FOUNDATION (MATHEMATICS)

## PERMUTATION AND COMBINATION 1. FACTORIAL NOTATION 2. FUNDAMENTAL PRINCIPLES OF The continuous product of first n natural OPERATION numbers is called factorial and it can be When one or more operations can be accomplished by number of ways then there represented by notation n or n!. are two principles to find the total number of ways to accomplish one, two, or all of the So n! = 1.2.3....(n-1).n operations without counting them as follows : $n! = n (n-1) (n-2) \dots 3.2.1$ or 2.1 Fundamental Principle of Multiplication $= n \{ (n-1) (n-2) \dots 3.2.1. \}$ Let there are two parts A and B of an operation n! = n (n-1)! = n (n-1) (n-2) !· . and if these two parts can be performed in m = n (n-1) (n-2) (n-3) !and n different number of ways respectively, then that operation can be completed in m × n (n-1).....(n - r + 1) = $\frac{n!}{(n-r)!}$ n ways. 2.2 Fundamental Principle of addition : SOME USEFUL RESULTS : If there are two operations such that they can 0! = 1 4! = 24 8! = 40320 be done independently in m and n ways = 120 9! = 362880 1! = 15! respectively, then any one of these two 2! = 2 6! = 720 10! = 3628800 operations can be done by (m + n) number of 3! = 6 7! = 5040 - n! = Meaninglessways. SOLVED PROBLEMS Ex.1 If $\frac{1}{9!} + \frac{1}{10!} = \frac{x}{11!}$ , then the value of x is Ex.3 Compute : 8! 30! (A) 123 (B) 125 (i) $\overline{(4!) \times (3!)}$ (ii) $\frac{1}{28!}$ (D) None of these (C) 121 (iii) LCM [4!, 5!, 6!] $\frac{1}{9!} + \frac{1}{10!} = \frac{x}{11!} \Longrightarrow \frac{1}{9!} + \frac{1}{10.9!} = \frac{x}{11.10.9!}$ Sol. 8! (i) $\frac{0.}{(4!) \times (3!)}$ Sol. $\Rightarrow \frac{1}{91} \sqrt{\frac{1}{10}} = \frac{1}{11} \frac{1}{10} = \frac{1}{1110} \frac{1}{10} = \frac{1}{1110}$ $= \frac{8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1}{(4 \times 3 \times 2 \times 1) \times (3 \times 2 \times 1)} = 280.$ (ii) $\frac{30!}{28!} = \frac{30 \times 29 \times (28!)}{28!} = 30 \times 29 = 870.$ $\Rightarrow \frac{11}{10} = \frac{x}{1110} \Rightarrow x = 11 \cdot 11 = 121$ (iii) We have $4! = (4 \times 3 \times 2 \times 1) = 2^3 \times 3$ The number of different words (meaningful Ex.2 $5! = (5 \times 4 \times 3 \times 2 \times 1) = 2^3 \times 3 \times 5$ or meaningless) can be formed by taking and $6! = (6 \times 5 \times 4 \times 3 \times 2 \times 1) = (2^4 \times 3^2 \times 5).$ four different letters from English alphabets :. LCM $[4!, 5!, 6!] = (2^4 \times 3^2 \times 5) = 720$ . is-(A) $(26)^4$ (B) 358800 Ex.4 Convert the product into factorials : 6.7.8.9 (C) (25)<sup>4</sup> (D) 15600 $6 \cdot 7 \cdot 8 \cdot 9 = \frac{(5!) \cdot 6 \cdot 7 \cdot 8 \cdot 9}{5!} = \frac{9!}{5!}$ Sol. Sol. The first letter of four letter word can be chosen by 26 ways, second by 25 ways, Ex.5 Find n if : $(n + 1)! = 12 \times (n-1)!$ third by 24 ways and fourth by 23 ways. So Sol. $(n + 1)! = 12 \times (n - 1)!$ number of four letter words $\Leftrightarrow$ (n +1)n × (n - 1)! = 12 × (n - 1)! $= 26 \times 25 \times 24 \times 23 = 358800$ $\Leftrightarrow$ (n+1)n = 12

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Q.1	(i) $\frac{9!}{(5!) \times (3!)}$ (ii) $\frac{32!}{29!}$					Q.9	In how many ways can a vowel, a consonant and a digit chosen out of the 26 letters of the English alphabet and the 10 digits ?				
	(iii) $\frac{(12!)}{9}$		Q.10	In a class there are 27 boys and 14 girls. The teacher wants to select 1 boy and 1 girl to represent the class in a function. In how many ways can the teacher make this selection ?							
Q.2	Find LCM [3										
Q.3	Write the following products in factorial notation: (i) $5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 \cdot 11 \cdot 12$					Q.11	In a city, telephone numbers consist of 6 digits and none of them begins with 0. How many telephone numbers could be possible in that city?				
Q.4	Evaluate: $\frac{r}{(r!) \times (n-r)!}$ , when n = 15 and r = 12.					Q.12	In how many ways can 6 letters be posted in 5 letter boxes available in the locality?				
Q.5	Find n, if : (i) $(n + 2) ! = 60 \times (n - 1) !$					Q.13	How many 3-digits number of distinct digits can be formed from the digits 2, 3, 7, 8, 9 ?				
Q.6	If $\frac{n!}{2(n-2)!}$ and $\frac{n!}{4!(n-4)!}$ are in the ration					Q.14	How many 4-digit numbers are there with distinct digits?				
	2 : 1, find n.					<b>a</b> : -	//\ · ·	-			
Q.7	There are 10 buses running between Delhi and Agra. In how many can a man go from Delhi to Agra and return by a different bus ?					<ul><li>Q.15 (i) How many 2-digit numbers are there?</li><li>(ii) How many 3-digit numbers are there?</li><li>(iii) How many 4-digit numbers are there?</li></ul>					
Q.8	In a text book on mathematics there are 3 exercises A, B, C consisting of 12, 18 and 9 questions respectively. In how many ways an three questions be selected choosing one from each exercise ?					Q.16	There are 6 books on physics and 5 books on chemistry in a bookshop. In how many ways can a student purchase either a book on physics or a book on chemistry				
				AN	ISWE	RK	ΈY				
1.	(i) 504 (ii) 29760 (iii) 1310 2. 40320				40320	3	. (i) -	12! 4!	4.	455	
5.	(i) 3	6.	n = 5	7.	90	8	. 1944	4	9.	1050	
10.	378	11.	900000	12.	5 <sup>6</sup> = 156	625 1	3. 60		14.	4536	
15.	(i) 90	(ii)	900	(iii) 9	000	1	6. 11				