



## MATHS

### BOOKS - MODERN PUBLICATION

### PERMUTATIONS AND COMBINATIONS

#### Example

1. Evaluate  $8!$ .



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2. Find  $\frac{7!}{5!}$ .



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3. Compute  $\frac{52!}{(47!)(5!)}$ .

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4. Compute  $(4!)(2!)$ . Is  $(4!)(2!) = 8!$ ?

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5. When  $n = 5$  and  $r = 2$ , find the values of:  $\frac{n!}{r!}$ .

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6. When  $n = 5$  and  $r = 2$ , find the values of :  $\frac{n!}{r!(n-r)!}$ .

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7. If  $\frac{1}{6!} + \frac{1}{7!} = \frac{x}{8!}$ , find  $x$

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8. Prove that :  $(2n)! = 2^n(n!)[1.3.5....(2n-1)]$  for all natural numbers  $n$ .

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9. Prove that  $(n!)^2 \leq n^n \cdot (n!) < (2n)!$  for all positive integers  $n$ .

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10. Prove that  $n!+1$  is not divisible by any integer between 2 and  $n$ .

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11. Prove that  $33!$  is divisible by  $2^{19}$  and what is the largest integer  $n$  such that  $33!$  is divisible by  $2^n$ ?

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**12.** A lady wants to select one cotton saree and one polyester saree from a textile shop. If there are 10 cotton varieties and 12 polyester Varieties, in how many ways can she choose the two sarees ?

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**13.** How many three-digit numbers can be formed without using the digits 0, 2, 3, 4, 5 and 6?

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**14.** How many 2-digit even numbers can be formed from the digits 1, 2,3, 4 and 5, if the digits can be repeated ?

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**15.** How many numbers are there between 100 and 1000 such that every digit is either 2 or 9?

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**16.** In a class there are 30 boys and 18 girls. The teacher wants to select one boy and one girl to represent the class for a quiz competition. In how many ways can the teacher make this selection ?

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**17.** How many 3-letter code words are possible using the first 10 letters of English alphabet if : no letter can be repeated ?

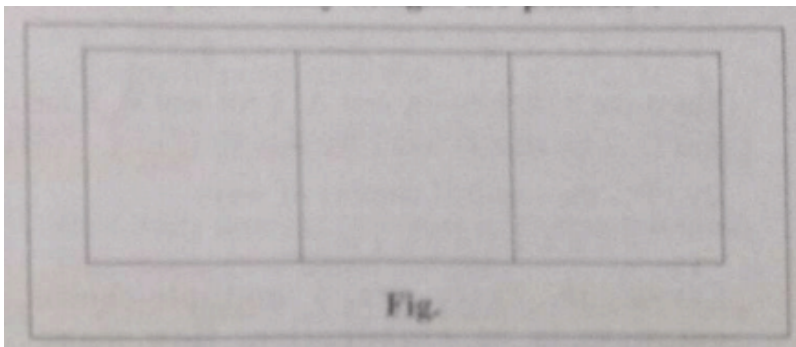
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**18.** How many 3-letter code words are possible using the first 10 letters of English alphabet if : letters are repeated ?

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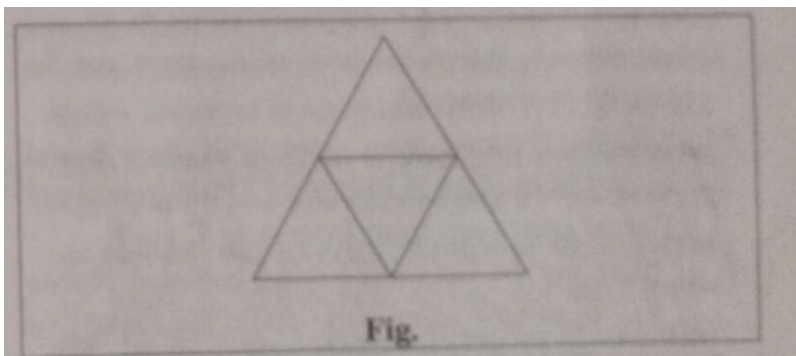
**19.** It has been decided that the flag of a newly formed forum will be in the form of three blocks, each coloured differently. If there are six colours on the whole to choose from, how

many designs are possible ?



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20. In how many ways can the following diagram be coloured subject to the following conditions ?



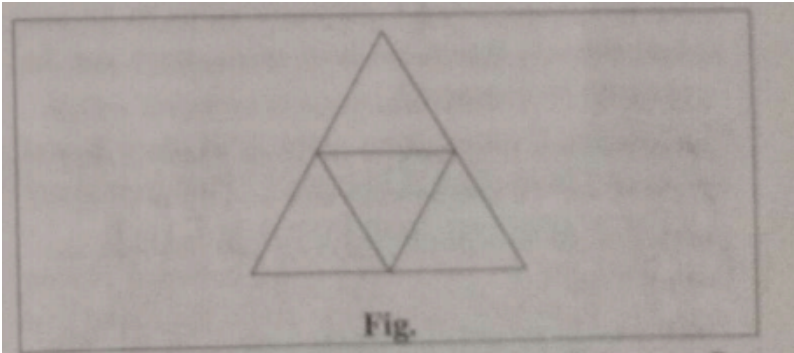
Each of the smaller triangle is to be painted with one of the three colours, red, blue or green.





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21. In how many ways can the following diagram be coloured subject to the following conditions ?



No two

adjacent regions receive the same colour .



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22. In how many ways can 5 persons sit in a car, 2 including the driver in the front seat and 3 in the back seat, if 2

particular persons out of the 5 are to avoid the driver's seat

?



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**23.** There are 4 multiple-choice questions in an examination.

How many sequence of answers are possible, if each question has 2 choices ?



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**24.** Find the number of different signals that can be generated by arranging at least 2 flags in order (one below the other) on a vertical staff, if five flags are available.



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25. Find the value of  ${}^4P_3$ .

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26. Find n if  ${}^nP_4 = 20^n P_2$ .

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27. Find the value of n such that :

$${}^nP_5 = 42^n P_3, n > 4.$$

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**28.** Find the value of  $n$  such that :

$$\frac{{}^n P_4}{{}^{n-1} P_4} = \frac{5}{3}, n > 4.$$

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**29.** Prove that if  $r \leq s \leq n$ , then  ${}^n P_s$  is divisible by  ${}^n P_r$ .

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**30.** Prove that :  $\hat{\ } n P_r = {}^{n-1} P_r + r {}^{n-1} P_{r-1}$ , for all natural numbers  $n$  and  $r$  for which the symbols are defined.

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31. Prove that :  ${}^n P_r = n^{n-1} P_{r-1}$ , for all natural numbers  $n$  and  $r$  for which the symbols are defined.

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32. Prove that

$$1 \cdot {}^1 P_1 + 2 \cdot {}^2 P_2 + 3 \cdot {}^3 P_3 + \dots + n \cdot {}^n P_n = {}^{n+1} P_{n+1} - 1$$

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33. How many three-digit numbers are there, with distinct digits, with each digit odd ?

