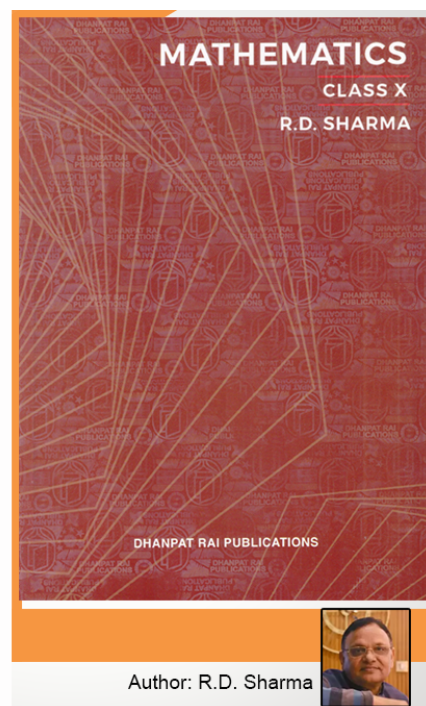


Class 10 - Chapter 6 Trigonometric Identities



RD Sharma Solutions for Class 10 Maths Chapter 6–Trigonometric Identities

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Exercise 6.1 Page No: 6.43

Prove the following trigonometric identities:

1. $(1 - \cos^2 A) \operatorname{cosec}^2 A = 1$

Solution:

Taking the L.H.S,

$$(1 - \cos^2 A) \operatorname{cosec}^2 A$$

$$= (\sin^2 A) \operatorname{cosec}^2 A \text{ [}\because \sin^2 A + \cos^2 A = 1 \Rightarrow 1 - \sin^2 A = \cos^2 A\text{]}$$

$$= 1^2$$

$$= 1 = \text{R.H.S}$$

– Hence Proved

2. $(1 + \cot^2 A) \sin^2 A = 1$

Solution:

By using the identity,

$$\operatorname{cosec}^2 A - \cot^2 A = 1 \Rightarrow \operatorname{cosec}^2 A = \cot^2 A + 1$$

Taking,

$$\text{L.H.S} = (1 + \cot^2 A) \sin^2 A$$

$$= \operatorname{cosec}^2 A \sin^2 A$$

$$= (\operatorname{cosec} A \sin A)^2$$

$$= ((1/\sin A) \times \sin A)^2$$

$$= (1)^2$$

$$= 1$$

$$= \text{R.H.S}$$

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– Hence Proved

3. $\tan^2 \theta \cos^2 \theta = 1 - \cos^2 \theta$

Solution:

We know that,

$$\sin^2 \theta + \cos^2 \theta = 1$$

Taking,

$$\text{L.H.S} = \tan^2 \theta \cos^2 \theta$$

$$= (\tan \theta \times \cos \theta)^2$$

$$= (\sin \theta)^2$$

$$= \sin^2 \theta$$

$$= 1 - \cos^2 \theta$$

$$= \text{R.H.S}$$

– Hence Proved

4. $\operatorname{cosec} \theta \sqrt{1 - \cos^2 \theta} = 1$

Solution:

Using identity,

$$\sin^2 \theta + \cos^2 \theta = 1 \Rightarrow \sin^2 \theta = 1 - \cos^2 \theta$$

Taking L.H.S,

$$\text{L.H.S} = \operatorname{cosec} \theta \sqrt{1 - \cos^2 \theta}$$

$$= \operatorname{cosec} \theta \sqrt{\sin^2 \theta}$$

$$= \operatorname{cosec} \theta \times \sin \theta$$

$$= 1$$

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= R.H.S

– Hence Proved

5. $(\sec^2 \theta - 1)(\operatorname{cosec}^2 \theta - 1) = 1$

Solution:

Using identities,

$$(\sec^2 \theta - \tan^2 \theta) = 1 \text{ and } (\operatorname{cosec}^2 \theta - \cot^2 \theta) = 1$$

We have,

$$\text{L.H.S} = (\sec^2 \theta - 1)(\operatorname{cosec}^2 \theta - 1)$$

$$= \tan^2 \theta \times \cot^2 \theta$$

$$= (\tan \theta \times \cot \theta)^2$$

$$= (\tan \theta \times 1/\tan \theta)^2$$

$$= 1^2$$

$$= 1$$

$$= \text{R.H.S}$$

– Hence Proved

6. $\tan \theta + 1/\tan \theta = \sec \theta \operatorname{cosec} \theta$

Solution:

We have,

$$\text{L.H.S} = \tan \theta + 1/\tan \theta$$

$$= (\tan^2 \theta + 1)/\tan \theta$$

$$= \sec^2 \theta / \tan \theta \text{ [}\because \sec^2 \theta - \tan^2 \theta = 1\text{]}$$

$$= (1/\cos^2 \theta) \times 1/(\sin \theta/\cos \theta) \text{ [}\because \tan \theta = \sin \theta / \cos \theta\text{]}$$

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$$= \cos \theta / (\sin \theta \times \cos^2 \theta)$$

$$= 1 / \cos \theta \times 1 / \sin \theta$$

$$= \sec \theta \times \operatorname{cosec} \theta$$

$$= \sec \theta \operatorname{cosec} \theta$$

$$= \text{R.H.S}$$

– Hence Proved

$$7. \cos \theta / (1 - \sin \theta) = (1 + \sin \theta) / \cos \theta$$

Solution:

We know that,

$$\sin^2 \theta + \cos^2 \theta = 1$$

So, by multiplying both the numerator and the denominator by $(1 + \sin \theta)$, we get

$$\begin{aligned} & \frac{\cos \theta}{1 - \sin \theta} \\ &= \frac{\cos \theta(1 + \sin \theta)}{(1 - \sin \theta)(1 + \sin \theta)} \\ &= \frac{\cos \theta}{(1 + \sin \theta)(1 - \sin^2 \theta)} \\ &= \frac{\cos \theta(1 + \sin \theta)}{\cos^2 \theta} \\ &= \frac{(1 + \sin \theta)}{\cos \theta} \end{aligned}$$

$$\text{L.H.S} =$$

$$= \text{R.H.S}$$

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– Hence Proved

8. $\cos \theta / (1 + \sin \theta) = (1 - \sin \theta) / \cos \theta$

Solution:

We know that,

$$\sin^2 \theta + \cos^2 \theta = 1$$

So, by multiplying both the numerator and the denominator by $(1 - \sin \theta)$, we get

$$\begin{aligned} & \frac{\cos \theta}{1 + \sin \theta} \\ &= \frac{\cos \theta (1 - \sin \theta)}{(1 + \sin \theta)(1 - \sin \theta)} \\ &= \frac{\cos \theta (1 - \sin \theta)}{(1 - \sin^2 \theta)} \\ &= \frac{\cos \theta (1 - \sin \theta)}{(\cos^2 \theta)} \\ &= \frac{(1 - \sin \theta)}{\cos \theta} \\ &= \frac{(1 - \sin \theta)}{\cos \theta} \end{aligned}$$

