

MATHEMATICS

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**XIth, XIIth, TARGET IIT-JEE
(MAIN + ADVANCE) & COMPETITIVE EXAM.
FOR XI (PQRS)**

COMBINATIONS & Their Properties

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THINGS TO REMEMBER

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

$$(i) \quad {}^n C_r = \frac{n!}{(n-r)!r!}$$

$$(ii) \quad {}^n C_r \times r! = {}^n P_r$$

$$(iii) \quad {}^n C_r + {}^n C_{n-r}$$

$$(iv) \quad {}^n C_r + {}^n C_{r-1} = {}^{n+1} C_r$$

$$(v) \quad {}^n C_r = \frac{n}{r} {}^{n-1} C_r = \frac{n}{r} \times \frac{n-1}{r-1} \cdot {}^{n-2} C_{r-2} = \dots = \frac{n}{r} \times \frac{n-1}{r-1} \times \frac{n-2}{r-2} \times \dots \times \frac{n-(r-1)}{1}$$

$$(vi) \quad {}^n C_x = {}^n C_y \Rightarrow x = y \text{ or, } x + y = n$$

(vii) If n is an even natural number, then the greatest among

$${}^n C_0, {}^n C_1, {}^n C_2, \dots, {}^n C_n \text{ is } {}^n C_{\frac{n}{2}}$$

If n is an odd natural number, then the greatest among

$${}^n C_0, {}^n C_1, {}^n C_2, \dots, {}^n C_n \text{ is } {}^n C_{\frac{n-1}{2}} \text{ or, } {}^n C_{\frac{n+1}{2}}$$

2. The number of ways of selecting r items or objects from a group of n distinct items or objects.

$$\frac{n!}{(n-r)!r!} = {}^n C_r$$

EXERCISE-1

1. If ${}^n C_7 = {}^n C_4$, find the value of n .

2. Find the value of the expression ${}^{47} C_4 + \sum_{j=1}^5 {}^{52-j} C_3$.

3. If ${}^n C_{15} = {}^n C_y$ and $x \neq y$, then $x + y = n$.

4. If ${}^n P_r = 720$ and ${}^n C_r = 120$, find r .

5. If ${}^{n+2} C_8 : {}^{n-2} P_4 = 57 : 16$, find n .

6. If ${}^n P_r = {}^n P_r + 1$ and ${}^n C_r = {}^n C_{r-1}$, find the value of n and r .

7. If ${}^{18} C_x = {}^{18} C_{x+2}$, find x .

8. If ${}^{15} C_r : {}^{15} C_{r-1} = 11 : 5$, find r .

9. Evaluate : ${}^{20} C_5 = \sum_{r=2}^5 {}^{25-r} C_4$

10. A person wishes to make up as many different parties as he can out of his 20 friends such that each party consists of the same number of persons. How many friends should be invited?

11. A committee of 5 is to be formed out of 6 gents and 4 ladies. In how many ways this can be done, when

(i) at least two ladies are included,

(ii) At most two ladies are included?

12. How many diagonals are there in a polygon with n sides ?
13. There are 10 points in a plane, no three of which are in the same straight line, excepting 4 points, which are collinear. Find the
 - (i) number of straight lines obtained from the pairs of these points;
 - (ii) number of triangles that can be formed with the vertices as these points.
14. In how many ways can a student choose 5 courses out of 9 courses if 2 courses are compulsory for every student ?
15. From a class of 12 boys and 10 girls, 10 students are to be chosen for a competition; at least including 4 boys and 4 girls. The 2 girls who won the prizes last year should be included. In how many ways can the selection be made ?
16. From 4 officers and 8 jawans in how many ways can 6 be chosen (i) to include exactly one officer (ii) to include at least one officer ?
17. In an examination, a student has to answer 4 questions out of 5 questions; questions 1 and 2 are however compulsory. Determine the number of ways in which the student can make the choice.
18. In how many ways can a committee of 5 persons be formed out of 6 men and 4 women when at least one woman has to be necessarily selected ?
19. Find the number of (i) diagonals (ii) triangles formed in a decagon.
20. In how many ways can a team of 3 boys and 3 girls be selected from 5 boys and 4 girls ?
21. A bag contains 5 black and 6 red balls. Determine the number of ways in which 2 black and 3 red balls can be selected.
22. A group consists of 4 girls and 7 boys. In how many ways can a team of 5 members be selected if the team has (i) no girl ? (ii) at least one boy and one girl ? (iii) at least 3 girls ?
23. How many four-letter words can be formed using the letters of the word 'INEFFECTIVE' ?
24. Find the number of combinations and permutations of 4 letters taken from the word 'EXAMINATION' ?
25. How many words can be formed by taking 4 letters at a time from the letters of the word 'MORADABAD' ?
26. How many words each of 3 vowels and 2 consonants can be formed from the letters of the word 'INVOLUTE' ?

EXERCISE-2

Answer each of the following questions in one word or one sentence of as per exact requirement of the questions :

1. If ${}^{35}C_{n+7} = {}^{35}C_{4n-2}$, then write the values of n .
2. Write the maximum number of points of intersection of 8 straight lines in a plane.
3. Write the number of ways in which 12 boys may be divided into three groups of 4 boys each.

EXERCISE-3

Mark the correct alternative in each of the following

1. There are 12 points in a plane. The number of the straight lines joining any two of the when 3 of them are collinear, is
 - (a) 62
 - (b) 120
 - (c) 7200
 - (d) none of these

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2. In how many ways can a committee of 5 be made out of 6 men and 4 women containing at least one women ?
(a) 246 (b) 222 (c) 186 (d) none of these
3. There are 13 players of cricket, out of which 4 are bowlers. In how many ways a team of eleven be selected from them so as to include at least two bowlers ?
(a) 72 (b) 78 (c) 42 (d) none of these
4. If ${}^{43}C_{r-6} = {}^{43}C_{3r+1}$, then the value of r is
(a) 12 (b) 8 (c) 6 (d) 10
5. A lady gives a dinner party for six guests. The number of ways in which they may be selected from among ten friends if two of the friends will not attend the party together is
(a) 112 (b) 140 (c) 164 (d) none of these