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**34.** How many different 6-digit numbers can be formed with the digits 0, 1, 3, 5, 7 and 9 ? (No digit being repeated.)

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**35.** How many of them are divisible by 10 if 6 digit numbers formed by 0,1,3,5,7,9 when no digit repeated?

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**36.** How many numbers greater than 56000 can be formed by using the digits 4, 5, 6,7, 8, no digit being repeated in any number ?

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**37.** Six candidates are called for interview to fill four posts in an office. Assuming that each candidate is fit for each post. determine the number of ways in which : first and second posts can be filled.



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**38.** Six candidates are called for interview to fill four posts in an office. Assuming that each candidate is fit for each post. determine the number of ways in which : first three posts can be filled.



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**39.** Six candidates are called for interview to fill four posts in an office. Assuming that each candidate is fit for each post. determine the number of ways in which : all the four posts can be filled.

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**40.** How many signals can be made by hoisting 5 flags of different colours ?

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**41.** Find the number of permutations of  $n$  things taken  $r$  at a time in which two particular things : always occur.

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**42.** Find the number of permutations of  $n$  things taken  $r$  at a time in which two particular things : never occur.

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**43.** In how many ways can six different rings be worn on the four fingers of one hand ?

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**44.** How many 3-digit numbers can be formed from the digits 1, 2, 3, 4 and 5 assuming (i) repetition of digits allowed (ii) repetition of digits not allowed ?

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**45.** There are three prizes to be distributed among 6 students. In how many ways can this be done when no boy gets more than one prize.

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**46.** There are three prizes to be distributed among 6 students. In how many ways can this be done when there is no restriction as to the number of prizes that a boy may get.

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**47.** There are three prizes to be distributed among 6 students. In how many ways can this be done when no boy gets all prizes.

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**48.** How many 7-digit numbers can be formed, using the digits 1, 2, 0, 2, 4, 2 and 4?

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**49.** How many numbers can be formed with the digits 1, 2, 3, 4, 3, 2, 1 so that odd digits always occupy the odd places?

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**50.** In how many ways can 4 red, 3 yellow and 2 green discs be arranged if the discs of the same colour are indistinguishable ?



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**51.** How many permutations of the letters of the word “APPLE” are there ?



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**52.** How many different words can be formed with the letters of the 'BHARAT' ? In how many of these B and H are never together ?



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**53.** How many different words can be formed with the letters of the 'BHARAT' ? How many of these begin with B and end with T ?



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**54.** If the different permutations of all the letter of the words 'EXAMINATION' are listed as in a dictionary, how many words are there in this list before the first word starting with E?



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**55.** A code word is to consist of two English alphabets followed by two distinct numbers between 1 and 9. For example, CA23 is a code word. How many such code words are there? How many of them end with an even integer ?

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**56.** Find the number of arrangements of the letters of the word 'INDEPENDENCE'. In how many of these arrangements, do the words start with P ?

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**57.** Find the number of arrangements of the letters of the word 'INDEPENDENCE'. In how many of these arrangements,

do all the vowels always occur together ?



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**58.** Find the number of arrangements of the letters of the word 'INDEPENDENCE'. In how many of these arrangements, do the vowels never occur together ?



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**59.** Find the number of arrangements of the letters of the word 'INDEPENDENCE'. In how many of these arrangements, do the words begin with I and end in P ?



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**60.** Number of ways in which is 8 boys can sit in a circle?

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**61.** In how many ways can 8 students be seated in : a line ?

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**62.** There are 6 gentlemen and 3 ladies to dine at a round table. In how many ways can they seat themselves so that no two ladies are seated together ?

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**63.** In how many ways can 6 beads of same colour form a necklace ?

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**64.** Three boys and three girls are to be seated around a table in a circle. Among them, the boy X does not want any girl neighbour and the girl Y does not want any boy neighbour. How many such arrangements are possible ?

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**65.** Evaluate  ${}^{10}C_4$ .

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66. Verify that  $2C(7, 4) = C(8, 4)$ .

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67. If  $C(n, 7) = C(n, 5)$ , find  $C(n, 4)$ .

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68. Prove that :  ${}^2C_1 + {}^3C_1 + {}^4C_1 = {}^3C_2 + {}^4C_2$ .

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69. Prove that  $\sum_{r=1}^5 {}^5C_r = 31$ .



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70. Prove that :  ${}^{2n}C_n = \frac{2^n [1.3.5. \dots (2n - 1)]}{n!}$ .

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71. Find n, if  ${}^{2n}C_1$ ,  ${}^{2n}C_2$  and  ${}^{2n}C_3$  are in A.P.

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72. Prove that the product of 2n consecutive negative integers is divisible by (2n)! .

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**73.** How many different teams of 7 payers can be chosen from 10 players ?

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**74.** How many chords can be drawn through 21 points on a circle?

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**75.** Number of diagonals in a hexagon are

(i) 6

(ii) 5

(iii) 9

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**76.** From a class of 32 students, 4 are to be chosen for a competition. In how many ways can this be done ?

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**77.** 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.

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**78.** A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the

committee consists of: exactly 3 girls ?



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**79.** A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of : at least three girls.



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**80.** A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of: atmost 3 girls ?



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**81.** What is the number of ways of choosing 4 cards from a pack of 52 playing cards, if four cards are of the same suit,

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**82.** What is the number of ways of choosing 4 cards from a pack of 52 playing cards, if four cards belong to four different suits,

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**83.** What is the number of ways of choosing 4 cards from a pack of 52 playing cards, if they are face cards.



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**84.** What is the number of ways of choosing 4 cards from a pack of 52 playing cards ? In how many of these : two are red cards and two are black cards?



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**85.** What is the number of ways of choosing 4 cards from a pack of 52 playing cards ? In how many of these : cards are of the same colour ?



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**86.** In an examination, a question paper consists of 12 questions divided into parts i.e. Part I and Part II, containing 5 and 7 questions respectively. A student is required to attempt 8 questions, selecting at least 3 from each part. In how many ways can a Student select the questions ?

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**87.** A Student has to answer 10 questions, choosing at least 4 from each of part A and part B. If there are 6 questions in part A and 7 questions in part B, in how many ways can the student choose 10 questions?

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**88.** A person wishes to make up as many different parties as he can out of his 16 friends such that each party consists of the same number of persons. How many friends should be invite ?



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**89.** A sports team of 11 students is to be constituted, choosing at least 5 from class XI and at least 5 from class XII. If there are 20 students in each of these classes, in how many ways can the teams be constituted ?



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**90.** In a village, there are 87 families, of which 52 families have at most 2 children. In a rural development programme, 20 families are to be chosen for assistance, of which at least 18 families must have at most 2 children. In how many ways can the choice be made ?

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**91.** If  $m$  parallel lines in a plane are intersected by a family of  $n$  parallel lines, find the number of parallelograms formed.