L.H.S =

= R.H.S

– Hence Proved

9. $\cos^2 \theta + 1/(1 + \cot^2 \theta) = 1$

Solution:

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We already know that,

$$\operatorname{cosec}^2 \theta - \cot^2 \theta = 1 \text{ and } \sin^2 \theta + \cos^2 \theta = 1$$

Taking L.H.S,

$$\text{L.H.S} = \cos^2 A + \frac{1}{1 + \cot^2 A}$$

$$= \cos^2 A + \frac{1}{\operatorname{cosec}^2 A}$$

$$= \cos^2 A + \left(\frac{1}{\operatorname{cosec} A} \right)^2$$

$$= \cos^2 A + \sin^2 A$$

$$= 1$$

$$= \text{R.H.S}$$

– Hence Proved

$$\mathbf{10. \sin^2 A + 1/(1 + \tan^2 A) = 1}$$

Solution:

We already know that,

$$\sec^2 \theta - \tan^2 \theta = 1 \text{ and } \sin^2 \theta + \cos^2 \theta = 1$$

Taking L.H.S,

$$\text{L.H.S} = \sin^2 A + \frac{1}{1 + \tan^2 A}$$

$$= \sin^2 A + \frac{1}{\sec^2 A}$$

$$= \sin^2 A + \left(\frac{1}{\sec A}\right)^2$$

$$= \sin^2 A + \cos^2 A$$

$$= 1$$

$$= \text{R.H.S}$$

– Hence Proved

11.

$$\sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}} = \operatorname{cosec} \theta - \cot \theta$$

Solution:

We know that, $\sin^2 \theta + \cos^2 \theta = 1$

Taking the L.H.S,

$$\begin{aligned}\text{L.H.S} &= \sqrt{\frac{1 - \cos \theta}{1 + \cos \theta}} \\&= \sqrt{\frac{(1 - \cos \theta)(1 - \cos \theta)}{(1 + \cos \theta)(1 - \cos \theta)}} \\&= \sqrt{\frac{(1 - \cos \theta)^2}{1 - \cos^2 \theta}} \\&= \frac{(1 - \cos \theta)^2}{\sin^2 \theta} \\&= \frac{(1 - \cos \theta)}{\sin \theta} \\&= \frac{1}{\sin \theta} - \frac{\cos \theta}{\sin \theta} \\&= \frac{1}{\sin \theta} - \frac{\cos \theta}{\sin \theta}\end{aligned}$$

$$= \operatorname{cosec} \theta - \cot \theta$$

$$= \text{R.H.S}$$

– Hence Proved

$$\mathbf{12. \frac{1 - \cos \theta}{\sin \theta} = \frac{\sin \theta}{1 + \cos \theta}}$$

Solution:

We know that,

$$\sin^2 \theta + \cos^2 \theta = 1$$

So, by multiplying both the numerator and the denominator by $(1 + \cos \theta)$, we get

$$\begin{aligned}\text{L.H.S} &= \frac{1 - \cos^2 \theta}{(1 + \cos \theta)(\sin \theta)} \\ &= \frac{(\sin^2 \theta)}{(1 + \cos \theta)(\sin \theta)} \\ &= \frac{(\sin \theta)}{(1 + \cos \theta)}\end{aligned}$$

= R.H.S

– Hence Proved

13. $\sin \theta / (1 - \cos \theta) = \operatorname{cosec} \theta + \cot \theta$

Solution:

Taking L.H.S,

$$\text{L. H. S} = \frac{\sin \theta}{1 - \cos \theta}$$

On multiplying by its conjugates, we have

$$= \frac{\sin \theta}{1 - \cos \theta} \times \frac{1 + \cos \theta}{1 + \cos \theta}$$

$$= \frac{\sin \theta (1 + \cos \theta)}{1 - \cos^2 \theta}$$

$$\text{Since, } (1 - \cos^2 \theta) = \sin^2 \theta$$

$$= \frac{\sin \theta + (\sin \theta \times \cos \theta)}{\sin^2 \theta}$$

$$= \frac{\sin \theta}{\sin^2 \theta} + \frac{\sin \theta \times \cos \theta}{\sin^2 \theta}$$

$$= \frac{1}{\sin \theta} + \frac{\cos \theta}{\sin \theta}$$

$$= \operatorname{cosec} \theta + \cot \theta$$

$$= \text{R.H.S}$$

– Hence Proved

$$14. (1 - \sin \theta) / (1 + \sin \theta) = (\sec \theta - \tan \theta)^2$$

Solution:

Taking the L.H.S,

$$\text{L. H. S} = \frac{1 - \sin \theta}{1 + \sin \theta}$$

On multiplying by its conjugate, we have

$$= \frac{1 - \sin \theta}{1 + \sin \theta} \times \frac{1 - \sin \theta}{1 - \sin \theta}$$

Since, $1 - \sin^2 \theta = \cos^2 \theta$

$$= \frac{(1 - \sin \theta)^2}{\cos^2 \theta}$$

$$= \left(\frac{1 - \sin \theta}{\cos \theta} \right)^2$$

$$= \left(\frac{1}{\cos \theta} - \frac{\sin \theta}{\cos \theta} \right)^2$$

$$= (\sec \theta - \tan \theta)^2$$

$$= \text{R.H.S}$$

– Hence Proved

15.

Solution:

Taking L.H.S,

$$\text{L. H. S} = \frac{(1 + \cot^2 \theta) \tan \theta}{\sec^2 \theta}$$

$$\text{Here, } 1 + \cot^2 \theta = \operatorname{cosec}^2 \theta$$

$$= \frac{\operatorname{cosec}^2 \theta \times \tan \theta}{\sec^2 \theta}$$

$$= \frac{1}{\sin^2 \theta} \times \frac{\cos^2 \theta}{1} \times \frac{\sin \theta}{\cos \theta}$$

$$= \frac{\cos \theta}{\sin \theta}$$

$$= \cot \theta$$

$$= \text{R.H.S}$$

– Hence Proved

$$\mathbf{16. \tan^2 \theta - \sin^2 \theta = \tan^2 \theta \sin^2 \theta}$$

Solution:

Taking L.H.S,

$$\text{L.H.S} = \tan^2 \theta - \sin^2 \theta$$

$$\text{Since, } \tan^2 \theta = \frac{\sin^2 \theta}{\cos^2 \theta}$$

$$= \frac{\sin^2 \theta}{\cos^2 \theta} - \sin^2 \theta$$

$$= \sin^2 \theta \left[\frac{1}{\cos^2 \theta} - 1 \right]$$

$$= \sin^2 \theta \left[\frac{1 - \cos^2 \theta}{\cos^2 \theta} \right]$$

$$= \frac{\sin^2 \theta}{\cos^2 \theta} \times \sin^2 \theta$$

$$= \tan^2 \theta \sin^2 \theta$$

$$= \text{R.H.S}$$

– Hence Proved

$$17. (\operatorname{cosec} \theta + \sin \theta)(\operatorname{cosec} \theta - \sin \theta) = \cot^2 \theta + \cos^2 \theta$$

