## BALABHADRA SKILL DEVELOPMENT ACADEMY MATHS FORMULA - 20

## PERMUTATIONS AND COMBINATIONS

SI	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)(r+1)
5	$\frac{n!}{(n-r)!}$	n(n-1)(n-2)(n-r+1)
6	Properties of <sup>n</sup> P <sub>r</sub>	$^{n}P_{0} = 1$ , $^{n}P_{1} = n$ and $^{n}P_{n-1} = n!$ $^{n}P_{r} = n^{-n-1}P_{r-1}$ $^{n-1}P_{r} = (n-r)^{-n-1}P_{r-1}$
	Andrew State Control of the Control	$^{n}P_{r} = r \times {^{n-1}P_{r-1}} + {^{n-1}P_{r}}$
7	Number of permutations of n distinct objects taking r at time is denoted by ${}^{n}P_{r}$	${}^{n}P_{r} = \frac{n!}{(n-r)!} = n(n-1)(n-2)(n-r+1)$ where $0 \le r \le n$
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	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	<sup>n-p</sup> P <sub>r</sub>



Number of permutations of n different things, taken all at a time, when m specified things never come together is  13  Properties of "Cr  (i) "Cr is a natural number (ii) "Cr = "Cr = n - 1" - 1" - 1" - 1" - 1" - 1" - 1" -	12	Number of second the	T
specified things never come together is    Properties of "Cr	12	things taken all things taken all things	
(i) ${}^{n}C_{r}$ is a natural number  (ii) ${}^{n}C_{0} = {}^{n}C_{n-1}$ , ${}^{n}C_{1} = n$ (iii) ${}^{n}C_{0} = {}^{n}C_{n-r}$ (iv) ${}^{n}C_{r} + {}^{n}C_{r-1} = {}^{n+1}C_{r}$ (v) ${}^{n}C_{x} = {}^{n}C_{y}$ , then $x = y$ or $x + y = n$ (vi) ${}^{n}C_{n-1}$ If $n$ is even, then the greatest value of ${}^{n}C_{r}$ is  If $n$ is odd, then the greatest value of ${}^{n}C_{r}$ is  If $n$ is odd, then the greatest value of ${}^{n}C_{r}$ is  (vii) ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ )/2  (ix) ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ )/2  (ix) ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ )/( ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ /( ${}^{n}C_{n-1}$ )/( ${}^{n}C_{n-1}$ /(		charge, taken all at a time, when m	$n! - m! \times (n - m + 1)!$
(ii) "C <sub>0</sub> = "C <sub>n</sub> =1, "C <sub>1</sub> =n  (iii) "C <sub>r</sub> = "C <sub>rr</sub> (iv) "C <sub>r</sub> + "C <sub>r-1</sub> = "+1 C <sub>r</sub> (v) "C <sub>x</sub> = "C <sub>y</sub> , then x=y or x+y=n  (vi) nx <sup>n-1</sup> C <sub>r-1</sub> =(n-r+1) "C <sub>r-1</sub> If n is even, then the greatest value of "C <sub>r</sub> is  If n is odd, then the greatest value of "C <sub>r</sub> is  If n is odd, then the greatest value of "C <sub>r</sub> is  (viii) "C <sub>0</sub> = " n-1 C <sub>r-1</sub> = (n-r+1) "C <sub>r-1</sub> (ix) "C <sub>r</sub> = " n-1 C <sub>r-1</sub> (ix) "C <sub>r</sub> - " n-1 C <sub>r</sub> (ix) " n n n n n n n n n n n n n n n n n n	13	specified things never come together is	
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If n is odd, then the greatest value of "C <sub>r</sub> is (viii) "C <sub>(n+1)/2</sub> or "C <sub>(n-1)/2</sub> (ix) "C <sub>r</sub> = \frac{n}{r} \text{ n-1} C_{r-1}  (x) "C <sub>r</sub> f" C <sub>r-1</sub> = \frac{n-r+1}{r}  (xi) "C <sub>0</sub> + "C <sub>1</sub> + "C <sub>2</sub> + + "C <sub>n</sub> = 2"  (xii) "C <sub>0</sub> + "C <sub>1</sub> + "C <sub>1</sub> + + "C <sub>n</sub> = 2"  (xiii) "C <sub>0</sub> + "C <sub>1</sub> + "C <sub>1</sub> + + "C <sub>1</sub> = 2"  (xiii) "C <sub>0</sub> + "C <sub>1</sub> + "C <sub>1</sub> + 2" + 1 C <sub>1</sub> + 2" + 1 C <sub>2</sub> + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xiv) "C <sub>n</sub> + \frac{n+1}{r} C_n + \frac{n+2}{r} C_n + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xv) "C <sub>n</sub> + \frac{n+1}{r} C_1 + \frac{n+2}{r} C_1 + \frac{n+1}{r} C_2 + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xv) "C <sub>n</sub> + \frac{n+1}{r} C_1 + \frac{n+2}{r} C_1 + \frac{n+1}{r} C_2 + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xv) "C <sub>n</sub> + \frac{n+1}{r} C_1 + \frac{n+1}{r} C_2 + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xv) "C <sub>n</sub> + \frac{n+1}{r} C_1 + \frac{n+1}{r} C_2 + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xv) "C <sub>n</sub> + \frac{n+1}{r} C_1 + \frac{n+1}{r} C_2 + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xv) "C <sub>n</sub> + \frac{n+1}{r} C_1 + \frac{n+1}{r} C_2 + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xv) "C <sub>n</sub> + \frac{n+1}{r} C_1 + \frac{n+1}{r} C_2 + + 2" + 1 C <sub>n</sub> = 2" C <sub>n+1</sub> (xii) "C <sub>0</sub> + "C <sub>1</sub> + "C		If n is even, then the greatest value of	(V) 11× C <sub>r-1</sub> =(11-1+1) C <sub>r-1</sub>
If n is odd, then the greatest value of ${}^{n}C_{r}$ is $(viii) {}^{n}C_{(n+1)/2} \text{ or } {}^{n}C_{(n-1)/2}$ $(ix) {}^{n}C_{r} = \frac{n}{r} {}^{n-1}C_{r-1}$ $(xi) {}^{n}C_{r} + {}^{n}C_{r-1} = \frac{n-r+1}{r}$ $(xi) {}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{n} = 2^{n}$ $(xii) {}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{n} = 2^{n}$ $(xiii) {}^{n}C_{0} + {}^{n}C_{2} + {}^{n}C_{4} + \dots + {}^{n}C_{n} = 2^{n}$ $(xiii) {}^{n}C_{0} + {}^{n}C_{2} + {}^{n}C_{4} + \dots + {}^{n}C_{n} = 2^{n}$ $(xiii) {}^{n}C_{0} + {}^{n}C_{2} + {}^{n}C_{4} + \dots + {}^{n}C_{n} = 2^{n}$ $(xiii) {}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{n} = 2^{n}$ $(xiii) {}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{1} + {}^{2n+1}C_{1} + {}^{2n+1}C_{2} + \dots + {}^{2n+1}C_{n} = 2^{n}$ $(xii) {}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{1} + {}^{2n+1}C_{1} + {}^{2n+1}C_{2} + \dots + {}^{2n+1}C_{n} = 2^{n}$ $(xiii) {}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{1} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{2n+1}C_{n} = 2^{n}$ $(xiii) {}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{2n+1}C_{1} + {}^{2n+1}C_{1} + {}^{2n+1}C_{2} + \dots + {}^{2n+1}C_{n} = 2^{n}$ $(xiv) {}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{1} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{2n+1}C_{1} + {}^$		nCris	(vii) <sup>n</sup> C <sub>n/2</sub>
(viii) $C_{(n+1)/2}$ or $C_{(n-1)/2}$ (ix) ${}^{n}C_{r} = \frac{n}{r} {}^{n-1}C_{r-1}$ (x) ${}^{n}C_{r} = \frac{n}{r} {}^{n-1}C_{r-1}$ (xi) ${}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{n} = 2^{n}$ (xii) ${}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{n} = 2^{n}$ (xiii) ${}^{2n+1}C_{0} + {}^{2n+1}C_{1} + {}^{2n+1}C_{2} + \dots + {}^{2n+1}C_{n} = 2^{2n}$ (xiv) ${}^{n}C_{n} + {}^{n+1}C_{n} + {}^{n+2}C_{n} + \dots + {}^{2n+1}C_{n} = 2^{2n}$ (xiv) ${}^{n}C_{n} + {}^{n+1}C_{n} + {}^{n+2}C_{n} + \dots + {}^{2n+1}C_{n} = 2^{2n}$ (xiv) ${}^{n}C_{n} + {}^{n+1}C_{n} + {}^{n+2}C_{n} + \dots + {}^{2n+1}C_{n} = 2^{2n}$ (xiv) ${}^{n}C_{n} + {}^{n+1}C_{n} + {}^{n+2}C_{n} + \dots + {}^{2n+1}C_{n} = 2^{2n}$ (xiv) ${}^{n}C_{n} + {}^{n}C_{n} + {}^{n}C_{n} + {}^{n}C_{n} + \dots + {}^{2n+1}C_{n} + {}^{n}C_{n} + \dots + {}^{2n+1}C_{n} = 2^{2n}$ (xiv) ${}^{n}C_{n} + {}^{n}C_{n} + {}^{n}C_{n} + {}^{n}C_{n} + \dots + {}^{2n+1}C_{n} + {}^{n}C_{n} + \dots + {}^{2n+1}C_{n} + {}^{n}C_{n} + {}^{n}C_{n} + \dots + {}^{2n+1}C_{n} + {}^{n}C_{n} + $			2. VA.
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(xi) ${}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{n} = 2^{n}$ (xii) ${}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{n} = 2^{n}$ (xii) ${}^{n}C_{0} + {}^{n}C_{2} + {}^{n}C_{4} + \dots = {}^{n}C_{1} + {}^{n}C_{3}$ ${}^{n}C_{5} + \dots = 2^{n-1}}$ (xiii) ${}^{2n+1}C_{0} + {}^{2n+1}C_{1} + {}^{2n+1}C_{2} + \dots + {}^{2n+1}C_{n} = 2^{2n}}$ (xiv) ${}^{n}C_{n} + {}^{n+1}C_{n} + {}^{n+2}C_{n} + \dots + {}^{2n+1}C_{n} = 2^{2n}$ (xiv) ${}^{n}C_{n} + {}^{n+1}C_{n} + {}^{n+2}C_{n} + \dots + {}^{2n+1}C_{n} = 2^{2n}$ (xiv) ${}^{n}C_{0} + {}^{n}C_{1} + {}^{n}C_{2} + \dots + {}^{n}C_{2} + \dots + {}^{n}C_{2}$ 14 The number of combination of n different things taken r at a time, where p particular things never occur is  15 If in a party n persons are present, then total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points			(IX) C <sub>r</sub> C <sub>r-1</sub>
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$(xii)  ^{n}C_{0} + ^{n}C_{2} + ^{n}C_{4} + = ^{n}C_{1} + ^{n}C_{3} + ^{n}C_{5} + = 2^{n-1} $ $(xiii)  ^{2n+1}C_{0} + ^{2n+1}C_{1} + ^{2n+1}C_{2} + + ^{2n+1}C_{n} = 2^{2n} $ $(xiv)  ^{n}C_{n} + ^{n+1}C_{n} + ^{n+2}C_{n} + + ^{2n-1}C_{n} = 2^{n}C_{n+1} $ $(xv)  \text{If r>n, then }  ^{n}C_{r} = 0$ 14 The number of combination of n different things taken r at a time, where p particular things never occur is 15 If in a party n persons are present, then total number of hand shakes 16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection 17 The number of straight lines passing through n points			
C <sub>5</sub> +=2 <sup>n-1</sup>			
(xiii) <sup>2n+1</sup> C <sub>0</sub> + <sup>2n+1</sup> C <sub>1</sub> + <sup>2n+1</sup> C <sub>2</sub> ++ <sup>2n+1</sup> C <sub>n</sub> =2 <sup>2n</sup> (xiv) <sup>n</sup> C <sub>n</sub> + <sup>n+1</sup> C <sub>n</sub> + <sup>n+2</sup> C <sub>n</sub> ++  (xv) If r>n, then <sup>n</sup> C <sub>r</sub> =0  14 The number of combination of n different things taken r at a time, where p particular things never occur is  15 If in a party n persons are present, then total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points		I	
2n+1C <sub>n</sub> =2 <sup>2n</sup> (xiv) <sup>n</sup> C <sub>n</sub> + <sup>n+1</sup> C <sub>n</sub> + <sup>n+2</sup> C <sub>n</sub> ++  2n-1C <sub>n</sub> = <sup>2n</sup> C <sub>n+1</sub> (xv) If r>n, then <sup>n</sup> C <sub>r</sub> =0  14 The number of combination of n different things taken r at a time, where p particular things never occur is  15 If in a party n persons are present, then total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points			