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**92.** In how many ways can 10 things be equally divided :  
between two persons?



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**93.** In how many ways can 10 things be equally divided : into two heaps ?



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**94.** A man has 6 friends. In how many ways can he invite one or more of his friends to a party ?



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**95.** From 4 mangoes, 5 oranges and 6 apples, how many selections of fruits can be made by taking at least one of

them ?



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**96.** A number lock on a suitcase has 3 wheels each labeled with ten digits from 0 to 9. If the opening of the lock is a particular sequence of three digits with no repeats, how many such sequences will be possible?



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**97.** A customer forgets a four-digit code of an Automatic Teller Machine (ATM) in a bank. However, he remembers that this code consists of digits 2, 3, 6 and 9. Find the largest

possible number of trails necessary to obtain the correct code.



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**98.** Give expressins in the following cases:

7 added to p.



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## Exercise

**1.** Compute the following :

5!.



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2. Compute the following :

6!.

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3. Compute the following :

7!.

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4. Compute the following :

$7! - 5!$ .

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5. Compute the following :

$$4! - 3!.$$

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6. Compute the following :

$$\frac{9! - 8!}{7!}.$$

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7. Compute the following :

$$2 \times 6! - 3 \times 5!.$$

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8. Compute the following :

$$3 \times 4! + 7 \times 4!.$$

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9. Compute the following :  $\frac{8!}{2 \times 6!}.$

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10. Compute the following :

$$\frac{12!}{(10)!(2)!}.$$

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11. Find the value of  $\frac{20!}{18!(20 - 18)!}$

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12. Is  $3! + 4! = 7!$ ?

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13. Convert the following into factorials :

2.4.6.8.10 .

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14. Convert the following into factorials :

4.5.6.7.8.9.10.11.

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15. Compute  $2!+3!$ . Is  $2!+3!=5!$ ?

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16. Compute  $\frac{8!}{4!}$ . Is  $\frac{8!}{4!} = 2!$ ?

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17. Evaluate  $(n - r)!$ , when :  $n=6, r=2$ .

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18. Evaluate  $(n - r)!$ , when :  $n=9, r=5$ .

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19. Evaluate  $\frac{n!}{(n - r)!}$  when :  $n= 10, r=4$ .

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20. Evaluate  $\frac{n!}{(n - r)!}$  when :  $n=12, r=3$ .

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21. Evaluate  $\frac{n!}{(n-r)!}$ , when  $n=6, r=2$

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22. Evaluate  $\frac{n!}{(n-r)!}$ , when  $n=9, r=5$ .

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23. Evaluate  $\frac{n!}{(n-r)!}$  when  $r=1$ .

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24. Evaluate  $\frac{n!}{(n-r)!}$  when  $r=2$ .

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25. Evaluate  $\frac{n!}{(n-r)!}$  when :  $r=3$ .

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26. Evaluate  $\frac{n!}{r!(n-r)!}$  when :  $n=6, r=2$ .

 [Watch Video Solution](#)

27. Evaluate  $\frac{n!}{r!(n-r)!}$  when :  $n=7, r=4$ .

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28. Evaluate  $\frac{n!}{r!(n-r)!}$  when :  $n=15, r=12$ .

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29. Find the L.C.M. of  $4!, 5!$  and  $6!$ .

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30. If  $\frac{1}{9!} + \frac{1}{10!} = \frac{n}{11!}$ , find  $n$ .

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31. If  $\frac{1}{8!} + \frac{1}{9!} = \frac{x}{10!}$ , find  $x$ .

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32. Prove that  $n!(n + 2) = n! + (n + 1)!$ .

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33. If  $(n+1)! = 12 [(n-1)!]$ , find  $n$ .

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34. If  $(n+2)! = 60 [(n-1)!]$ , find  $n$ .

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35. If  $(n+2)! = (2550)(n!)$ , find  $n$ .



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36. If  $\frac{n!}{2!(n-2)!} : \frac{n!}{4!(n-4)!} = 2:1$ . Find the value of  $n$ .

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37. Prove that

$$\frac{n!}{r!(n-r)!} + \frac{n!}{(r-1)!(n-r+1)!} = \frac{(n+1)!}{r!(n-r+1)!}.$$

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38. Prove that there are exactly  $4!$  numbers between 1000 and 10000 that contain the digits 1, 3, 5 and 7.

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**39.** show that  $2^{16}$  divides  $32!$ . also, find the largest value of  $n$  for which  $32!$  is divisible by  $2^n$ .



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**40.** There are five colleges in a city. In how many ways can a man send 3 of his sons to a college, if no two of his sons are to read in the same college ?



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**41.** John wants to go abroad by ship and return by air. He has a choice of 6 different ships to go and 4 airlines to return. In how many ways can he perform his journey ?



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**42.** There are 5 routes from place A to place B and 3 routes from place B to place C. Find how many different routes are there from A to C via B.



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**43.** If there are 20 steamers plying between places A and B, in how many ways could the round trip from A be made if the return was made on : the same steamer ?



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**44.** If there are 20 steamers plying between places A and B, in how many ways could the round trip from A be made if the return was made on : a different steamer ?

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**45.** In how many ways can 5 persons draw water from 5 taps, assuming no tap remains unused ?

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**46.** In how many ways can 3 people be seated in a row containing 7 seats ?

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**47.** A sample of 3 bulbs is tested. A bulb is labelled 'G' if it is good and 'D' if it is defective. Find the number of all the possible outcomes.



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**48.** How many 4-letter code words are possible using the first 10 letters of the English alphabet, if no letter can be repeated ?



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**49.** Six pictures are to be arranged from left to right on a wall of an art gallery for display. How many arrangements

are possible ?



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**50.** The digits, from 0 to 9, are written on slips of paper and placed in a box. Three of the Slips of paper are drawn and placed in order. How many different outcomes are possible ?



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**51.** For a group photograph, 3 boys and 2 girls stand in a line in all possible ways. How many photos could be taken if each photo corresponds to each such arrangement ?



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**52.** How many 5-digit telephone numbers can be constructed using the digits 0 to 9 if each number starts with 67 and no digit appears more than once?

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**53.** Given (i) 4 flags (ii) 5 flags of different colours, how many different Signals can be generated if each signal requires the use of two flags, one below the other ?

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**54.** Find the number of different signals that can be made by arranging at least three flags in order on a vertical pole, if 6 different flags are available.



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**55.** How many numbers can be formed from the digits 1, 2, 3, 9 if repetition of digits is not allowed ?



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**56.** Kartar goes to a movie. The cinema hall has two entrances and three exits. In how many ways can Kartar enter and exit from the hall ?



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**57.** Find the number of different signals that can be generated by arranging at least 2 flags in order (one below the other) on a vertical staff, if five flags are available.

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**58.** In a monthly test, the teacher decides that there will be three questions. one from each of Exercises 5, 6 and 7 of the text book. If there are 12 questions in Exercise 5, 18 in Exercise 6 and 9 in Exercise 7, in how many ways can the three questions be selected ?