Solution:

$$\text{Taking L.H.S} = (\operatorname{cosec} \theta + \sin \theta)(\operatorname{cosec} \theta - \sin \theta)$$

On multiplying we get,

$$= \operatorname{cosec}^2 \theta - \sin^2 \theta$$

$$= (1 + \cot^2 \theta) - (1 - \cos^2 \theta) \text{ [Using } \operatorname{cosec}^2 \theta - \cot^2 \theta = 1 \text{ and } \sin^2 \theta + \cos^2 \theta = 1]$$

$$= 1 + \cot^2 \theta - 1 + \cos^2 \theta$$

$$= \cot^2 \theta + \cos^2 \theta$$

$$= \text{R.H.S}$$

– Hence Proved

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18. $(\sec \theta + \cos \theta)(\sec \theta - \cos \theta) = \tan^2 \theta + \sin^2 \theta$

Solution:

Taking L.H.S = $(\sec \theta + \cos \theta)(\sec \theta - \cos \theta)$

On multiplying we get,

$$= \sec^2 \theta - \sin^2 \theta$$

$$= (1 + \tan^2 \theta) - (1 - \sin^2 \theta) \text{ [Using } \sec^2 \theta - \tan^2 \theta = 1 \text{ and } \sin^2 \theta + \cos^2 \theta = 1]$$

$$= 1 + \tan^2 \theta - 1 + \sin^2 \theta$$

$$= \tan^2 \theta + \sin^2 \theta$$

$$= \text{R.H.S}$$

– Hence Proved

19. $\sec A(1 - \sin A)(\sec A + \tan A) = 1$

Solution:

Taking L.H.S = $\sec A(1 - \sin A)(\sec A + \tan A)$

Substituting $\sec A = 1/\cos A$ and $\tan A = \sin A/\cos A$ in the above we have,

$$\text{L.H.S} = 1/\cos A (1 - \sin A)(1/\cos A + \sin A/\cos A)$$

$$= 1 - \sin^2 A / \cos^2 A \text{ [After taking L.C.M]}$$

$$= \cos^2 A / \cos^2 A \text{ [}\because 1 - \sin^2 A = \cos^2 A]$$

$$= 1$$

$$= \text{R.H.S}$$

– Hence Proved

20. $(\operatorname{cosec} A - \sin A)(\sec A - \cos A)(\tan A + \cot A) = 1$

Solution:

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Taking L.H.S = $(\operatorname{cosec} A - \sin A)(\sec A - \cos A)(\tan A + \cot A)$

Putting, $\operatorname{cosec} A = \frac{1}{\sin A}$, $\sec A = \frac{1}{\cos A}$, $\tan A = \frac{\sin A}{\cos A}$, $\cot A = \frac{\cos A}{\sin A}$

Substituting the above in the L.H.S, we get

$$= \left(\frac{1}{\sin A} - \sin A \right) \left(\frac{1}{\cos A} - \cos A \right) \left(\frac{\sin A}{\cos A} + \frac{\cos A}{\sin A} \right)$$

$$= \left(\frac{1 - \sin^2 A}{\sin A} \right) \left(\frac{1 - \cos^2 A}{\cos A} \right) \left(\frac{\sin^2 A + \cos^2 A}{\sin A \cos A} \right)$$

$$= (\cos^2 A / \sin A) (\sin^2 A / \cos A) (1 / \sin A \cos A) \quad [\because \sin^2 \theta + \cos^2 \theta = 1]$$

$$= (\sin A \cos A) (1 / \cos A \sin A)$$

$$= 1$$

$$= \text{R.H.S}$$

– Hence Proved

21. $(1 + \tan^2 \theta)(1 - \sin \theta)(1 + \sin \theta) = 1$

Solution:

Taking L.H.S = $(1 + \tan^2 \theta)(1 - \sin \theta)(1 + \sin \theta)$

And, we know $\sin^2 \theta + \cos^2 \theta = 1$ and $\sec^2 \theta - \tan^2 \theta = 1$

So,

$$\text{L.H.S} = (1 + \tan^2 \theta)(1 - \sin \theta)(1 + \sin \theta)$$

$$= (1 + \tan^2 \theta)\{(1 - \sin \theta)(1 + \sin \theta)\}$$

$$= (1 + \tan^2 \theta)(1 - \sin^2 \theta)$$

$$= \sec^2 \theta (\cos^2 \theta)$$

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$$= (1/\cos^2 \theta) \times \cos^2 \theta$$

$$= 1$$

$$= \text{R.H.S}$$

– Hence Proved

$$\mathbf{22. \sin^2 A \cot^2 A + \cos^2 A \tan^2 A = 1}$$

Solution:

We know that,

$$\cot^2 A = \cos^2 A / \sin^2 A \text{ and } \tan^2 A = \sin^2 A / \cos^2 A$$

Substituting the above in L.H.S, we get

$$\text{L.H.S} = \sin^2 A \cot^2 A + \cos^2 A \tan^2 A$$

$$= \{\sin^2 A (\cos^2 A / \sin^2 A)\} + \{\cos^2 A (\sin^2 A / \cos^2 A)\}$$

$$= \cos^2 A + \sin^2 A$$

$$= 1 [\because \sin^2 \theta + \cos^2 \theta = 1]$$

$$= \text{R.H.S}$$

– Hence Proved

$$\text{(i) } \cot \theta - \tan \theta = \frac{2 \cos 2\theta - 1}{\sin \theta * \cos \theta}$$

$$\text{(ii) } \tan \theta - \cot \theta = \left(\frac{2 \sin^2 \theta - 1}{\sin \theta * \cos \theta} \right)$$

23.

