

RD Sharma
Solutions
Class 11 Maths
Chapter 16
Ex 16.1

Permutations Ex 16.1 Q1

(i)

We have,

$$\frac{30!}{28!} = \frac{30 \times 29 \times 28!}{28!}$$

$$= 30 \times 29$$

$$= 870$$

Hence, $\frac{30!}{28!} = 870$

(ii)

We have,

$$\frac{11! - 10!}{9!} = \frac{11 \times 10 \times 9! - 10 \times 9!}{9!}$$

$$= \frac{9! \times 10 [11 - 1]}{9!}$$

$$= 10 \times 10$$

$$= 100$$

Hence, $\frac{11! - 10!}{9!} = 100$

(iii)

We have,

$$8! = 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

$$7! = 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

and $6! = 6 \times 5 \times 4 \times 3 \times 2 \times 1$

$$\therefore \text{L.C.M.}(6!, 7!, 8!) = 8!$$

Permutations Ex 16.1 Q2

L.H.S:

$$\frac{1}{9!} + \frac{1}{10!} + \frac{1}{11!}$$

$$\frac{1}{9!} + \frac{1}{10 \times 9!} + \frac{1}{11 \times 10 \times 9!}$$

$$= \frac{11 \times 10 + 11 + 1}{11 \times 10 \times 9!}$$

$$= \frac{110 + 11 + 1}{11!}$$

$$= \frac{122}{11!}$$

$$= \text{RHS}$$

Hence, $\frac{1}{9!} + \frac{1}{10!} + \frac{1}{11!} = \frac{122}{11!}$

Permutations Ex 16.1 Q3(i)

We have,

$$\frac{1}{4!} + \frac{1}{5!} = \frac{x}{6!}$$

$$\Rightarrow \frac{1}{4!} + \frac{1}{5 \times 4!} = \frac{x}{6 \times 5 \times 4!}$$

$$\Rightarrow 4! \times \left[\frac{1}{4!} + \frac{1}{5 \times 4!} \right] = \frac{x}{30}$$

$$\Rightarrow 1 + \frac{1}{5} = \frac{x}{30}$$

$$\Rightarrow \frac{6}{5} = \frac{x}{30}$$

$$\Rightarrow \frac{x}{30} = \frac{6}{5}$$

$$\Rightarrow x = \frac{6 \times 30}{5}$$

$$\Rightarrow x = 6 \times 6$$

$$\Rightarrow x = 36$$

Hence, $x = 36$.

Permutations Ex 16.1 Q3(ii)

$$\frac{x}{10!} = \frac{1}{8!} + \frac{1}{9!}$$

$$\Rightarrow x = \frac{10!}{8!} + \frac{10!}{9!}$$

$$\Rightarrow x = \frac{10 \times 9 \times 8!}{8!} + \frac{10 \times 9!}{9!}$$

$$\Rightarrow x = 10 \times 9 + 10$$

$$\Rightarrow x = 100$$

Permutations Ex 16.1 Q3(iii)

$$\frac{1}{6!} + \frac{1}{7!} = \frac{x}{8!}$$

$$\Rightarrow x = \frac{8!}{6!} + \frac{8!}{7!}$$

$$\Rightarrow x = \frac{8 \times 7 \times 6!}{6!} + \frac{8 \times 7!}{7!}$$

$$\Rightarrow x = 8 \times 7 + 8$$

$$\Rightarrow x = 64$$

Permutations Ex 16.1 Q4(i)

We have,

$$5 \times 6 \times 7 \times 8 \times 9 \times 10$$

$$= \frac{10 \times 9 \times 8 \times 7 \times 6 \times 5 \times (4 \times 3 \times 2 \times 1)}{4 \times 3 \times 2 \times 1}$$

$$= \frac{10!}{4!}$$

Hence, $5 \times 6 \times 7 \times 8 \times 9 \times 10 = \frac{10!}{4!}$

Permutations Ex 16.1 Q4(ii)

We have,

$$3 \times 6 \times 9 \times 12 \times 15 \times 18$$

$$= 3 \times (3 \times 2) \times (3 \times 3) \times (3 \times 4) \times (3 \times 5) \times (3 \times 6)$$

$$= 3^6 \times [2 \times 3 \times 4 \times 5 \times 6]$$

$$= 3^6 \times (6!)$$

Permutations Ex 16.1 Q4(iii)

