परमाणु ऊर्जा शिक्षण संस्था
(परमाणु ऊर्जा विभाग का स्वायत्त निकाय, भारत सरकार)
ATOMIC ENERGY EDUCATION SOCIETY
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# CLASS: XI
# SUBJECT:MATHEMATICS
# CHAPTER: PERMUTATIONS ANDCOMBINATIONS , MODULE-2

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# In this module we are going to learn about:

- PERMUTATIONS
- Permutation of n different objects
- Factorial notation :
- The number of permutations of n different objects taken r at a time
- The number of permutations of n objects ,where p objects are of the same kind and rest are all different
- The number of permutations of n objects ,where $P_1$ objects are of one kind ,$P_2$ objects are of the second kind,… ,…..$P_k$ are of k th kind

Lets take an example ,

If all the letters of the word 'ROSE' are to be arranged, then the number of possibilities is 4x3x2x1 = 24

For the same word 'ROSE' ,if only two letters of it are to be arranged ,then the number of possibilities is 4x3 =12

Thus ,

A Permutation is an arrangement in a definite order of a number of objects taken some or all at a time

Permutation of n different objects The number of permutations of $n$ different objects taken r at a time when $0 < r \leq n$ and the objects do not repeat can be obtained by fundamental principle of counting as n(n-1)(n-2)……(n-r+1) , which is denoted by $n_{P_r}$

Factorial notation :

The notation n! represents the product of first n natural numbers ,i.e., the product

1x2x3x….x(n-1)xn = n! and 0! defined as 1 .

$$The\ formula \qquad for \qquad n_{p_r} = \frac{n!}{(n-r)!}$$

Examples: (i) 5! = 5x4x3x2x1=120

(ii)7!= 7x6x5x4x3x2x1= 5040

(iii) $\frac{12!}{5!} = \frac{12\ .11.10.9.8.7.6.5!}{5!}$

$= 12.11.10.9.8.7.6 = 3991680$

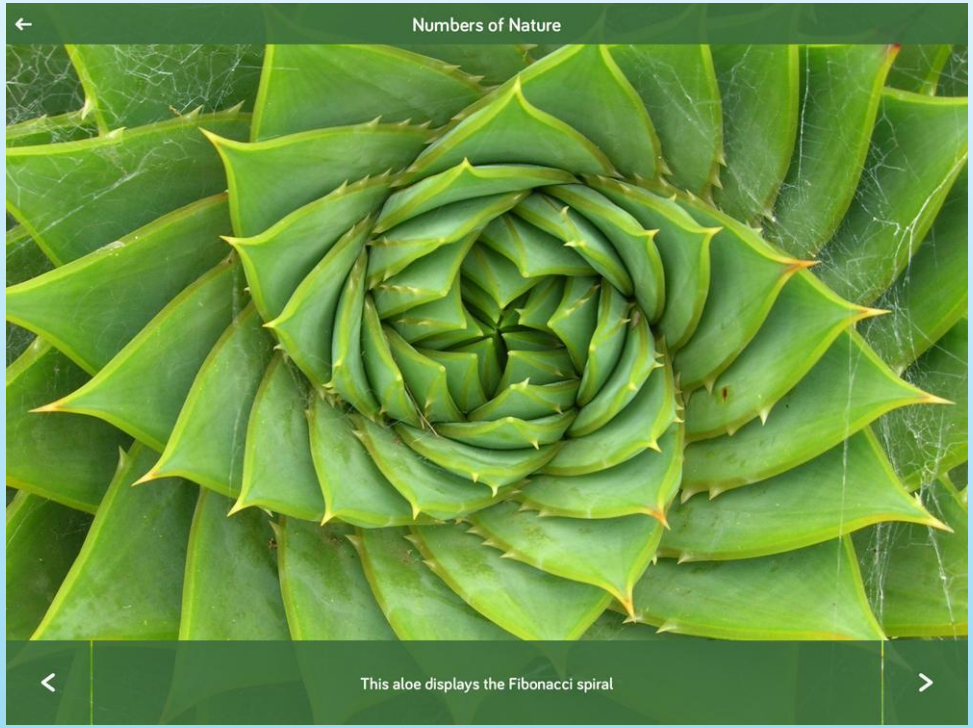
(iv) 6! – 5! = 600

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

We have $\frac{1}{8!}+\frac{1}{9X8!}=\frac{x}{10.9.8!}$

Therefore , $1+\frac{1}{9}=\frac{x}{10X9}$ or $\frac{10}{9}=\frac{x}{10X9}$

So, x = 100.



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

We have $\frac{1}{6!} + \frac{1}{7X6!} = \frac{x}{.8!}$

$\frac{1}{6!}\left(1+\frac{1}{7}\right) = \frac{x}{8X7X6!}$ ,

$\frac{1}{6!} x\frac{8}{7} = \frac{x}{8X7X6!}$ ,Hence x = 64

- Find the number of different four-digit numbers that can be formed with the digits 2,3,4,7 and using each digit only once is ?

  The required number of ways= $4_{p_4}$ = 4! = 24

- The number of 3 letter words which can be formed by the letters of the word 'NUMBER' if repetitions are not allowed is $6_{p_3} = 120$.

- The number of permutations of n different objects taken r at a time ,where repetitions is allowed ,is $n^r$ .
- Examples:

  The number of 3 letter words which can be formed by the letters of the word 'NUMBER' if repetitions are allowed is $6^3$.

- Find the number of possible outcomes when a coin is tossed 6 times is?

  Ans:

  When a coin is tossed 6 times ,then the total number of possibilities is $2^6 = 64$

The number of permutations of n objects ,where p objects are of the same kind and rest are all different = $\frac{n!}{p!}$

Examples:

How many words with or with out meaning can be formed from the word 'HELLO'?

Ans: Total number of letters in the word is 5
out of which the letter L repeats twice

Hence total number of words possible is $\frac{5!}{2!}$ = 60

The number of permutations of n objects ,where $P_1$ objects are of one kind ,$P_2$ objects are of the second kind,… ,…..$P_k$ are of k th kind and the rest ,if any ,are of different kind is $\frac{n!}{p_1!p_2!\,p_3!\ldots p_k!}$

Example :

There are 4 identical apples and 5 identical bananas.

In how many ways can you arrange all of the fruits in a row?

Ans: Total number of fruits is 9 ,out of which 4 of one kind and 5 are of second kind

Hence total number of permutations is $\frac{9!}{4!.5!}$

# Practice questions:

1. Find the value of (i) $\frac{11!}{10!}$ (ii) ${}^{6}P_{3} - {}^{5}P_{2}$
2. How many 3-digit numbers can be formed using the digits 1 to 9 if no digit is repeated?
3. 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?

4. Find the number of 5-digit telephone numbers having at least one of the two digits repeated is ?

5.Find the total number of 9-digit numbers which have all different digits?

6.How many words with or with out meaning can be formed from the word :

(i)NICE

(ii)CARAVAN

(iii)INTELLIGENT

(iv)MATHEMATICS

# THANK YOU
# HAPPY LEARNING

REFERENCES:

NCERT TEXT BOOK,

NCERT EXEMPLAR,

DIKSHA WEBSITE