Solution:

(i) Taking the L.H.S and using $\sin^2 \theta + \cos^2 \theta = 1$, we have

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$$\text{L.H.S} = \cot \theta - \tan \theta$$

$$= \frac{\cos \theta}{\sin \theta} - \frac{\sin \theta}{\cos \theta}$$

$$= \frac{\cos^2 \theta - \sin^2 \theta}{\sin \theta \times \cos \theta}$$

$$= \frac{\cos^2 \theta - (1 - \cos^2 \theta)}{\sin \theta \times \cos \theta}$$

$$= \frac{\cos^2 \theta - 1 + \cos^2 \theta}{\sin \theta \times \cos \theta}$$

$$= \left(\frac{2 \cos^2 \theta - 1}{\sin \theta \times \cos \theta} \right)$$

$$= \text{R.H.S}$$

– Hence Proved

(ii) Taking the L.H.S and using $\sin^2 \theta + \cos^2 \theta = 1$, we have

$$\text{L.H.S} = \tan \theta - \cot \theta$$

$$\begin{aligned}&= \frac{\sin \theta}{\cos \theta} - \frac{\cos \theta}{\sin \theta} \\&= \frac{\sin^2 \theta - \cos^2 \theta}{\sin \theta \cos \theta} \\&= \frac{\sin^2 \theta - (1 - \sin^2 \theta)}{\sin \theta \cos \theta} \\&= \frac{\sin^2 \theta - (1 + \sin^2 \theta)}{\sin \theta \cos \theta} \\&= \left(\frac{2 \sin^2 \theta - 1}{\sin \theta \cos \theta} \right)\end{aligned}$$

= R.H.S

– Hence Proved

24. $(\cos^2 \theta / \sin \theta) - \operatorname{cosec} \theta + \sin \theta = 0$

Solution:

Taking L.H.S and using $\sin^2 \theta + \cos^2 \theta = 1$, we have

$$\begin{aligned}\text{L.H.S} &= \frac{\cos^2 \theta}{\sin \theta} - \operatorname{cosec} \theta + \sin \theta \\&= \left(\frac{\cos^2 \theta}{\sin \theta} - \operatorname{cosec} \theta \right) + \sin \theta \\&= \left(\frac{\cos^2 \theta}{\sin \theta} - \frac{1}{\sin \theta} \right) + \sin \theta \\&= \left(\frac{\cos^2 \theta - 1}{\sin \theta} \right) + \sin \theta \\&= \left(\frac{-\sin^2 \theta}{\sin \theta} \right) + \sin \theta\end{aligned}$$

$$= -\sin \theta + \sin \theta$$

$$= 0$$

$$= \text{R.H.S}$$

- Hence proved

25.

Solution:

Taking L.H.S,

$$\begin{aligned}\text{LHS} &= \frac{1}{1 + \sin A} + \frac{1}{1 - \sin A} \\&= \frac{(1 - \sin A) + (1 + \sin A)}{(1 + \sin A)(1 - \sin A)} \\&= \frac{1 - \sin A + 1 + \sin A}{1 - \sin^2 A} \quad \because (1 + \sin A)(1 - \sin A) = 1 - \sin^2 A \\&= \frac{2}{1 - \sin^2 A} \\&= \frac{2}{\cos^2 A} \quad [\because 1 - \sin^2 A = \cos^2 A]\end{aligned}$$

$$= 2 \sec^2 A$$

$$= \text{R.H.S}$$

- Hence proved

26.

Solution:

Taking the LHS and using $\sin^2 \theta + \cos^2 \theta = 1$, we have

$$\begin{aligned}\text{LHS} &= \frac{1 + \sin \theta}{\cos \theta} + \frac{\cos \theta}{1 + \sin \theta} \\&= \frac{(1 + \sin \theta)^2 + \cos^2 \theta}{\cos \theta(1 + \sin \theta)} \\&= \frac{1 + \sin^2 \theta + 2 \sin \theta + \cos^2 \theta}{\cos \theta(1 + \sin \theta)} \\&= \frac{2(1 + \sin \theta)}{\cos \theta(1 + \sin \theta)}\end{aligned}$$

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$$= 2 / \cos \theta$$

$$= 2 \sec \theta$$

$$= \text{R.H.S}$$

- Hence proved

$$\frac{(1 + \sin \theta)^2 + (1 - \sin \theta)^2}{2 \cos^2 \theta} = \frac{1 + \sin^2 \theta}{1 - \sin^2 \theta}$$

27.

Solution:

Taking the LHS and using $\sin^2 \theta + \cos^2 \theta = 1$, we have

$$\begin{aligned} \text{L. H. S} &= \frac{(1 + \sin \theta)^2 + (1 - \sin \theta)^2}{2 \cos^2 \theta} \\ &= \frac{(1 + 2 \sin \theta + \sin^2 \theta) + (1 - 2 \sin \theta + \sin^2 \theta)}{2 \cos^2 \theta} \\ &= \frac{1 + 2 \sin \theta + \sin^2 \theta + 1 - 2 \sin \theta + \sin^2 \theta}{2 \cos^2 \theta} \\ &= \frac{2 + 2 \sin^2 \theta}{2 \cos^2 \theta} \\ &= \frac{2(1 + \sin^2 \theta)}{2(1 - \sin^2 \theta)} \\ &= \frac{(1 + \sin^2 \theta)}{(1 - \sin^2 \theta)} \end{aligned}$$

$$= \text{R.H.S}$$

- Hence proved

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28.

$$\frac{1 + \tan^2 \theta}{1 + \cot^2 \theta} = \tan^2 \theta$$

Solution:

Taking L.H.S,

$$\frac{1 + \tan^2 \theta}{1 + \cot^2 \theta}$$

Using $\sec^2 \theta - \tan^2 \theta = 1$ and $\operatorname{cosec}^2 \theta - \cot^2 \theta = 1$

$$\begin{aligned} &= \frac{1 + \tan^2 \theta}{1 + \cot^2 \theta} = \frac{\sec^2 \theta}{\operatorname{cosec}^2 \theta} \\ &= \frac{1}{\cos^2 \theta} \sin^2 \theta = \tan^2 \theta \end{aligned}$$

= R.H.S

- Hence proved

$$\frac{1 + \sec \theta}{\sec \theta} = \frac{\sin^2 \theta}{1 - \cos \theta}$$

29.

Solution:

Taking L.H.S and using $\sin^2 \theta + \cos^2 \theta = 1$, we have

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$$\begin{aligned}\text{LHS} &= \frac{1 + \sec \theta}{\sec \theta} \\&= \frac{1 + \frac{1}{\cos \theta}}{\frac{1}{\cos \theta}} \\&= \frac{\cos \theta + 1}{\cos \theta} \cdot \cos \theta \\&= 1 + \cos \theta \\&= \frac{(1 - \cos \theta)(1 + \cos \theta)}{1 - \cos \theta} \\&= \frac{1 - \cos^2 \theta}{1 - \cos \theta} \\&= \frac{\sin^2 \theta}{1 - \cos \theta}\end{aligned}$$

Multiplying by $(1 - \cos \theta)$ to
numerator and denominator

= R.H.S

- Hence proved

$$\frac{\tan \theta}{1 - \cot \theta} + \frac{\cot \theta}{1 - \tan \theta} = 1 + \tan \theta + \cot \theta$$

30.

