NCERT Solutions for Class 11 Maths Chapter 3 Exercise 3.3: NCERT Solutions for Class 11 Maths Chapter 3 Exercise 3.3 focus on the trigonometric functions of the sum and difference of two angles. This exercise helps students explore and understand the application of key trigonometric identities, which are crucial for solving various problems in trigonometry.

The solutions provided in the NCERT textbook offer detailed, step-by-step explanations that align with the latest CBSE syllabus. By practicing these problems, students can enhance their conceptual understanding and problem-solving skills, ensuring thorough preparation for exams. These solutions are designed to support students in mastering the fundamental concepts of trigonometry.

NCERT Solutions for Class 11 Maths Chapter 3 Exercise 3.3 Overview

NCERT Solutions for Class 11 Maths Chapter 3 Exercise 3.3 is centered around Trigonometric Functions of Sum and Difference of Two Angles. This exercise helps students understand the fundamental identities related to the sum and difference of angles in trigonometry, which are key concepts for solving more complex problems in the subject.

In this exercise, students are introduced to the application of trigonometric identities when two angles are added or subtracted. The exercise covers how to use these identities to simplify expressions and solve problems involving sine, cosine, and other trigonometric functions.

Key Concepts:

- The **Sum and Difference Formulas** help in transforming expressions involving the sum or difference of angles into simpler forms, which makes solving trigonometric problems easier.
- **Understanding symmetry** in trigonometric functions is important in determining how functions behave when angles are negative or when different operations like addition and subtraction are performed on them.

Topics Covered:

- **Trigonometric identities** for the sum and difference of two angles.
- How to apply these identities to evaluate or simplify trigonometric expressions.
- Problem-solving techniques based on these identities.
- Real-life applications of these formulas in various problems.

Exercise Breakdown:

The problems in Exercise 3.3 involve:

1. Simplifying trigonometric expressions using the sum and difference identities.

2. Solving equations where angles are combined with addition or subtraction.
3. Applying these formulas in various real-life contexts, including angles and measurements in geometry or physics.

The solutions provided in this exercise are designed to give step-by-step guidance, helping students better understand how to use these identities effectively. By practicing these problems, students will become comfortable with recognizing when and how to use the sum and difference identities, which is critical for mastering the topic of trigonometry.

Class 11 Maths Chapter 3 Exercise 3.3 Questions and Answers PDF

Class 11 Maths Chapter 3 Exercise 3.3 Questions and Answers PDF is available for students to download and access detailed solutions. This PDF contains step-by-step solutions to all the questions in Exercise 3.3, which focuses on the trigonometric functions of sum and difference of two angles. By referring to this PDF, students can enhance their problem-solving skills and ensure thorough preparation for exams. You can download the PDF from the provided link below for easy access and effective learning.

Class 11 Maths Chapter 3 Exercise 3.3 Questions and Answers PDF

NCERT Solutions for Class 11 Maths Chapter 3 Trigonometric Functions Exercise 3.3

Below is the NCERT Solutions for Class 11 Maths Chapter 3 Trigonometric Functions Exercise 3.3:

Prove that:

1.

$$\sin^2\frac{\pi}{6}+\cos^2\frac{\pi}{3}-\tan^2\frac{\pi}{4}=-\frac{1}{2}$$

Solution:

Consider

$$\text{L.H.S.} = \sin^2\frac{\pi}{6} + \cos^2\frac{\pi}{3} - \tan^2\frac{\pi}{4}$$

So we get

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

By further calculation

= 1/4 + 1/4 – 1

= - 1/2

= RHS

2.

$$2\sin^2\frac{\pi}{6} + \operatorname{cosec}^2\frac{7\pi}{6}\cos^2\frac{\pi}{3} = \frac{3}{2}$$

Solution:

Consider

$$\text{L.H.S.} = 2\sin^2\frac{\pi}{6} + \operatorname{cosec}^2\frac{7\pi}{6}\cos^2\frac{\pi}{3}$$

By further calculation

$$= 2\left(\frac{1}{2}\right)^2 + \operatorname{cosec}^2\left(\pi + \frac{\pi}{6}\right)\left(\frac{1}{2}\right)^2$$

It can be written as

$$= 2 \times \frac{1}{4} + \left(-\operatorname{cosec}\frac{\pi}{6}\right)^2\left(\frac{1}{4}\right)$$

So we get

$$= \frac{1}{2} + (-2)^2\left(\frac{1}{4}\right)$$

Here

= 1/2 + 4/4

= 1/2 + 1

= 3/2

= RHS

3.

