



Trigonometric Ratios Ex 5.2 Q12

Answer :

We have,

$$\cot^2 30^\circ - 2 \cos^2 60^\circ - \frac{3}{4} \sec^2 45^\circ - 4 \sec^2 30^\circ \dots\dots (1)$$

Now,

$$\cot 30^\circ = \sqrt{3}, \cos 60^\circ = \frac{1}{2}, \sec 45^\circ = \sqrt{2}, \sec 30^\circ = \frac{2}{\sqrt{3}}$$

So by substituting above values in equation (1)

We get,

$$\begin{aligned} & \cot^2 30^\circ - 2 \cos^2 60^\circ - \frac{3}{4} \sec^2 45^\circ - 4 \sec^2 30^\circ \\ &= (\sqrt{3})^2 - 2 \left(\frac{1}{2} \right)^2 - \frac{3}{4} (\sqrt{2})^2 - 4 \left(\frac{2}{\sqrt{3}} \right)^2 \\ &= 3 - 2 \times \frac{1^2}{2^2} - \frac{3}{4} \times 2 - 4 \times \frac{2^2}{(\sqrt{3})^2} \end{aligned}$$

Now, in the third term 4 gets cancelled by 2 and 2 remains

Therefore,

$$\begin{aligned} & \cot^2 30^\circ - 2 \cos^2 60^\circ - \frac{3}{4} \sec^2 45^\circ - 4 \sec^2 30^\circ \\ &= 3 - 2 \times \frac{1}{4} - \frac{3}{2} - 4 \times \frac{4}{3} \end{aligned}$$

Now in the second term, 4 gets cancelled by 2 and 2 remains
Therefore,

$$\begin{aligned} & \cot^2 30^\circ - 2 \cos^2 60^\circ - \frac{3}{4} \sec^2 45^\circ - 4 \sec^2 30^\circ \\ &= 3 - \frac{1}{2} - \frac{3}{2} - 4 \times \frac{4}{3} \\ &= 3 - \frac{1}{2} - \frac{3}{2} - \frac{16}{3} \end{aligned}$$

Now, LCM of denominator in the above expression is 6

Therefore by taking LCM

We get,

$$\begin{aligned} & \cot^2 30^\circ - 2 \cos^2 60^\circ - \frac{3}{4} \sec^2 45^\circ - 4 \sec^2 30^\circ \\ &= \frac{3 \times 6}{1 \times 6} - \frac{1 \times 3}{2 \times 3} - \frac{3 \times 3}{2 \times 3} - \frac{16 \times 2}{3 \times 2} \\ &= \frac{18}{6} - \frac{3}{6} - \frac{9}{6} - \frac{32}{6} \\ &= \frac{18 - 3 - 9 - 32}{6} \\ &= \frac{18 - 44}{6} \\ &= \frac{-26}{6} \end{aligned}$$

Now in the above expression, $\frac{-26}{6}$ gets reduced to $\frac{-13}{3}$

Therefore,

$$\cot^2 30^\circ - 2 \cos^2 60^\circ - \frac{3}{4} \sec^2 45^\circ - 4 \sec^2 30^\circ = \frac{-13}{3}$$

Trigonometric Ratios Ex 5.2 Q13

Answer :

We have,

$$(\cos 0^\circ + \sin 45^\circ + \sin 30^\circ)(\sin 90^\circ - \cos 45^\circ + \cos 60^\circ) \dots\dots (1)$$

Now,

$$\sin 90^\circ = \cos 0^\circ = 1, \sin 45^\circ = \cos 45^\circ = \frac{1}{\sqrt{2}}, \sin 30^\circ = \cos 60^\circ = \frac{1}{2}$$

So by substituting above values in equation (1)

We get,

$$\begin{aligned} & (\cos 0^\circ + \sin 45^\circ + \sin 30^\circ)(\sin 90^\circ - \cos 45^\circ + \cos 60^\circ) \\ &= \left(1 + \frac{1}{\sqrt{2}} + \frac{1}{2}\right) \left(1 - \frac{1}{\sqrt{2}} + \frac{1}{2}\right) \end{aligned}$$