Solution:

Taking LHS, we have

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$$\begin{aligned}\text{LHS} &= \frac{\tan \theta}{1 - \frac{1}{\tan \theta}} + \frac{\cot \theta}{1 - \tan \theta} \\&= \frac{\tan^2 \theta}{\tan \theta - 1} + \frac{\cot \theta}{1 - \tan \theta} \\&= \frac{1}{1 - \tan \theta} \left[\frac{1}{\tan \theta} - \tan^2 \theta \right] \\&= \frac{1}{1 - \tan \theta} \left[\frac{1 - \tan^3 \theta}{\tan \theta} \right] \\&= \frac{1}{1 - \tan \theta} \frac{(1 - \tan \theta)(1 + \tan \theta + \tan^2 \theta)}{\tan \theta} \quad [\text{Since, } a^3 - b^3 = (a - b)(a^2 + ab + b^2)] \\&= \frac{1 + \tan \theta + \tan^2 \theta}{\tan \theta} \\&= \frac{1}{\tan \theta} + \frac{\tan \theta}{\tan \theta} + \frac{\tan^2 \theta}{\tan \theta}\end{aligned}$$

$$= 1 + \tan \theta + \cot \theta$$

$$= \text{R.H.S}$$

- Hence proved

$$\mathbf{31. \sec^6 \theta = \tan^6 \theta + 3 \tan^2 \theta \sec^2 \theta + 1}$$

Solution:

From trig. Identities we have,

$$\sec^2 \theta - \tan^2 \theta = 1$$

On cubing both sides,

$$(\sec^2 \theta - \tan^2 \theta)^3 = 1$$

$$\sec^6 \theta - \tan^6 \theta - 3 \sec^2 \theta \tan^2 \theta (\sec^2 \theta - \tan^2 \theta) = 1 [\text{Since, } (a - b)^3 = a^3 - b^3 - 3ab(a - b)]$$

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$$\sec^6 \theta - \tan^6 \theta - 3\sec^2 \theta \tan^2 \theta = 1$$

$$\Rightarrow \sec^6 \theta = \tan^6 \theta + 3\sec^2 \theta \tan^2 \theta + 1$$

Hence, L.H.S = R.H.S

- Hence proved

$$32. \operatorname{cosec}^6 \theta = \cot^6 \theta + 3\cot^2 \theta \operatorname{cosec}^2 \theta + 1$$

Solution:

From trig. Identities we have,

$$\operatorname{cosec}^2 \theta - \cot^2 \theta = 1$$

On cubing both sides,

$$(\operatorname{cosec}^2 \theta - \cot^2 \theta)^3 = 1$$

$$\operatorname{cosec}^6 \theta - \cot^6 \theta - 3\operatorname{cosec}^2 \theta \cot^2 \theta (\operatorname{cosec}^2 \theta - \cot^2 \theta) = 1 [\text{Since, } (a - b)^3 = a^3 - b^3 - 3ab(a - b)]$$

$$\operatorname{cosec}^6 \theta - \cot^6 \theta - 3\operatorname{cosec}^2 \theta \cot^2 \theta = 1$$

$$\Rightarrow \operatorname{cosec}^6 \theta = \cot^6 \theta + 3 \operatorname{cosec}^2 \theta \cot^2 \theta + 1$$

Hence, L.H.S = R.H.S

- Hence proved

33.

Solution:

Taking L.H.S and using $\sec^2 \theta - \tan^2 \theta = 1 \Rightarrow 1 + \tan^2 \theta = \sec^2 \theta$

$$\begin{aligned}\text{LHS} &= \frac{\sec^2 \theta \cdot \cot \theta}{\operatorname{cosec}^2 \theta} \\ &= \frac{1 \cdot \sin^2 \theta \cdot \cos \theta}{\cos^2 \theta \cdot \frac{1}{\sin \theta}} \\ &= \frac{\sin \theta}{\cos \theta} = \tan \theta\end{aligned}$$

= R.H.S

- Hence proved

34.

$$\frac{1 + \cos A}{\sin^2 A} = \frac{1}{1 - \cos A}$$

Solution:

Taking L.H.S and using the identity $\sin^2 A + \cos^2 A = 1$, we get

$$\sin^2 A = 1 - \cos^2 A$$

$$\Rightarrow \sin^2 A = (1 - \cos A)(1 + \cos A)$$

$$\begin{aligned}\text{LHS} &= \frac{1 + \cos A}{(1 - \cos A)(1 + \cos A)} \\ &= \frac{1}{(1 - \cos A)}\end{aligned}$$

- Hence proved

35.

Solution:

We have,

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$$\text{LHS} = \frac{\sec A - \tan A}{\sec A + \tan A}$$

Rationalizing the denominator and numerator with $(\sec A + \tan A)$ and using $\sec^2 \theta - \tan^2 \theta = 1$ we get,

$$\begin{aligned} &= \frac{\sec^2 A - \tan^2 A}{(\sec A + \tan A)^2} \\ &= \frac{1}{(\sec A + \tan A)^2} \\ &= \frac{1}{(\sec^2 A + \tan^2 A + 2 \sec A \tan A)} \\ &= \frac{1}{\left(\frac{1}{\cos^2 A} + \frac{\sin^2 A}{\cos^2 A} + \frac{2 \sin A}{\cos A}\right)} \\ &\Rightarrow \frac{\cos^2 A}{1 + \sin^2 A + 2 \sin A} \\ &= \frac{\cos^2 A}{(1 + \sin A)^2} \end{aligned}$$

= R.H.S

- Hence proved

$$1 + \frac{\cos A}{\sin A} = \frac{\sin A}{1 - \cos A}$$

36.

Solution:

We have,

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-10-maths-chapter-6-trigonometric-identities/>

$$\text{LHS} = \frac{1 + \cos A}{\sin A}$$

On multiplying numerator and denominator by $(1 - \cos A)$, we get

$$= \frac{(1 + \cos A)(1 - \cos A)}{\sin A(1 - \cos A)}$$

$$= \frac{1 - \cos^2 A}{\sin A(1 - \cos A)}$$

$$= \frac{\sin^2 A}{\sin A(1 - \cos A)}$$

$$= \frac{\sin A}{1 - \cos A}$$

= R.H.S

- Hence proved

$$\sqrt{\frac{1 + \sin A}{1 - \sin A}} = \sec A + \tan A$$

37. (i)

Solution:

Taking L.H.S and rationalizing the numerator and denominator with $\sqrt{1 + \sin A}$, we get

$$\begin{aligned} &= \sqrt{\frac{(1 + \sin A)(1 + \sin A)}{(1 - \sin A)(1 + \sin A)}} = \sqrt{\frac{(1 + \sin A)^2}{1 - \sin^2 A}} \\ &= \sqrt{\frac{(1 + \sin A)^2}{\cos^2 A}} = \sqrt{\frac{(1 + \sin A)}{\cos A}} \\ &= \frac{1}{\cos A} + \frac{\sin A}{\cos A} = \sec A + \tan A \end{aligned}$$

= R.H.S

- Hence proved

$$\sqrt{\frac{(1 - \cos A)}{(1 + \cos A)}} + \sqrt{\frac{(1 + \cos A)}{(1 - \cos A)}} = 2 \operatorname{cosec} A$$

