

## EXERCISE 16.1

**Compute:**

**(i)  $30!/28!$**

**(ii)  $(11! - 10!)/9!$**

**(iii) L.C.M. (6!, 7!, 8!)**

**Solution:**

**(i)  $30!/28!$**

Let us evaluate,

$$\begin{aligned} 30!/28! &= (30 \times 29 \times 28!)/28! \\ &= 30 \times 29 \\ &= 870 \end{aligned}$$

**(ii)  $(11! - 10!)/9!$**

Let us evaluate,

We know,

$$11! = 11 \times 10 \times 9 \times \dots \times 1$$

$$10! = 10 \times 9 \times 8 \times \dots \times 1$$

$$9! = 9 \times 8 \times 7 \times \dots \times 1$$

By using these values we get,

$$\begin{aligned} (11! - 10!)/9! &= (11 \times 10 \times 9! - 10 \times 9!)/9! \\ &= 9! (110 - 10)/9! \\ &= 110 - 10 \\ &= 100 \end{aligned}$$

**(iii) L.C.M. (6!, 7!, 8!)**

Let us find the LCM of (6!, 7!, 8!)

We know,

$$8! = 8 \times 7 \times 6!$$

$$7! = 7 \times 6!$$

$$6! = 6!$$

So,

$$\begin{aligned} \text{L.C.M. (6!, 7!, 8!)} &= \text{LCM} [8 \times 7 \times 6!, 7 \times 6!, 6!] \\ &= 8 \times 7 \times 6! \\ &= 8! \end{aligned}$$

**2. Prove that:  $1/9! + 1/10! + 1/11! = 122/11!$**

**Solution:**

Given:

$$1/9! + 1/10! + 1/11! = 122/11!$$

Let us consider LHS:  $1/9! + 1/10! + 1/11!$

$$\begin{aligned} 1/9! + 1/10! + 1/11! &= 1/9! + 1/(10 \times 9!) + 1/(11 \times 10 \times 9!) \\ &= (110 + 11 + 1)/(11 \times 10 \times 9!) \\ &= 122/11! \\ &= \text{RHS} \end{aligned}$$

Hence proved.

**3. Find x in each of the following:**

**(i)**  $1/4! + 1/5! = x/6!$

**(ii)**  $x/10! = 1/8! + 1/9!$

**(iii)**  $1/6! + 1/7! = x/8!$

**Solution:**

**(i)**  $1/4! + 1/5! = x/6!$

We know that

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

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

So by using these values,

$$1/4! + 1/5! = x/6!$$

$$1/4! + 1/(5 \times 4!) = x/6!$$

$$(5 + 1) / (5 \times 4!) = x/6!$$

$$6/5! = x/(6 \times 5!)$$

$$x = (6 \times 6 \times 5!)/5!$$

$$= 36$$

$\therefore$  The value of x is 36.

**(ii)**  $x/10! = 1/8! + 1/9!$

We know that

$$10! = 10 \times 9!$$

$$9! = 9 \times 8!$$

So by using these values,

$$x/10! = 1/8! + 1/9!$$

$$x/10! = 1/8! + 1/(9 \times 8!)$$

$$x/10! = (9 + 1) / (9 \times 8!)$$

$$x/10! = 10/9!$$

$$x/(10 \times 9!) = 10/9!$$

$$x = (10 \times 10 \times 9!)/9!$$

$$= 10 \times 10$$

$$= 100$$

∴ The value of x is 100.

**(iii)**  $1/6! + 1/7! = x/8!$

We know that

$$8! = 8 \times 7 \times 6!$$

$$7! = 7 \times 6!$$

So by using these values,

$$1/6! + 1/7! = x/8!$$

$$1/6! + 1/(7 \times 6!) = x/8!$$

$$(1 + 7)/(7 \times 6!) = x/8!$$

$$8/7! = x/8!$$

$$8/7! = x/(8 \times 7!)$$

$$x = (8 \times 8 \times 7!)/7!$$

$$= 8 \times 8$$

$$= 64$$

∴ The value of x is 64.