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**59.** The students in a class are seated according to the marks in the previous examination. Once it so happens that four of these students get equal marks and therefore the same rank. To decide their seating arrangement, the teacher wants to write down all possible arrangements, one in each of separate bits of paper, in order to choose one of these by lots. How many bits of paper are required ?

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**60.** Eight children are to be seated on a bench. In how many ways can the children be seated ?

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**61.** Eight children are to be seated on a bench. How many arrangements are possible if the youngest child sits at the left hand end of the bench ?

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**62.** How many 3-digit numbers can be formed from the digits 1, 2, 3, 4 and 5 assuming (i) repetition of digits allowed (ii) repetition of digits not allowed ?

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**63.** A coin is tossed three times and the outcomes are recorded. How many possible outcomes are there ? How

many possible outcomes if the coin is tossed : Four times,  
Five times, n times ?

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**64.** A class consists of 40 girls and 60 boys. In how many ways can a president, vice president, treasurer and secretary be chosen if the treasurer must be a girl, the secretary must be a boy and a student may not hold more than one office ?

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**65.** How many numbers are there between 100 and 1000 such that 7 is in the unit's place ?

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**66.** How many numbers are there between 100 and 1000 such that at least one of their digits is 7 ?

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**67.** How many of them have exactly one of their digits as 7 ?

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**68.** A mint prepares metallic calendars specifying months, dates and days in the form of monthly sheets (one plate for each month). How many types of February calendars should it prepare to serve for all the possibilities in the future years ?



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**69.** For a set of five true or false questions, no student has written all correct answers, and no two students have given the same sequence of answers. What is the maximum number of students in the class, for this to be possible ?



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**70.** How many automobile licence plates can be made if the inscription on each contains two different letters followed by three different digits ?



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**71.** The Licence plates for vehicles registered in Delhi consist of 3 letters (of English alphabet) followed by 1, 2, 3 or 4 digits. The letter on the extreme right has to be 'D'. For the 1-digit number plates, the number 0 is not allowed. For others, the digits and the letters, of course can repeat, but the numbers should be significant. Determine the possible number of licence plates.

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**72.** Evaluate :

$${}^8P_5.$$

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**73.** Evaluate :

$${}^{10}P_3.$$



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**74.** Evaluate :

$${}^{20}P_4.$$



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**75.** Evaluate :

$${}^{75}P_2.$$



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76. Find r if :

$${}^5P_r = {}^6P_{r-1}.$$



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77. Find r if :

$${}^{10}P_r = 2^9 P_r.$$



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78. Find the value of r if  $5 \cdot {}^4P_r = 6 \cdot {}^5P_{r-1}$ .



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79. Find r if  ${}^5P_r = 2 \cdot {}^6P_{r-1}$ .



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80. Find  $r$  if :  $P(11,r) = P(12,r-1)$



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81. Find  $r$  if :

$${}^{10}P_{r+1} : {}^{11}P_r = 30 : 11.$$



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82. Find  $n$  if :

$${}^{2n}P_3 = 100^n P_2.$$



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83. Find n if :

$${}_{30}P_6 = {}^{n+2}P_7.$$



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84. Find n if :

$$2^5 P_3 = {}^n P_4.$$



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85. Find n if  ${}^{n-1}P_3 : {}^n P_4 = 1 : 9$ .



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**86.** Prove that :

$${}^n P_n = 2^n P_{n-2}.$$

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**87.** Prove that :

$${}^{10} P_3 = {}^9 P_3 + 3^9 P_2.$$

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**88.** Show that  ${}^{\wedge} n P_n = {}^n P_{n-1}$  for all natural numbers  $n$  .

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**89.** How many 3-digit numbers can be formed by using the digits 1 to 9 if no digit is repeated?

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**90.** How many 3-digit even numbers can be made using the digits 1, 2, 3, 4, 6, 7, if no digit is repeated?

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**91.** How many 3-digit even numbers can be formed from the digits 1, 2, 3, 4, 5, 6 if the digits can be repeated?

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**92.** In how many ways can five children stand in a queue ?

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**93.** How many different signals can be generated from 6 flags of different colours if each signal makes use of all the flags at a time, placed one below the other?

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**94.** Seven songs are to be rendered in a programme. In how many different orders could they be rendered?

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**95.** There are 6 items in column A and 6 items in column B. A student is asked to match each item in column A with an item in column B. How many possible answers (correct or incorrect) are there to the question ?

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**96.** How many 3-digit numbers are there without repetition?

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**97.** How many 4-digit numbers are there with no digit repeated?

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**98.** How many natural numbers from 1 to 1000 have none of their digits repeated ?

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**99.** How many 3-digit even numbers can be made using the digits 1, 2, 3, 4, 6, 7, if no digit is repeated?

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**100.** How many 3-digit even numbers can be formed from the digits 1, 2, 3, 4, 5, 6 if the digits can be repeated?

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**101.** Find the number of 4-digit numbers that can be formed using the digits 1, 2, 3, 4, 5 if no digit is repeated. How many of these will be even?

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**102.** How many numbers lying between 100 and 1000 can be formed with the digits 0, 1, 2, 3, 4, 5, the repetition of the digits is not allowed?

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**103.** How many 4 digit numbers can be formed from the digits 1 to 9 if not digit can be repeated.

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**104.** How many 4-digit numbers are there with no digit repeated?

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**105.** How many 6-digit numbers can be formed from the digits 0, 1, 3, 5, 7 and 9 which are divisible by 10 and no digit is repeated ?

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**106.** Ten horses are running a race. In how many ways can these horses come in the first, second and third place,

assuming no ties ?



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**107.** From a committee of 8 persons, in how many ways can we choose a chairman and a vice chairman assuming one person can not hold more than one position?



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**108.** From a pool of 12 candidates, in how many ways can we select president, vice president, secretary and a treasurer if each of the 12 candidates can hold any office ?



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**109.** Four alphabets E, K, S and V, one in each were purchased from a plastic warehouse. How many ordered pairs of alphabets, to be used as initials, can be formed from them ?

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**110.** Show that there are 4536 numbers between 1000 and 10000, which have none of their digits repeated. Of these, how many are odd numbers ?

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**111.** How many natural numbers not exceeding 4321 can be formed with the digits 1, 2, 3 and 4, if the digits can repeat ?

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**112.** From the digits 1, 2, 3, 4, 5, 6, how many three-digit odd numbers can be formed when the repetition of the digits is not allowed ?

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**113.** How many of the natural numbers can be formed from the digits 2, 3, 5, 7, 9 ? How many of them are odd ?

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**114.** How many 5-digit telephone numbers can be constructed using the digits 0 to 9 if each number starts

with 67 and no digit appears more than once?



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**115.** In a certain city, all telephone numbers have six digits, the first two digits always being 41 or 42 or 46 or 62 or 64. How many telephone numbers have all six digits distinct ?