(ii)

Solution:

Taking L.H.S and rationalizing the numerator and denominator with its respective conjugates, we get

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$$\begin{aligned}&= \sqrt{\frac{(1 - \cos A)(1 - \cos A)}{(1 + \cos A)(1 - \cos A)}} + \sqrt{\frac{(1 + \cos A)(1 + \cos A)}{(1 - \cos A)(1 + \cos A)}} \\&= \sqrt{\frac{(1 - \cos A)^2}{(1 - \cos^2 A)}} + \sqrt{\frac{(1 + \cos A)^2}{(1 - \cos^2 A)}} \\&= \sqrt{\frac{(1 - \cos A)^2}{(\sin^2 A)}} + \sqrt{\frac{(1 + \cos A)^2}{(\sin^2 A)}} \\&= \frac{(1 - \cos A)}{(\sin A)} + \frac{(1 + \cos A)}{(\sin A)} \\&= \frac{(1 - \cos A + 1 + \cos A)}{(\sin A)} \\&= \frac{(2)}{(\sin A)}\end{aligned}$$

$$= 2 \operatorname{cosec} A$$

$$= \text{R.H.S}$$

- Hence proved

38. Prove that:

(i)

Solution:

Taking L.H.S and rationalizing the numerator and denominator with its respective conjugates, we get

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$$\begin{aligned} &= \sqrt{\frac{(\sec \theta - 1)(\sec \theta - 1)}{(\sec \theta + 1)(\sec \theta - 1)}} + \sqrt{\frac{(\sec \theta + 1)(\sec \theta + 1)}{(\sec \theta - 1)(\sec \theta + 1)}} \\ &= \sqrt{\frac{(\sec \theta - 1)^2}{(\sec^2 \theta - 1)}} + \sqrt{\frac{(\sec \theta + 1)^2}{(\sec^2 \theta - 1)}} \\ &= \sqrt{\frac{(\sec \theta - 1)^2}{\tan^2 \theta}} + \sqrt{\frac{(\sec \theta + 1)^2}{\tan^2 \theta}} \\ &= \frac{(\sec \theta - 1)}{\tan \theta} + \frac{(\sec \theta + 1)}{\tan \theta} \\ &= \frac{(\sec \theta - 1 + \sec \theta + 1)}{\tan \theta} \\ &= \frac{(2 \sec \theta)}{\tan \theta} \\ &= \frac{2}{\sin \theta} \end{aligned}$$

$$= 2 \operatorname{cosec} \theta$$

$$= \text{R.H.S}$$

- Hence proved

(ii)

Solution:

Taking L.H.S and rationalizing the numerator and denominator with its respective conjugates, we get

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-10-maths-chapter-6-trigonometric-identities/>

$$\begin{aligned} &= \sqrt{\frac{(1 + \sin \theta)(1 + \sin \theta)}{(1 - \sin \theta)(1 + \sin \theta)}} + \sqrt{\frac{(1 - \sin \theta)(1 - \sin \theta)}{(1 + \sin \theta)(1 - \sin \theta)}} \\ &= \sqrt{\frac{(1 + \sin \theta)^2}{(1 - \sin^2 \theta)}} + \sqrt{\frac{(1 - \sin \theta)^2}{(1 - \sin^2 \theta)}} \\ &= \sqrt{\frac{(1 + \sin \theta)^2}{(\cos^2 \theta)}} + \sqrt{\frac{(1 - \sin \theta)^2}{(\cos^2 \theta)}} \\ &= \frac{(1 + \sin \theta)}{(\cos \theta)} + \frac{(1 - \sin \theta)}{(\cos \theta)} \\ &= \sqrt{\frac{(1 + \sin \theta + 1 - \sin \theta)}{(\cos \theta)}} \\ &= \frac{(2)}{(\cos \theta)} = 2 \sec \theta \end{aligned}$$

= R.H.S

- Hence proved

(iii)

Solution:

Taking L.H.S and rationalizing the numerator and denominator with its respective conjugates, we get

<https://www.indcareer.com/schools/rd-sharma-solutions-for-class-10-maths-chapter-6-trigonometric-identities/>

$$\begin{aligned} &= \sqrt{\frac{(1 - \cos \theta)(1 - \cos \theta)}{(1 + \cos \theta)(1 - \cos \theta)}} + \sqrt{\frac{(1 + \cos \theta)(1 + \cos \theta)}{(1 - \cos \theta)(1 + \cos \theta)}} \\ &= \sqrt{\frac{(1 - \cos \theta)^2}{(1 - \cos^2 \theta)}} + \sqrt{\frac{(1 + \cos \theta)^2}{(1 - \cos^2 \theta)}} \\ &= \sqrt{\frac{(1 - \cos \theta)^2}{(\sin^2 \theta)}} + \sqrt{\frac{(1 + \cos \theta)^2}{(\sin^2 \theta)}} \\ &= \frac{(1 - \cos \theta)}{(\sin \theta)} + \frac{(1 + \cos \theta)}{(\sin \theta)} \\ &= \frac{(1 - \cos \theta + 1 + \cos \theta)}{(\sin \theta)} \\ &= \frac{(2)}{(\sin \theta)} \end{aligned}$$

$$= 2 \operatorname{cosec} \theta$$

$$= \text{R.H.S}$$

- Hence proved

(iv)

Solution:

Taking L.H.S, we have

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$$= \frac{\sec \theta - 1}{\sec \theta + 1} = \frac{1 - \cos \theta}{1 + \cos \theta}$$

On multiplying numerator and denominator by $1 + \cos \theta$, we get

$$= \frac{(1 - \cos \theta)(1 + \cos \theta)}{(1 + \cos \theta)(1 + \cos \theta)}$$

$$= \frac{(1 - \cos^2 \theta)}{(1 + \cos \theta)^2}$$

$$= \frac{\sin^2 \theta}{(1 + \cos \theta)^2}$$

$$= \left(\frac{\sin \theta}{1 + \cos \theta} \right)^2$$

= R.H.S

- Hence proved

$$(\sec A - \tan A)^2 = \frac{1 - \sin A}{1 + \sin A}$$

39.

Solution:

Taking LHS = $(\sec A - \tan A)^2$, we have

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$$\begin{aligned} &= \left[\frac{1}{\cos A} - \frac{\sin A}{\cos A} \right]^2 \\ &= \frac{(1 - \sin A)^2}{\cos^2 A} \\ &= \frac{(1 - \sin A)^2}{1 - \sin^2 A} \\ &= \frac{(1 - \sin A)^2}{(1 + \sin A)(1 - \sin A)} \\ &= \frac{(1 - \sin A)}{(1 + \sin A)} \end{aligned}$$

= R.H.S

- Hence proved

$$\frac{1 - \cos A}{1 + \cos A} = (\cot A - \operatorname{cosec} A)^2$$

40.