Now, LCM of both the product terms in the above expression is $2\sqrt{2}$

Therefore we get,

$$\begin{aligned} & (\cos 0^\circ + \sin 45^\circ + \sin 30^\circ)(\sin 90^\circ - \cos 45^\circ + \cos 60^\circ) \\ &= \left(\frac{1 \times 2\sqrt{2}}{1 \times 2\sqrt{2}} + \frac{1 \times 2}{\sqrt{2} \times 2} + \frac{1 \times \sqrt{2}}{2 \times \sqrt{2}}\right) \times \left(\frac{1 \times 2\sqrt{2}}{1 \times 2\sqrt{2}} - \frac{1 \times 2}{\sqrt{2} \times 2} + \frac{1 \times \sqrt{2}}{2 \times \sqrt{2}}\right) \\ &= \left(\frac{2\sqrt{2}}{2\sqrt{2}} + \frac{2}{2\sqrt{2}} + \frac{\sqrt{2}}{2\sqrt{2}}\right) \times \left(\frac{2\sqrt{2}}{2\sqrt{2}} - \frac{2}{2\sqrt{2}} + \frac{\sqrt{2}}{2\sqrt{2}}\right) \\ &= \left(\frac{2\sqrt{2} + 2 + \sqrt{2}}{2\sqrt{2}}\right) \times \left(\frac{2\sqrt{2} - 2 + \sqrt{2}}{2\sqrt{2}}\right) \end{aligned}$$

Now by rearranging terms in the numerator of above expression

We get,

$$\begin{aligned} & (\cos 0^\circ + \sin 45^\circ + \sin 30^\circ)(\sin 90^\circ - \cos 45^\circ + \cos 60^\circ) \\ &= \left(\frac{2\sqrt{2} + \sqrt{2} + 2}{2\sqrt{2}}\right) \times \left(\frac{2\sqrt{2} + \sqrt{2} - 2}{2\sqrt{2}}\right) \\ &= \frac{(2\sqrt{2} + \sqrt{2} + 2) \times (2\sqrt{2} + \sqrt{2} - 2)}{(2\sqrt{2}) \times (2\sqrt{2})} \end{aligned}$$

Now, by applying formula $[(a+b)(a-b) = a^2 - b^2]$ in the numerator of the above expression we get,

$$\begin{aligned} & (\cos 0^\circ + \sin 45^\circ + \sin 30^\circ)(\sin 90^\circ - \cos 45^\circ + \cos 60^\circ) \\ &= \frac{(2\sqrt{2} + \sqrt{2})^2 - 2^2}{2 \times 2 \times \sqrt{2} \times \sqrt{2}} \\ &= \frac{(2\sqrt{2} + \sqrt{2})^2 - 2^2}{4 \times 2} \dots\dots (2) \end{aligned}$$

Now, we know that $(a+b)^2 = a^2 + 2ab + b^2$

Therefore,

$$(2\sqrt{2} + \sqrt{2})^2 = (2\sqrt{2})^2 + 2(2\sqrt{2})(\sqrt{2}) + (\sqrt{2})^2$$

Now, by substituting the above value of $(2\sqrt{2} + \sqrt{2})^2$ in equation (2)

We get,

$$\begin{aligned} & (\cos 0^\circ + \sin 45^\circ + \sin 30^\circ)(\sin 90^\circ - \cos 45^\circ + \cos 60^\circ) \\ &= \frac{\left[(2\sqrt{2})^2 + 2(2\sqrt{2})(\sqrt{2}) + (\sqrt{2})^2 \right] - 2^2}{4 \times 2} \\ &= \frac{[8 + 8 + 2] - 4}{8} \\ &= \frac{18 - 4}{8} \\ &= \frac{14}{8} \end{aligned}$$

Now $\frac{14}{8}$ gets reduced to $\frac{7}{4}$

Therefore,

$$\begin{aligned} & (\cos 0^\circ + \sin 45^\circ + \sin 30^\circ)(\sin 90^\circ - \cos 45^\circ + \cos 60^\circ) \\ &= \frac{7}{4} \end{aligned}$$

$$\text{Hence, } (\cos 0^\circ + \sin 45^\circ + \sin 30^\circ)(\sin 90^\circ - \cos 45^\circ + \cos 60^\circ) = \frac{7}{4}$$

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