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**116.** It is required to seat 5 men and 4 women in a row so that the women occupy the even places. How many such arrangements are possible ?



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**117.** In how many ways can 4 boys and 3 girls be seated in a row of 7 chairs if boys and girls alternate ?

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**118.** In how many ways can 4 boys and 3 girls be seated in a row so that no two girls are together ?

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**119.** In how many ways can 5 boys and 3 girls sit in a row so that no two girls are sit together?

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**120.** In how many ways can 4 boys and 3 girls be seated in a row so that no two girls are together ?

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**121.** Find the number of 4 letter words, with or without meaning, which can be formed out of the letters of the word 'ROSE', where the repetition of the letters is not allowed.

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**122.** The letters of the word 'TUESDAY' are arranged in a line, each arrangement ending with letter S. How many different arrangements are possible ? How many of them start with letter D ?



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**123.** How many 3-letter words can be made using the letters of the word 'ORIENTAL' ?

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**124.** Find the number of different 8-letter arrangements that can be made from the letters of the word DAUGHTER so that all vowels do not occur together.

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**125.** In how many ways can the letters of the word 'HEXAGON' be permuted ? In how many words, vowels will be together

”?



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**126.** How many 3-letter words can be made using the letters of the word ‘ORIENTAL’ ?



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**127.** How many words, with or without meaning, each of 3 vowels and 2 consonants, can be formed from the letters of the word ‘INVOLUTE’ ?



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**128.** How many words can be formed out of the letters of the word 'ARTICLE' so that vowels may occupy even places ?

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**129.** In how many ways can the letters of the word 'PENCIL' be arranged so that N is always next to E?

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**130.** In how many ways can 5 children be arranged in a line such that : two of them, Ram and Shyam are always together?

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**131.** In how many ways can 5 girls be seated in a row so that two girls Ridhi and Sanya are never together?

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**132.** Four books, one each in Chemistry, Physics, Biology and Mathematics, are to be arranged in a shelf. In how many ways can this be done ?

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**133.** How many signals can be made by hoisting 5 flags of different colours ?



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**134.** How many different 4-digit numbers can be formed from the digits 2, 3, 4 and 6 if each digit is used only once in a number? Further, how many of these numbers : end in a 4?



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**135.** How many different 4-digit numbers can be formed from the digits 2, 3, 4 and 6 if each digit is used only once in a number? Further, how many of these numbers : end in a 3?



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**136.** How many different 4-digit numbers can be formed from the digits 2, 3, 4 and 6 if each digit is used only once in a number ? Further, how many of these numbers : end in a 3 or 6 ?

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**137.** How many numbers greater than 40000 can be formed using the digits 1,2,3,4 and 5 if each digit is used only once in each number ?

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**138.** How many odd numbers greater than 80000 can be formed using the digits 2,3,4,5 and 8 if each digit is used

only once in a number ?



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**139.** A teacher wants to arrange 5 students on the platform such that the boy 'YUSUF' occupies the first position and the girls 'GEETA' and 'SEETA' are always together. How many such arrangements are possible ?



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**140.** When a group photograph is taken, all the seven teachers should be in the first row and all the twenty students should be in second row, If the two corners of the second row are reserved for the two tallest students,

interchangeable only between them and if the middle seat of the front row is reserved for the principal, how many arrangements are possible?



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**141.** In an examination hall, there are four rows of chairs. Each row has 8 chairs one behind the other. There are two classes sitting for the examination with 16 students in each class. It is desired that in each row, all students belong to the same class and that no two adjacent rows are allotted to the same class. In how many ways can these 32 students be seated?



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**142.** Find the number of permutations of 8 things, taken 3 at a time, in which 2 particular things are always : included .

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**143.** Find the number of permutations of 8 things, taken 3 at a time, in which 2 particular things are always : excluded .

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**144.** Find the number of permutations of 12 things, taken 6 at a time, in which 3 particular things are : included .

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**145.** Find the number of permutations of 12 things, taken 6 at a time, in which 3 particular things are : excluded .

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**146.** Find the number of permutations of  $n$  things, taken  $r$  at a time, in which 3 particular things : always occur.

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**147.** Find the number of permutations of  $n$  things, taken  $r$  at a time, in which 3 particular things : will never occur.

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**148.** How many 5-digit numbers can be formed by using the digits 5, 4, 3, 3, 0?

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**149.** In how many ways can 3 prizes be given to 10 boys when a boy may receive any number of prizes ?

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**150.** In how many ways can 4 prizes be given to 3 boys when a boy is eligible for all the prizes ?

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**151.** How many possible outcomes are there if 2 coin is tossed 5 times ?

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**152.** There are 10 true-false Statements in a question paper. How many sequences of answers are possible ?

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**153.** There are 4 candidates for the post of a lecturer in Mathematics and one is to be selected by votes of 5 men. In how many ways can the votes be given ?

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**154.** How many numbers greater than 1000000 can be formed by using the digits 1, 2, 0, 2, 4, 2, 4?

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**155.** How many 5-digit even numbers can be formed using the digits 1, 2, 5, 4, 5?

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**156.** How many numbers of four digits can be formed by using the digits 1, 3, 5, 7, 9, a digit being repeated any number of times in any number?

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**157.** How many numbers between 20,000 and 30,000 can be formed by using the digits 2, 3, 5,6,7, if each digit may be repeated any number of times in any number ?



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**158.** How many numbers greater than one lac can be formed by using the digits 2, 3,0,5, 3, 2 taken all together ?



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**159.** How many different signals can be transmitted by arranging 3 red, 2 yellow and 2 green flags on a pole ?





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**160.** In how many ways can 5 flags, in which 3 are red, one is white and one is blue, be arranged on a staff, one below the other, if flags of one colour are not distinguishable ?



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**161.** Find the number of arrangements, which can be made from the letters of the word : CHANDIGARH .



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**162.** Find the number of arrangements, which can be made from the letters of the word : KURUKSHETRA.



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**163.** Find the number of arrangements, which can be made from the letters of the word : EXAMINATION .



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**164.** Find the number of arrangements, which can be made from the letters of the word : MATHEMATICS.



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**165.** Find the number of arrangements, which can be made from the letters of the word : INDEPENDENCE.







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**166.** Find the number of arrangements, which can be made from the letters of the word : EXPLOITATION.



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**167.** Find the number of arrangements, which can be made from the letters of the word : ASSASSINATION .



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**168.** Find the number of arrangements, which can be made from the letters of the word : ALGEBRA.



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**169.** Find the number of arrangements, which can be made from the letters of the word : ENGINEERING.

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**170.** Find the number of arrangements, which can be made from the letters of the word : ALLAHABAD.

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**171.** In how many of the distinct permutations of the letters in MISSISSIPPI do the four I's not come together?

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**172.** There are five round stickers, 3 of them are red and the other two are green. It is desired to make a design by pasting them in a row. How many such designs are possible ?



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**173.** How many words can be formed using the letter A thrice, the letter B twice and the letter C once ?