(xiv) ${}^{n}C_{n} + {}^{n+1}C_{n} + {}^{n+2}C_{n} + \dots + {}^{2n-1}C_{n} = {}^{2n}C_{n+1}$ (xv) If $r > n$ , then ${}^{n}C_{r} = 0$ 14 The number of combination of $n$ different things taken $r$ at a time, where $p$ particular things never occur is  15 If in a party $n$ persons are present, then total number of hand shakes  16 Out of $n$ non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through $n$ points		Waterconn. 18	$(XIII)^{2i+1}C_0 + {}^{2i+1}C_1 + {}^{2i+1}C_2 + \dots +$
2n-1C <sub>n</sub> =2nC <sub>n+1</sub> (xv) If r>n, then nC <sub>r</sub> =0  14 The number of combination of n different things taken r at a time, where p particular things never occur is  15 If in a party n persons are present, then total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points		The state of the s	
The number of combination of n different things taken r at a time, where p particular things never occur is  15 If in a party n persons are present, then total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points		, 5 <sup>7</sup>	$(xiv) {}^{n}C_{n} + {}^{n+1}C_{n} + {}^{n+2}C_{n} + \dots +$
The number of combination of n different things taken r at a time, where p particular things never occur is  15 If in a party n persons are present, then total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points		50. 14 St.	$^{2n-1}C_n = ^{2n}C_{n+1}$
The number of combination of n different things taken r at a time, where p particular things never occur is  If in a party n persons are present, then total number of hand shakes  Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  The number of straight lines passing through n points			
different things taken r at a time, where p particular things never occur is  15 If in a party n persons are present, then total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points	14	The number of combination of n	-1
p particular things never occur is  If in a party n persons are present, then total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points		different things taken r at a time, where	п-р <sub>С</sub> г
total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points		p particular things never occur is	-,
total number of hand shakes  16 Out of n non-concurrent and non-parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points	15	If in a party n persons are present, then	n <sub>o</sub>
parallel staright lines, the number of points of intersection  17 The number of straight lines passing through n points		total number of hand shakes	$^{\circ}C_{2}$
points of intersection  17 The number of straight lines passing through n points	16	Out of n non-concurrent and non-	
points of intersection  17 The number of straight lines passing through n points		parallel staright lines, the number of	nC <sub>2</sub>
through n points		points of intersection	
18 Number of traingles formed by joining p	1/_	The number of straight lines passing	
18   Number of traingles formed by joining p	10	through n points	C <sub>2</sub>
nc	18	Number of traingles formed by joining n	nC
non-collinear points nC3		non-collinear points	C <sub>3</sub>



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

11.

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