We have,

$$\begin{aligned} & (n+1)(n+2)(n+3)\dots\dots\dots(2n) \\ &= \frac{[1 \times 2 \times 3 \times 4 \dots\dots\dots(n-1)n] \times (n+1)(n+2)\dots(2n-1) \times 2n}{[1 \times 2 \times 3 \times 4 \dots\dots\dots(n-1)n]} \\ &= \frac{(2n)!}{n!} \end{aligned}$$

Permutations Ex 16.1 Q4(iv)

We have,

$$\begin{aligned} & 1 \times 3 \times 5 \times 7 \times 9 \dots\dots\dots(2n-1) \\ &= \frac{[1.3.5.7.9 \dots\dots(2n-1)] \cdot [2.4.6.8 \dots\dots(2n-2)(2n)]}{2.4.6.8 \dots\dots(2n-2)(2n)} \\ &= \frac{[1.3.5.7.9 \dots\dots(2n-1)] \cdot [2.4.6.8 \dots\dots(2n-2)(2n)]}{2^n [1.2.3.4 \dots\dots((n-1)(n))]} \\ &= \frac{1.2.3.4.5.6.7.8 \dots\dots(2n-2)(2n-1)(2n)}{2^n \cdot n!} \\ &= \frac{(2n)!}{2^n \cdot n!} \end{aligned}$$

$$\therefore 1.3.5.7.9 \dots\dots(2n-1) = \frac{(2n)!}{2^n \cdot n!}$$

Permutations Ex 16.1 Q5

$$\begin{aligned}
 \text{(i)} \quad \text{LHS} &= (2+3)! \\
 &= 5! \\
 &= 5 \times 4 \times 3 \times 2 \times 1 \\
 &= 120
 \end{aligned}$$

$$\begin{aligned}
 \text{and, RHS} &= 2! + 3! \\
 &= 2 \times 1 + 3 \times 2 \\
 &= 2 \times 1 + 3 \times 2 \times 1 \\
 &= 2 + 6 \\
 &= 8
 \end{aligned}$$

$$\therefore 120 \neq 8$$

$$\therefore (2+3)! \neq 2! + 3!$$

So, it is false.

$$\begin{aligned}
 \text{(ii)} \quad \text{LHS} &= (2 \times 3)! \\
 &= 6! \\
 &= 6 \times 5 \times 4 \times 3 \times 2 \times 1 \\
 &= 720
 \end{aligned}$$

$$\begin{aligned}
 \text{and, RHS} &= 2! \times 3! \\
 &= 2 \times 1 \times 3 \times 2 \\
 &= 12
 \end{aligned}$$

$$\therefore 720 \neq 12$$

$$\therefore (2 \times 3)! \neq 2! \times 3!$$

Hence, it is false.

Permutations Ex 16.1 Q6

$$\begin{aligned}
 \text{LHS} &= n! + (n+1)! \\
 &= n! + (n+1)(n+1-1)! \\
 &= n! + (n+1)n! \\
 &= n!(1+n+1) \\
 &= n!(n+2) \\
 &= \text{RHS}
 \end{aligned}$$

