If n is odd, then the greatest value of ${}^nC_r$ is	(viii) ${}^nC_{(n+1)/2}$ or ${}^nC_{(n-1)/2}$
		(ix) ${}^nC_r = \frac{n}{r}\ {}^{n-1}C_{r-1}$
		(x) ${}^nC_r / {}^nC_{r-1} = \frac{n-r+1}{r}$
		(xi) ${}^nC_0 + {}^nC_1 + {}^nC_2 + \ldots\ldots + {}^nC_n = 2^n$
		(xii) ${}^nC_0 + {}^nC_2 + {}^nC_4 + \ldots\ldots = {}^nC_1 + {}^nC_3 + {}^nC_5 + \ldots. = 2^{n-1}$
		(xiii) ${}^{2n+1}C_0 + {}^{2n+1}C_1 + {}^{2n+1}C_2 + \ldots\ldots + {}^{2n+1}C_n = 2^{2n}$
		(xiv) ${}^nC_n + {}^{n+1}C_n + {}^{n+2}C_n + \ldots\ldots + {}^{2n-1}C_n = {}^{2n}C_{n+1}$
		(xv) If $r>n$, then ${}^nC_r = 0$
14	The number of combination of n different things taken r at a time, where p particular things never occur is	${}^{n-p}C_r$
15	If in a party n persons are present, then total number of hand shakes	${}^nC_2$
16	Out of n non-concurrent and non-parallel staright lines, the number of points of intersection	${}^nC_2$
17	The number of straight lines passing through n points	${}^nC_2$
18	Number of traingles formed by joining n non-collinear points	${}^nC_3$

19	Number of triangles formed by joining n points out of which m points are collinear	${}^{n}C_3 - {}^{m}C_3$
20	In a polygon, the total number of diagonals out of n points (no three points are collinear)	$\frac{n(n-3)}{2}$

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