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**174.** Find the permutations of the word 'SERIES'. How many of them begin and end with S ?



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**175.** In how many distinct ways can the product  $xy^2z^2$  be written without using exponents ?

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**176.** There are 3 white, 4 red and 1 blue marbles in a bag. They are drawn one by one and arranged in a row. Assuming that all the 8 marbles are drawn, determine the number of different arrangements if marbles of same colour are indistinguishable.

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**177.** How many even numbers are there with three digits such that if 5 is one of the digits, then 7 is the next digit ?

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**178.** How many arithmetic progressions with 10 terms are there whose first term is in the set  $\{1, 2, 3\}$  and whose common difference is in the set  $\{2, 3, 4\}$  ?

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**179.** Find the number of words which can be made by using all the letters of the word "AGAIN" if these words are written as in dictionary. What will be the 50th word?

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**180.** If there are six periods on each working day of a school, in how many ways can one arrange 5 subjects such that each subject is allotted at least one period ?



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**181.** Find how many arrangements can be made with the letters of the word 'MATHEMATICS' ? In how many of them : consonants occur together ?



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**182.** Find how many arrangements can be made with the letters of the word 'MATHEMATICS' ? In how many of them : vowels occur together?

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**183.** Find how many arrangements can be made with the letters of the word 'MATHEMATICS' ? In how many of them : vowels do not occur together ?

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**184.** In how many ways can the letters of the word PERMUTATIONS be arranged if the words start with P and end with S?



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**185.** In how many ways can the letters of the word PERMUTATIONS be arranged if the vowels are all together?



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**186.** In how many ways can the letters of the word PERMUTATIONS be arranged if the there are always 4 letters between P and S?



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**187.** Four persons A, B, C and D are to be seated at a circular table. In how many ways can they be seated ?

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**188.** There are 6 gentlemen and 5 ladies to dine at a round table. In how many ways can they seat themselves so that no two ladies are together ?

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**189.** Four men and four women sit to dine at a round table. In how many ways can they seat themselves so that no two women are together ?

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**190.** In how many ways can 5 persons A, B,C, D and E sit around a circular table if : B and D sit next to each other ?

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**191.** In how many ways can 5 persons A, B,C, D and E sit around a circular table if : A and D do not sit next to each other ?

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**192.** How many different necklaces can be formed with 6 white and 5 red beads ?



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**193.** Find the number of ways in which  $n$  different beads can be arranged to form a necklace.



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**194.** Find the number of ways in which  $n$  things of which  $r$  are alike, can be arranged in a circular order.



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**195.** The Prime Ministers of 8 countries meet together to discuss a problem. In how many ways can they sit together

at a round table, if India and Pakistan Prime Ministers are not to sit together ?

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**196.** In how many ways can 8 girls be seated at a round table, provided Parveen and Vipal are not to sit together ?

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**197.** Evaluate the following :

$${}^{12}C_7.$$

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**198.** Evaluate the following :

$${}^{10}C_8.$$



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**199.** Evaluate the following :

$${}^9C_0.$$



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**200.** Evaluate the following :

$${}^{50}C_{47}.$$



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**201.** Evaluate the following :

$${}^{15}C_{14}.$$



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**202.** Evaluate the following :

$${}^{10}C_4 + {}^{10}C_5.$$



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**203.** Evaluate the following :

$${}^{13}C_6 + {}^{13}C_5.$$



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**204.** Evaluate the following :

$${}^{19}C_{17} + {}^{19}C_{18}.$$

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**205.** Evaluate the following :

$${}^{61}C_{57} - {}^{60}C_{56}.$$

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**206.** Evaluate the following :

$${}^{25}C_{22} - {}^{24}C_{21}.$$

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207. Evaluate the following :

$${}^{31}C_{26} - {}^{30}C_{26}.$$

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208. Verify that :

$${}^8C_4 + {}^8C_3 = {}^9C_4.$$

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209. If  ${}^nC_8 = {}^nC_2$ , find  ${}^nC_2$ .

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210. If  ${}^nC_{10} = {}^nC_{12}$ , determine n and hence  ${}^nC_5$ .





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211. If  ${}^n C_9 = {}^n C_8$ , find  ${}^n C_{17}$ .



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212. Verify that  $2C(7, 4) = C(8, 4)$ .



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213. Find  $n$  if  ${}^n C_2 = {}^n C_3$ .



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214. Prove that  $1 + {}^3C_1 + {}^4C_2 = {}^5C_3$ .

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215. Determine n if  ${}^{2n}C_3 : {}^nC_3 = 11:1$

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216. If  ${}^{2n}C_3 : {}^nC_2 = 12:1$ , find n .

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217. If  ${}^nC_r : {}^nC_{r+1} = 1:2$  and  ${}^nC_{r+1} : {}^nC_{r+2} = 2:3$ , find n and r.

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218. If  ${}^{n-1}C_r : {}^n C_r : {}^{n+1} C_r = 6 : 9 : 13$ , find  $n$  and  $r$ .

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219. If  $m = {}^n C_2$ , prove that  ${}^m C_2 = 3 \times {}^{n+1} C_4$ .

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220. Prove that  ${}^n C_r + 2 {}^n C_{r-1} + {}^n C_{r-2} = {}^{n+2} C_r$ .

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221. Prove that  ${}^n P_r = {}^n C_r P_r$ .

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222. Prove that  ${}^n C_r C_5 = {}^n C_5^{n-5} C_{r-5}$ .

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223. Prove that the product of any  $k$  consecutive integers is divisible by  $k!$ .

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224. Show that  $\frac{(n + 1)(n + 2)(n + 3)\dots(n + r)}{r!}$  is a whole number.

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225. Prove that  ${}^{n-1}C_3 + {}^{n-1}C_4 > {}^n C_3$  if  $n > 7$ .

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226. Verify that  ${}^n C_r = \frac{n}{r} {}^{n-1} C_{r-1}$  and hence prove that

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

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227. Find  $n$  if  ${}^nC_4$ ,  ${}^nC_5$  and  ${}^nC_6$  are in A.P.

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228. In how many ways can 5 sportsmen be selected from a group of 10 ?

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229. How many selections of 4 books can be made from 8 different-books ?

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**230.** A committee of 2 boys is to be selected from 4 boys. In how many ways can this be done ?

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**231.** In how many ways can a committee be selected from 15 persons if the committee is to have : 3 members.

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**232.** In how many ways can a committee be selected from 15 persons if the committee is to have : 13 members.

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**233.** Sudha wants to choose any 9 stamps from a set of 11 different stamps. How many different selections can she make ?

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**234.** How many lines can be drawn through 6 points on a circle ?

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**235.** How many triangles can be drawn through  $n$  points on a circle ?

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**236.** A polygon has 44 diagonals, find the number of its sides.

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**237.** Find the number of diagonals of a : pentagon .

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**238.** Find the number of diagonals of a : octagon .

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**239.** If there are 12 persons in a party, and if each two of them shake hands with each other, how many handshakes happen ?