Solution:

Taking L.H.S and rationalizing the numerator and denominator with $(1 - \cos A)$, we get

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$$= \frac{(1 - \cos A)(1 - \cos A)}{(1 + \cos A)(1 - \cos A)}$$

$$= \frac{(1 - \cos A)^2}{(1 - \cos^2 A)}$$

$$= \frac{(1 - \cos A)^2}{(\sin^2 A)}$$

$$= \left(\frac{1}{\sin A} - \frac{\cos A}{\sin A} \right)^2$$

$$= (\operatorname{cosec} A - \cot A)^2$$

$$= (\cot A - \operatorname{cosec} A)^2$$

$$= \text{R.H.S}$$

- Hence proved

$$\frac{1}{\sec A - 1} + \frac{1}{\sec A + 1} = 2 \operatorname{cosec} A \cot A$$

41.

Solution:

Considering L.H.S and taking L.C.M and on simplifying we have,

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$$= \frac{\sec A + 1 + \sec A - 1}{(\sec A + 1)(\sec A - 1)}$$

$$= \frac{2 \sec A}{(\sec^2 A - 1)}$$

$$= \frac{2 \sec A}{(\tan^2 A)}$$

$$= \frac{2 \cos^2 A}{(\cos A \sin^2 A)}$$

$$= \frac{2 \cos A}{(\sin^2 A)}$$

$$= \frac{2 \cos A}{(\sin A)(\sin A)}$$

$$= 2 \operatorname{cosec} A \cot A = \text{RHS}$$

- Hence proved

$$\frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A} = \sin A + \cos A$$

42.

Solution:

Taking LHS, we have

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$$\begin{aligned} &= \frac{\cos A}{1 - \tan A} + \frac{\sin A}{1 - \cot A} \\ &= \frac{\cos A}{1 - \frac{\sin A}{\cos A}} + \frac{\sin A}{1 - \frac{\cos A}{\sin A}} \\ &= \frac{\cos^2 A}{\cos A - \sin A} - \frac{\sin^2 A}{\cos A - \sin A} \\ &= \frac{\cos^2 A - \sin^2 A}{\cos A - \sin A} \\ &= \frac{(\cos A + \sin A)(\cos A - \sin A)}{\cos A - \sin A} \end{aligned}$$

$$= \cos A + \sin A$$

$$= \text{RHS}$$

- Hence proved

43.

Solution:

Considering L.H.S and taking L.C.M and on simplifying we have,

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$$= \frac{(\operatorname{cosec} A)(\operatorname{cosec} A + 1 + \operatorname{cosec} A - 1)}{(\operatorname{cosec}^2 A - 1)}$$

$$= \frac{(2 \operatorname{cosec}^2 A)}{\cot^2 A}$$

$$= \frac{2 \sin^2 A}{\sin^2 A \cdot \cos^2 A}$$

$$= \frac{2}{\cos^2 A}$$

$$= 2 \sec^2 A$$

$$= \text{RHS}$$

- Hence proved

Exercise 6.2 Page No: 6.54

1. If $\cos \theta = 4/5$, find all other trigonometric ratios of angle θ .

Solution:

We have,

$$\cos \theta = 4/5$$

And we know that,

$$\sin \theta = \sqrt{1 - \cos^2 \theta}$$

$$\Rightarrow \sin \theta = \sqrt{1 - (4/5)^2}$$

$$= \sqrt{1 - (16/25)}$$

$$= \sqrt{[(25 - 16)/25]}$$

$$= \sqrt{(9/25)}$$

$$= 3/5$$

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$$\therefore \sin \theta = 3/5$$

$$\text{Since, } \operatorname{cosec} \theta = 1/\sin \theta$$

$$= 1/(3/5)$$

$$\Rightarrow \operatorname{cosec} \theta = 5/3$$

$$\text{And, } \sec \theta = 1/\cos \theta$$

$$= 1/(4/5)$$

$$\Rightarrow \sec \theta = 5/4$$

Now,

$$\tan \theta = \sin \theta / \cos \theta$$

$$= (3/5) / (4/5)$$

$$\Rightarrow \tan \theta = 3/4$$

$$\text{And, } \cot \theta = 1/\tan \theta$$

$$= 1/(3/4)$$

$$\Rightarrow \cot \theta = 4/3$$

2. If $\sin \theta = 1/\sqrt{2}$, find all other trigonometric ratios of angle θ .

Solution:

We have,

$$\sin \theta = 1/\sqrt{2}$$

And we know that,

$$\cos \theta = \sqrt{1 - \sin^2 \theta}$$

$$\Rightarrow \cos \theta = \sqrt{1 - (1/\sqrt{2})^2}$$

$$= \sqrt{1 - (1/2)}$$

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$$= \sqrt{[(2 - 1)/2]}$$

$$= \sqrt{(1/2)}$$

$$= 1/\sqrt{2}$$

$$\therefore \cos \theta = 1/\sqrt{2}$$

$$\text{Since, cosec } \theta = 1/\sin \theta$$

$$= 1/(1/\sqrt{2})$$

$$\Rightarrow \text{cosec } \theta = \sqrt{2}$$

$$\text{And, sec } \theta = 1/\cos \theta$$

$$= 1/(1/\sqrt{2})$$

$$\Rightarrow \sec \theta = \sqrt{2}$$

Now,

$$\tan \theta = \sin \theta / \cos \theta$$

$$= (1/\sqrt{2}) / (1/\sqrt{2})$$

$$\Rightarrow \tan \theta = 1$$

$$\text{And, cot } \theta = 1/\tan \theta$$

$$= 1/(1)$$

$$\Rightarrow \cot \theta = 1$$

$$\text{If } \tan \theta = \frac{1}{\sqrt{2}}, \text{ find the value of } \frac{\text{cosec}^2 \theta - \sec^2 \theta}{\text{cosec}^2 \theta + \cot^2 \theta}.$$

3.

Solution:

Given,

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$$\tan \theta = 1/\sqrt{2}$$

By using $\sec^2 \theta - \tan^2 \theta = 1$,

$$\sec \theta = \sqrt{1 + \tan^2 \theta} = \sqrt{1 + \left(\frac{1}{\sqrt{2}}\right)^2} = \sqrt{1 + \frac{1}{2}} = \sqrt{\frac{3}{2}}$$

And,

$$\cot \theta = \frac{1}{\tan \theta} = \frac{1}{\frac{1}{\sqrt{2}}} = \sqrt{2}$$

From identity, we have

$$\operatorname{cosec} \theta = \sqrt{1 + \cot^2 \theta} = \sqrt{1 + 2} = \sqrt{3}$$

Substituting the values, we get

$$\begin{aligned} \frac{\operatorname{cosec}^2 \theta - \sec^2 \theta}{\operatorname{cosec}^2 \theta + \cot^2 \theta} &= \frac{(\sqrt{3})^2 - \left(\sqrt{\frac{3}{2}}\right)^2}{(\sqrt{3})^2 + (\sqrt{2})^2} \\ &= \frac{3 - \frac{3}{2}}{3 + 2} = \frac{\frac{3}{2}}{5} = \frac{3}{10} \end{aligned}$$

4.