**4. Convert the following products into factorials:**

**(i)**  $5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10$

**(ii)**  $3 \cdot 6 \cdot 9 \cdot 12 \cdot 15 \cdot 18$

**(iii)**  $(n + 1)(n + 2)(n + 3) \dots (2n)$

**(iv)**  $1 \cdot 3 \cdot 5 \cdot 7 \cdot 9 \dots (2n - 1)$

**Solution:**

**(i)**  $5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10$

Let us evaluate

We can write it as:

$$5 \cdot 6 \cdot 7 \cdot 8 \cdot 9 \cdot 10 = (1 \times 2 \times 3 \times 4 \times 5 \times 6 \times 7 \times 8 \times 9 \times 10) / (1 \times 2 \times 3 \times 4) \\ = 10! / 4!$$

**(ii)**  $3 \cdot 6 \cdot 9 \cdot 12 \cdot 15 \cdot 18$

Let us evaluate

$$3 \cdot 6 \cdot 9 \cdot 12 \cdot 15 \cdot 18 = (3 \times 1) \times (3 \times 2) \times (3 \times 3) \times (3 \times 4) \times (3 \times 5) \times (3 \times 6) \\ = 3^6 (1 \times 2 \times 3 \times 4 \times 5 \times 6) \\ = 3^6 (6!)$$

**(iii)**  $(n + 1)(n + 2)(n + 3) \dots (2n)$

Let us evaluate

$$(n + 1)(n + 2)(n + 3) \dots (2n) = [(1)(2)(3) \dots (n) \dots (n + 1)(n + 2)(n + 3) \dots (2n)] / (1)(2)(3) \dots (n)$$

$$= (2n)!/n!$$

(iv)  $1 \cdot 3 \cdot 5 \cdot 7 \cdot 9 \dots (2n - 1)$

Let us evaluate

$$\begin{aligned} 1 \cdot 3 \cdot 5 \cdot 7 \cdot 9 \dots (2n - 1) &= [(1) (3) (5) \dots (2n-1)] [(2) (4) (6) \dots (2n)] / [(2) (4) (6) \dots (2n)] \\ &= [(1) (2) (3) (4) \dots (2n-1) (2n)] / 2^n [(1) (2) (3) \dots (n)] \\ &= (2n)! / 2^n n! \end{aligned}$$

**5. Which of the following are true:**

(i)  $(2 + 3)! = 2! + 3!$

(ii)  $(2 \times 3)! = 2! \times 3!$

**Solution:**

(i)  $(2 + 3)! = 2! + 3!$

Let us consider LHS:  $(2 + 3)!$

$$(2 + 3)! = 5!$$

Now RHS,

$$\begin{aligned} 2! + 3! &= (2 \times 1) + (3 \times 2 \times 1) \\ &= 2 + 6 \\ &= 8 \end{aligned}$$

LHS  $\neq$  RHS

$\therefore$  The given expression is false.

(ii)  $(2 \times 3)! = 2! \times 3!$

Let us consider LHS:  $(2 \times 3)!$

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

Now RHS,

$$\begin{aligned} 2! \times 3! &= (2 \times 1) \times (3 \times 2 \times 1) \\ &= 12 \end{aligned}$$

LHS  $\neq$  RHS

$\therefore$  The given expression is false.

**6. Prove that:  $n! (n + 2) = n! + (n + 1)!$**

**Solution:**

Given:

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

Let us consider RHS =  $n! + (n + 1)!$



$$\begin{aligned}n! + (n + 1)! &= n! + (n + 1)(n + 1 - 1)! \\ &= n! + (n + 1)n! \\ &= n!(1 + n + 1) \\ &= n!(n + 2) \\ &= \text{L.H.S}\end{aligned}$$

L.H.S = R.H.S

Hence, Proved.



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