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**240.** In a student's reunion meeting in a school, 16 students show up. Each shakes hands with each other exactly once. Determine the total number of handshakes.

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**241.** How many different committees, each consisting of 3 girls and 2 boys can be chosen from 7 girls and 5 boys ?

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**242.** In how many ways can a team of 3 boys and 3 girls be selected from 5 boys and 4 girls?

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**243.** Find the number of ways of selecting 9 balls from 6 red balls, 5 white balls and 5 blue balls if each selection consists of 3 balls of each colour.

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**244.** A bookshelf contains 7 different Mathematics textbooks and 5 different Physics textbooks. How many groups of 3

Mathematics and 3 Physics textbooks can be selected ?

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**245.** A boy has 3 library tickets and 8 books of his interest in the library. Of these 8, he does not want to borrow Mathematics Part II, unless Mathematics Part I is also borrowed. In how many ways can he choose the three books to be borrowed ?

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**246.** Out of 7 consonants and 4 vowels, how many words can be made each containing 3 consonants and 2 vowels ?

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**247.** In how many ways can a student choose a programme of 5 courses if 9 courses are available and 2 specific courses are compulsory for every student?

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**248.** 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.

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**249.** In an examination, Yamini has to select 4 questions from each part. There are 6, 7 and 8 questions in Part I, Part II and Part III respectively. What is the number of possible combinations in which she can choose the questions ?

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**250.** If 20 lines are drawn in a plane such that no two of them are parallel and no three are concurrent. In how many points will they intersect each other ?

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**251.** There are 15 points in a plane, no three of which are collinear. Find the number of triangles formed by joining

them.



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**252.** A student is allowed to select atmost  $n$  books from a collection of  $(2n + 1)$  books. If the number of ways in which he can do this is 64, find  $n$ .



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**253.** Determine the number of 5 card combinations out of a deck of 52 cards if there is exactly (i) one ace (ii) one king in each combination.



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**254.** In how many ways can we select a cricket eleven from 17 players in which only 5 players can bowl if each cricket eleven must include exactly 4 bowlers ?

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**255.** In how many ways can a football team of 11 players be selected from 16 players? How many of these will (i) include 2 particular players (ii) exclude 2 particular players ?

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**256.** A committee of 5 members is to be selected from among 6 boys and 5 girls. Determine the number of ways of



selecting the committee if it is to consist of at least one boy and one girl.

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**257.** In how many ways a committee of 5 members can be selected from 6 men and 5 ladies consisting of 3 men and 2 ladies?

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**258.** Out of 5 men and 2 women a committee of 3 is to be formed. In how many ways can it be formed if at least one woman is to be included ?

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**259.** A committee of 3 members is to be formed out of 5 men and 2 women. Find the number of ways of selecting the committee if it is to consist of at least one woman .

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**260.** A committee of 3 persons is to be constituted from a group of 2 men and 3 women. In how many ways can this be done? How many of these committees would consist of 1 man and 2 women?

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**261.** 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:  
no girl.

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**262.** 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:  
at least one boy one girl.

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**263.** 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:  
at least 3 girls.



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**264.** In how many ways can 5 members forming a committee out of 10 be selected so that : two particular members must be included?



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**265.** In how many ways can 5 members forming a committee out of 10 be selected so that : two particular members must not be included ?



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**266.** A question paper has two parts: Part A and Part B. each part containing ten questions. If the student has to choose 8 questions from part A and 5 questions from part B. In how many ways can he choose the questions?

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**267.** A mathematics paper consists of 10 questions divided into two parts I and II, each part containing 5 questions. A student is required to attempt 4 questions in all, taking at least 2 questions from each part. In how many ways can the student select the questions ?

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**268.** From a class of 25 students, 10 are to be chosen for an excursion party. There are 3 students who decide that either all of them will join or none of them will join. In how many ways can the excursion party be chosen ?



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**269.** 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 ?



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**270.** A bag contains 4 red, 3 white and 2 blue balls. Three balls are drawn at random out of the bag. Determine the number of ways of selecting at least one white ball in the selection.

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**271.** In how many ways can 12 things be equally divided : between 2 persons?

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**272.** In how many ways can 12 things be equally divided : into 2 heaps ?

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**273.** In how many ways can 18 different books be divided equally among three students ?

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**274.** In how many ways can 12 things be equally divided among 4 persons ?

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**275.** In how many ways can 15 things be divided into groups of 8, 4 and 3 respectively.

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**276.** A man has 7 friends. In how many ways can he invite one or more of them to a party ?

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**277.** In how many ways can a person invite one or more of his 8 friends to a feast ?

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**278.** In how many ways can a student of XI class choose 5 subjects out of 9 available subjects if two subjects, English (core) and Hindi (core) are compulsory .





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**279.** In an Examination, a candidate has to pass in each of the four subjects. In how many ways can he fail ?



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**280.** From 2 mangoes, 3 oranges and 4 apples, how many selections of fruits can be made by taking : at least one of them?



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**281.** From 2 mangoes, 3 oranges and 4 apples, how many selections of fruits can be made by taking : at least one of

each kind ?



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**282.** At an election, a voter may vote for any number of candidates not greater than the number to be chosen. There are 7 candidates and 4 members are to be chosen. In how many ways can a person vote ?



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**283.** If  $m$  red balls and  $n$  white balls are placed in a row so that no two white balls are together, prove that if  $m > n$ , the total number of ways in which this can be done is  ${}^{m+1}C_n$ .



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**284.** Serial numbers for an item produced in a factory are to be made using two letters followed by four digits (0 to 9). If the letters are to be taken from the first six letters of English alphabet without repetition and the digits are also not repeated in a serial number, how many serial numbers are possible ?



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**285.** How many 3-letter code words are possible using the first 10 letters of English alphabet if : letters are repeated ?



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**286.** In how many ways, can three jobs I, II and III be assigned to three persons A, B and C, if one person is assigned only one job and all are capable of doing each job ? Which assignment of jobs will take the least time to complete the jobs, if time taken (in hours) by an individual on each job is as follows :

Person ↓	Job →	1	2	3
A		5	4	4
B		$4\frac{1}{2}$	$3\frac{1}{2}$	4
C		5	3	5



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**287.** A biologist studying the genetic code is interested to know the number of possible arrangements of 12 molecules in a chain. The chain contains 4 different molecules represented by the initials A (for Adenine), C (for Cytosine), G