Solution:

Given,

$$\tan \theta = 3/4$$

By using $\sec^2 \theta - \tan^2 \theta = 1$,

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$$\sec \theta = \sqrt{1 + \tan^2 \theta} = \sqrt{1 + \left(\frac{3}{4}\right)^2} = \sqrt{1 + \frac{9}{16}} = \sqrt{\frac{16 + 9}{16}} = \sqrt{\frac{25}{16}}$$

$$\sec \theta = 5/4$$

Since, $\sec \theta = 1 / \cos \theta$

$$\Rightarrow \cos \theta = 1 / \sec \theta$$

$$= 1 / (5/4)$$

$$= 4/5$$

$$\frac{\operatorname{cosec}^2 \theta - \sec^2 \theta}{\operatorname{cosec}^2 \theta + \cot^2 \theta} = \frac{1 - \frac{4}{5}}{1 + \frac{4}{5}} = \frac{\frac{1}{5}}{\frac{9}{5}} = \frac{1}{9}$$

So,

$$\text{If } \tan \theta = \frac{12}{5}, \text{ find the value of } \frac{1 + \sin \theta}{1 - \sin \theta}$$

5.

Solution:

Given, $\tan \theta = 12/5$

Since, $\cot \theta = 1 / \tan \theta = 1 / (12/5) = 5/12$

Now, by using $\operatorname{cosec}^2 \theta - \cot^2 \theta = 1$

$$\operatorname{cosec} \theta = \sqrt{1 + \cot^2 \theta}$$

$$= \sqrt{1 + (5/12)^2}$$

$$= \sqrt{1 + 25/144}$$

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$$= \sqrt{(169/25)}$$

$$\Rightarrow \operatorname{cosec} \theta = 13/5$$

Now, we know that

$$\sin \theta = 1/\operatorname{cosec} \theta$$

$$= 1/(13/5)$$

$$\Rightarrow \sin \theta = 5/13$$

Putting value of $\sin \theta$ in the expression we have,

$$= \frac{1 + \frac{12}{13}}{1 - \frac{12}{13}} = \frac{\frac{13 + 12}{13}}{\frac{13 - 12}{13}}$$

$$= 25/1$$

$$= 25$$

If $\cot \theta = \frac{1}{\sqrt{3}}$, find the value of $\frac{1 - \cos^2 \theta}{2 - \sin^2 \theta}$

6.

Solution:

Given,

$$\cot \theta = 1/\sqrt{3}$$

Using $\operatorname{cosec}^2 \theta - \cot^2 \theta = 1$, we can find $\operatorname{cosec} \theta$

$$\operatorname{cosec} \theta = \sqrt{(1 + \cot^2 \theta)}$$

$$= \sqrt{(1 + (1/\sqrt{3})^2)}$$

$$= \sqrt{(1 + (1/3))} = \sqrt{((3 + 1)/3)}$$

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$$= \sqrt{4/3}$$

$$\Rightarrow \operatorname{cosec} \theta = 2/\sqrt{3}$$

$$\text{So, } \sin \theta = 1/\operatorname{cosec} \theta = 1/(2/\sqrt{3})$$

$$\Rightarrow \sin \theta = \sqrt{3}/2$$

And, we know that

$$\cos \theta = \sqrt{1 - \sin^2 \theta}$$

$$= \sqrt{1 - (\sqrt{3}/2)^2}$$

$$= \sqrt{1 - (3/4)}$$

$$= \sqrt{(4 - 3)/4}$$

$$= \sqrt{1/4}$$

$$\Rightarrow \cos \theta = 1/2$$

Now, using $\cos \theta$ and $\sin \theta$ in the expression, we have

$$= \frac{1 - \left(\frac{1}{2}\right)^2}{2 - \left(\frac{\sqrt{3}}{2}\right)^2}$$

$$= \frac{1 - \frac{1}{4}}{2 - \frac{3}{4}} = \frac{\frac{3}{4}}{\frac{5}{4}}$$

$$= 3/5$$

If $\operatorname{cosec} A = \sqrt{2}$, find the value of $\frac{2 \sin^2 A + 3 \cot^2 A}{4(\tan^2 A - \cos^2 A)}$.

7.

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Solution:

Given,

$$\operatorname{cosec} A = \sqrt{2}$$

Using $\operatorname{cosec}^2 A - \cot^2 A = 1$, we find $\cot A$

$$\cot A = \sqrt{\operatorname{cosec}^2 A - 1} = \sqrt{(\sqrt{2})^2 - 1} = \sqrt{2 - 1} = 1$$

$$\begin{aligned}\text{So, } \tan A &= 1 / \cot A \\ &= 1 / 1 = 1\end{aligned}$$

$$\text{And, } \sin A = 1 / \operatorname{cosec} A = 1 / \sqrt{2}$$

$$\cos A = \sqrt{1 - \sin^2 A} = \sqrt{1 - \left(\frac{1}{\sqrt{2}}\right)^2} = \sqrt{\frac{1}{\sqrt{2}}} = \frac{1}{\sqrt{2}}$$

On substituting we get,

$$\begin{aligned}&= \frac{2 \left[\frac{1}{\sqrt{2}} \right]^2 + 3[1]^2}{4 \left[[1] - \left[\frac{1}{\sqrt{2}} \right]^2 \right]} \\ &= \frac{2 \times \frac{1}{2} + 3}{4 \left[1 - \frac{1}{2} \right]} \Rightarrow \frac{1 + 3}{4 \cdot \frac{1}{2}}\end{aligned}$$

$$= 4/2$$

$$= 2$$

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About RD Sharma

RD Sharma isn't the kind of author you'd bump into at lit fests. But his bestselling books have helped many CBSE students lose their dread of maths. Sunday Times profiles the tutor turned internet star

He dreams of algorithms that would give most people nightmares. And, spends every waking hour thinking of ways to explain concepts like 'series solution of linear differential equations'. Meet Dr Ravi Dutt Sharma — mathematics teacher and author of 25 reference books — whose name evokes as much awe as the subject he teaches. And though students have used his thick tomes for the last 31 years to ace the dreaded maths exam, it's only recently that a spoof video turned the tutor into a YouTube star.

R D Sharma had a good laugh but said he shared little with his on-screen persona except for the love for maths. "I like to spend all my time thinking and writing about maths problems. I find it relaxing," he says. When he is not writing books explaining mathematical concepts for classes 6 to 12 and engineering students, Sharma is busy dispensing his duty as vice-principal and head of department of science and humanities at Delhi government's Guru Nanak Dev Institute of Technology.

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