$$\therefore n!(n+2) = n! + (n+1)!$$

Hence, proved

Permutations Ex 16.1 Q7

We have,

$$(n+2)! = 60[(n-1)!]$$

$$(n+2)(n+1)(n)(n-1)! = 60[(n-1)!]$$

$$\Rightarrow (n+2)(n+1)n = 60$$

$$\Rightarrow (n+2)(n+1)n = 5 \times 4 \times 3$$

$$\therefore n = 3 \quad [\text{By comparing}]$$

Hence, $n = 3$

Permutations Ex 16.1 Q8

We have,

$$(n+1)! = 90[(n-1)!]$$

$$\Rightarrow (n+1) \times n \times (n-1)! = 90[(n-1)!]$$

$$\Rightarrow n(n+1) = 90$$

$$\Rightarrow n^2 + n = 90$$

$$\Rightarrow n^2 + n - 90 = 0$$

$$\Rightarrow n^2 + 10n - 9n - 90 = 0$$

$$\Rightarrow n(n+10) - 9(n+10) = 0$$

$$\Rightarrow (n-9)(n+10) = 0$$

$$\Rightarrow n-9 = 0 \quad [\because n+10 \neq 0]$$

$$\Rightarrow n = 9$$

Hence, $n = 9$

Permutations Ex 16.1 Q9

We have,

$$(n+3)! = 56[(n+1)!]$$

$$\Rightarrow (n+3) \times (n+2) \times (n+1)! = 56[(n+1)!]$$

$$\Rightarrow (n+2)(n+3) = 56$$

$$\Rightarrow n^2 + 3n + 2n + 6 = 56$$

$$\Rightarrow n^2 + 5n + 6 - 56 = 0$$

$$\Rightarrow n^2 + 5n - 50 = 0$$

$$\Rightarrow n^2 + 10n - 5n - 50 = 0$$

$$\Rightarrow n(n+10) - 5(n+10) = 0$$

$$\Rightarrow (n+10)(n-5) = 0$$

$$\Rightarrow n-5 = 0 \quad [\because n+10 \neq 0]$$

$$\Rightarrow n-5 = 0$$

$$\Rightarrow n = 5$$

Permutations Ex 16.1 Q10

We have,

$$\frac{(2n)!}{3!(2n-3)!} = \frac{44}{3}$$
$$\frac{n!}{2!(n-2)!}$$

$$\Rightarrow \frac{(2n)! \times 2!(n-2)!}{3!(2n-3)! \times n!} = \frac{44}{3}$$

$$\Rightarrow \frac{(2n)(2n-1)(2n-2)(2n-3)! \times 2!(n-2)!}{3 \times 2!(2n-3)! \times n(n-1)(n-2)!} = \frac{44}{3}$$

$$\Rightarrow \frac{2n(2n-1)(2n-2)}{3n(n-1)} = \frac{44}{3}$$

$$\Rightarrow \frac{2(2n-1) \times 2(n-1)}{3(n-1)} = \frac{44}{3}$$

$$\Rightarrow 4(2n-1) = 44$$

$$\Rightarrow 2n-1 = 11$$

$$\Rightarrow 2n = 12$$

$$\Rightarrow n = 6$$

$$\therefore n = 6$$

Permutations Ex 16.1 Q11(i)

We have,

$$\text{LHS} = \frac{n!}{(n-r)!}$$

$$= \frac{n(n-1)(n-2)(n-3)\dots(n-r+2)(n-r+1)(n-r)!}{(n-r)!}$$

$$= n(n-1)(n-2)(n-3)\dots(n-r+2)(n-r+1)$$

$$= n(n-1)(n-2)(n-3)\dots\{(n-(r-2))(n-(r-1))\}$$

$$= n(n-1)(n-2)(n-3)\dots(n-(r-1))$$

$$= \text{RHS}$$

$$\therefore \text{LHS} = \text{RHS}$$

Hence proved

Permutations Ex 16.1 Q11(ii)

We have,

$$\begin{aligned}\text{LHS} &= \frac{n!}{(n-r)!r!} + \frac{n!}{(n-r+1)!(r-1)!} \\ &= \frac{n!}{(n-r)!r \times [(r-1)!]} + \frac{n!}{(n-r+1)[(n-r)!](r-1)!} \\ &= \frac{n!}{(n-r)! \times (r-1)!} \left[\frac{1}{r} + \frac{1}{n-r+1} \right] \\ &= \frac{n!}{(n-r)! \times (r-1)!} \left[\frac{n-r+1+r}{r(n-r+1)} \right] \\ &= \frac{n!}{(n-r)! \times (r-1)!} \left[\frac{n+1}{r(n-r+1)} \right] \\ &= \frac{(n+1) \times n!}{(n-r+1) \times (n-r)! \times r \times (r-1)!} \\ &= \frac{(n+1)!}{(n-r+1)! \times r!} \\ &= \frac{(n+1)!}{r!(n-r+1)!} \\ &= \text{RHS}\end{aligned}$$

\therefore LHS = RHS

Hence proved

Permutations Ex 16.1 Q12

We have,

$$\text{LHS} = \frac{(2n+1)!}{n!}$$

$$= \frac{(2n+1)[1.2.3.4.5.6.7.8\dots(2n-1)2n]}{n!}$$

$$= \frac{[1.3.5.7\dots(2n-1) \times (2n+1)][2.4.6.8\dots(2n-2)2n]}{n!}$$

$$= \frac{[1.3.5.7\dots(2n-1)(2n+1)] \times 2^n [1.2.3.4\dots(n-1)n]}{n!}$$

$$= \frac{[1.3.5.7\dots(2n-1)(2n+1)] 2^n \times n!}{n!}$$

$$= 2^n [1.3.5.7\dots(2n-1)(2n+1)]$$

= RHS

Hence proved