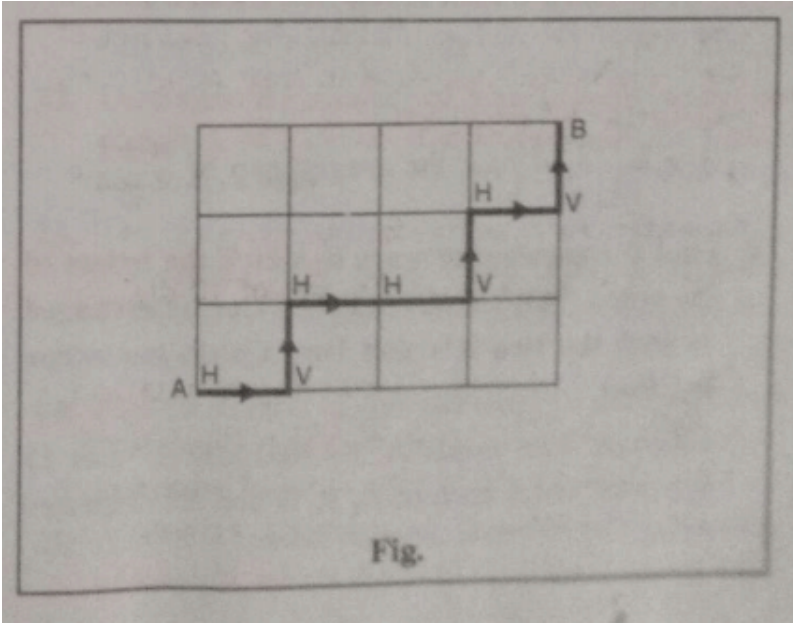
(for Guanine) and T (for Thymine) and 3 molecules of each kind. How many different such arrangements are possible in all ?



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**288.** In the fig., we see that it has 4 horizontal blocks (or paths) and 3 vertical blocks (or paths). This is known as 4 x 3 grid. Seema wishes to go from A to B but the instruction is that she must go only on the right and only up, but not necessary in that order. How many possible paths does she

have at her disposal ?



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**289.** Find the number of divisors of the number 36000.

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290. Prove that  $33!$  is divisible by  $2^{15}$ .

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291. If  $r$  is allowed to vary, find the value of  $r$  for which  ${}^n C_r$  is maximum.

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292. Find the number of ways in which the letters of the word "ARRANGEMENT" can be arranged so that the two R's and two A's do not occur together.

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**293.** How many words, with or without meaning, each of 2 vowels and 3 consonants, can be formed from the letters of the word DAUGHTER ?

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**294.** How many words, with or without meaning, can be formed using all the letters of the word EQUATION at a time so that the vowels and consonants occur together?

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**295.** In how many ways can the letters of the word ASSASSINATION be arranged so that all the S's are together ?

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**296.** In how many ways can the letters of the word 'ALGEBRA' can be arranged in a row if : the two A's are together?

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**297.** In how many ways can the letters of the word 'ALGEBRA' can be arranged in a row if : the two A's are not together ?

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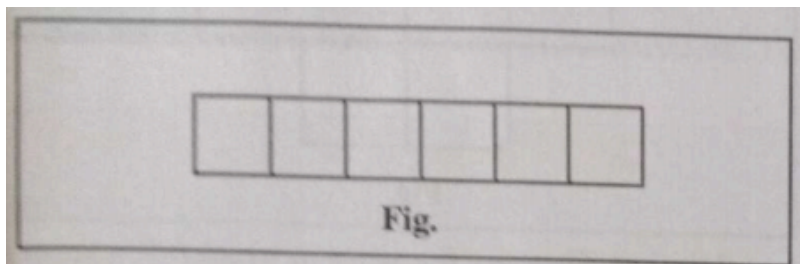
**298.** In how many different ways can five boys and five girls form a circle such that the boys and girls alternate?

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**299.** We wish to select 6 persons from 8, but if the person A is chosen, then B must be chosen. In how many ways can the selection be made ?

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**300.** Each of the six squares in the strip shown in the fig., is to be coloured with anyone of ten different colours so that no two adjacent squares have the same colour. Find the number of ways of colouring the strip.



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**301.** A mathematical club consists of 18 members. In how many ways can the members select a president, a vice president, a secretary and a treasurer if a member can hold only one position at a time.

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**302.** How many arithmetic progressions with 10 terms are there whose first term is in the set  $\{1, 2, 3\}$  and whose common difference is in the set  $\{2, 3, 4\}$ ?

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**303.** There are 6 items in column A and 6 items in column B. A student is asked to match each item in column A with an item in column B. How many possible answers (correct or incorrect) are there to the question ?

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**304.** A code word is to consist of two distinct English alphabets followed by two distinct numbers from 1 to 9. For example, PA 31 is one such code word. How many different words are possible? How many end in an odd number ?

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**305.** How many 4-letter words, with or without meaning, can be formed out of the letters of the word, 'LOGARITHMS', if repetition of letters is not allowed ?

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**306.** Find the number of permutations of the letters of the words 'DADDY DID A DEADLY DEED'.

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**307.** In how many different ways can the word 'EATERAN EATER' be arranged so that no two E's occur together.

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**308.** Three married couples are to be seated in a row having six seats in a cinema hall. If spouses are to be seated next to each other, in how many ways can they be seated ? Find also the number of ways of their seating if all the ladies sit together.

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**309.** 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: no girl.

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**310.** 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: at least one boy one girl.

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**311.** 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: no girl.

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**312.** A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of: exactly 3 girls ?





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**313.** A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done, when the committee consists of:  
at least 3 girls?



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**314.** A committee of 7 has to be formed from 9 boys and 4 girls. In how many ways can this be done when the committee consists of: at most 3 girls ?



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**315.** Determine the number of 5 cards combination out of a deck of 52 cards if at least one of the 5 cards has to be a king ?

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**316.** The English alphabet has 5 vowels and 21 consonants. How many words with two different vowels and 2 different consonants can be formed from the alphabet ?

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**317.** Find the number of permutations of  $n$  different things taken  $r$  at a time such that 3 specific things occur together ?

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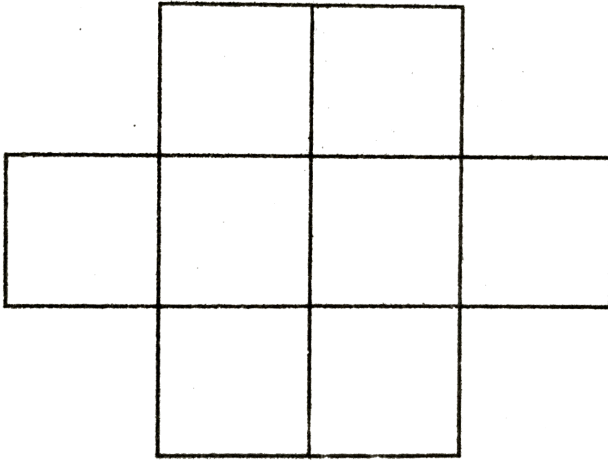
**318.** A coin is tossed 5 times. Determine the number of ways in which 0 head (i.e. 0 head and 5 tails) can appear. Also find the number of ways in which 1 head (i.e. 1 head and 4 tails) can appear, and so on. Then complete the given table :

<i>No. of heads :</i>	0	1	2	3	4	5
<i>No. of ways :</i>						

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**319.** Six X 's have to be placed in the squares of the figure below, such that each row contains atleast one X. in how

many different ways can this be done?



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