

CH # 7 TAHIR F.A.F.Sc. Part: I

**Permutation, Combination
and Probability**

Factorial Notation:-

If n is a positive integer then the product

$$n(n-1)(n-2)(n-3) \dots \dots \dots 4 \cdot 3 \cdot 2 \cdot 1$$

is called factorial of n and is denoted as $n!$ or n .

Factorial notation was introduced by Christian Kramp in 1808.

There are some characteristics of factorial:-

(i) $n! = n(n-1)! = n(n-1)(n-2)! = n(n-1)(n-2)(n-3)!$

(ii) $0! = 1$

(iii) $1! = 1$

Exercise: 7.1

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Q:1 Evaluate each of the followings:-

(i) $4! = 4 \cdot 3 \cdot 2 \cdot 1$

(ii) $6! = 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1$

$4! = 24$ Ans

$6! = 720$ Ans

(iii) $\frac{8!}{7!} = \frac{8 \cdot 7!}{7!}$

(iv) $\frac{10!}{7!} = \frac{10 \cdot 9 \cdot 8 \cdot 7!}{7!}$

$\frac{8!}{7!} = 8$ Ans

$\frac{10!}{7!} = 720$ Ans

(v) $\frac{11!}{4! \cdot 7!} = \frac{11 \cdot 10 \cdot 9 \cdot 8 \cdot 7!}{4 \cdot 3 \cdot 2 \cdot 1 \cdot 7!}$

(vi) $\frac{6!}{3! \cdot 3!} = \frac{6 \cdot 5 \cdot 4 \cdot 3!}{3 \cdot 2 \cdot 1 \cdot 3!}$

$\frac{11!}{4! \cdot 7!} = 330$ Ans

$\frac{6!}{3! \cdot 3!} = 20$ Ans

(vii) $\frac{8!}{4! \cdot 2!} = \frac{8 \cdot 7 \cdot 6 \cdot 5 \cdot 4!}{2 \cdot 1 \cdot 4!}$

(viii) $\frac{11!}{2! \cdot 4! \cdot 5!} = \frac{11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5!}{2 \cdot 1 \cdot 4 \cdot 3 \cdot 2 \cdot 1 \cdot 5!}$

$\frac{8!}{4! \cdot 2!} = 840$ Ans

$\frac{11!}{2! \cdot 4! \cdot 5!} = 6930$ Ans

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CH # 7 (Ist Year)

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(2)

$$(ix) \frac{9!}{2!(9-2)!} = \frac{9!}{2! \cdot 7!}$$

$$\frac{9!}{2!(9-2)!} = \frac{9 \cdot 8 \cdot 7!}{2 \cdot 1 \cdot 7!}$$

$$\frac{9!}{2!(9-2)!} = 36 \text{ Ans.}$$

$$(x) \frac{15!}{15!(15-15)!} = \frac{15!}{15! \cdot 0!}$$

$$\frac{15!}{15!(15-15)!} = \frac{15!}{15! \cdot 1} \quad (\because 0! = 1)$$

$$\frac{15!}{15!(15-15)!} = 1 \text{ Ans.}$$

$$(xi) \frac{3!}{0!} = \frac{3 \cdot 2 \cdot 1}{1}$$

$$\frac{3!}{0!} = 6 \text{ Ans.}$$

$$(xii) 4! 0! 1! = 4 \cdot 3 \cdot 2 \cdot 1 \cdot 1 \cdot 1$$

$$4! 0! 1! = 24 \text{ Ans.}$$

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Q:2 Write each of the following in factorial form:-

$$(i) 6 \cdot 5 \cdot 4 = \frac{6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{3 \cdot 2 \cdot 1}$$

$$6 \cdot 5 \cdot 4 = \frac{6!}{3!} \text{ Ans.}$$

$$(ii) 12 \cdot 11 \cdot 10 = \frac{12 \cdot 11 \cdot 10 \cdot 9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}{9 \cdot 8 \cdot 7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}$$

$$12 \cdot 11 \cdot 10 = \frac{12!}{9!} \text{ Ans.}$$

$$(iii) 20 \cdot 19 \cdot 18 \cdot 17 = \frac{20 \cdot 19 \cdot 18 \cdot 17 \cdot 16!}{16!}$$

$$20 \cdot 19 \cdot 18 \cdot 17 = \frac{20!}{16!} \text{ Ans.}$$

($\because n(n-1) = n!$)

$$(iv) \frac{10 \cdot 9}{2 \cdot 1} = \frac{10 \cdot 9 \cdot 8!}{8! \cdot 2 \cdot 1}$$

$$\frac{10 \cdot 9}{2 \cdot 1} = \frac{10!}{8! \cdot 2!} \text{ Ans.}$$

$$(v) \frac{8 \cdot 7 \cdot 6}{3 \cdot 2 \cdot 1} = \frac{8 \cdot 7 \cdot 6 \cdot 5!}{5! \cdot 3 \cdot 2 \cdot 1}$$

$$\frac{8 \cdot 7 \cdot 6}{3 \cdot 2 \cdot 1} = \frac{8!}{5! \cdot 3!} \text{ Ans.}$$

$$(vi) \frac{52 \cdot 51 \cdot 50 \cdot 49}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{52 \cdot 51 \cdot 50 \cdot 49 \cdot 48!}{4 \cdot 3 \cdot 2 \cdot 1 \cdot 48!}$$

$$\frac{52 \cdot 51 \cdot 50 \cdot 49}{4 \cdot 3 \cdot 2 \cdot 1} = \frac{52!}{4! \cdot 48!} \text{ Ans.}$$

$$(vii) n(n-1)(n-2) = \frac{n(n-1)(n-2)(n-3)!}{(n-3)!}$$

$$n(n-1)(n-2) = \frac{n!}{(n-3)!} \text{ Ans.}$$

$$(viii) (n+2)(n+1)(n) = \frac{(n+2)(n+1)(n)(n-1)!}{(n-1)!}$$

$$(n+2)(n+1)(n) = \frac{(n+2)!}{(n-1)!} \text{ Ans.}$$

$$(ix) \frac{(n+1)(n)(n-1)}{3 \cdot 2 \cdot 1} = \frac{(n+1)(n)(n-1)(n-2)!}{3 \cdot 2 \cdot 1 (n-2)!}$$

$$\frac{(n+1)(n)(n-1)}{3 \cdot 2 \cdot 1} = \frac{(n+1)!}{3! (n-2)!} \text{ Ans.}$$

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

$$n(n-1)(n-2)\dots(n-r+1) = \frac{n!}{(n-r)!} \text{ Ans.}$$

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