$$\cot^2\frac{\pi}{6}+\operatorname{cosec}\frac{5\pi}{6}+3\tan^2\frac{\pi}{6}=6$$

Solution:

Consider

$$\text{L.H.S.} = \cot^2\frac{\pi}{6}+\operatorname{cosec}\frac{5\pi}{6}+3\tan^2\frac{\pi}{6}$$

So we get

$$=\left(\sqrt{3}\right)^2+\operatorname{cosec}\left(\pi-\frac{\pi}{6}\right)+3\left(\frac{1}{\sqrt{3}}\right)^2$$

By further calculation

$$=3+\operatorname{cosec}\frac{\pi}{6}+3\times\frac{1}{3}$$

We get

= 3 + 2 + 1

= 6

= RHS

4.

$$2\sin^2\frac{3\pi}{4}+2\cos^2\frac{\pi}{4}+2\sec^2\frac{\pi}{3}=10$$

Solution:

Consider

$$\text{L.H.S} = 2\sin^2\frac{3\pi}{4} + 2\cos^2\frac{\pi}{4} + 2\sec^2\frac{\pi}{3}$$

So we get

$$= 2\left\{\sin\left(\pi - \frac{\pi}{4}\right)\right\}^2 + 2\left(\frac{1}{\sqrt{2}}\right)^2 + 2(2)^2$$

By further calculation

$$= 2\left\{\sin\frac{\pi}{4}\right\}^2 + 2\times\frac{1}{2} + 8$$

It can be written as

$$= 2\left(\frac{1}{\sqrt{2}}\right)^2 + 1 + 8$$

= 1 + 1 + 8

= 10

= RHS

5. Find the value of:

(i) sin 75°

(ii) tan 15°

Solution:

(i) sin 75°

It can be written as

= sin (45° + 30°)

Using the formula [sin (x + y) = sin x cos y + cos x sin y]

= sin 45° cos 30° + cos 45° sin 30°

Substituting the values

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

By further calculation

$$=\frac{\sqrt{3}}{2\sqrt{2}}+\frac{1}{2\sqrt{2}}$$

$$=\frac{\sqrt{3}+1}{2\sqrt{2}}$$

(ii) tan 15°

It can be written as

= tan (45° – 30°)

Using formula

$$\tan\left(x-y\right)=\frac{\tan x-\tan y}{1+\tan x\tan y}$$

$$= \frac{\tan 45° - \tan 30°}{1 + \tan 45° \tan 30°}$$

Substituting the values

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

By further calculation

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

So we get

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

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

Prove the following:

6.

$$\cos\left(\frac{\pi}{4} - x\right)\cos\left(\frac{\pi}{4} - y\right) - \sin\left(\frac{\pi}{4} - x\right)\sin\left(\frac{\pi}{4} - y\right) = \sin(x + y)$$

Solution:

Consider LHS =

$$\cos\left(\frac{\pi}{4}-x\right)\cos\left(\frac{\pi}{4}-y\right)-\sin\left(\frac{\pi}{4}-x\right)\sin\left(\frac{\pi}{4}-y\right)$$

We can write it as

$$=\frac{1}{2}\left[2\cos\left(\frac{\pi}{4}-x\right)\cos\left(\frac{\pi}{4}-y\right)\right]+\frac{1}{2}\left[-2\sin\left(\frac{\pi}{4}-x\right)\sin\left(\frac{\pi}{4}-y\right)\right]$$

By further simplification

$$=\frac{1}{2}\left[\cos\left\{\left(\frac{\pi}{4}-x\right)+\left(\frac{\pi}{4}-y\right)\right\}+\cos\left\{\left(\frac{\pi}{4}-x\right)-\left(\frac{\pi}{4}-y\right)\right\}\right]$$

$$+\frac{1}{2}\left[\cos\left\{\left(\frac{\pi}{4}-x\right)+\left(\frac{\pi}{4}-y\right)\right\}-\cos\left\{\left(\frac{\pi}{4}-x\right)-\left(\frac{\pi}{4}-y\right)\right\}\right]$$

Using the formula

2 cos A cos B = cos (A + B) + cos (A – B)

-2 sin A sin B = cos (A + B) – cos (A – B)

$$=2\times\frac{1}{2}\left[\cos\left\{\left(\frac{\pi}{4}-x\right)+\left(\frac{\pi}{4}-y\right)\right\}\right]$$

We get

$$=\cos\left[\frac{\pi}{2}-(x+y)\right]$$

= sin (x + y)

= RHS

7.

$$\frac{\tan\left(\frac{\pi}{4}+x\right)}{\tan\left(\frac{\pi}{4}-x\right)}=\left(\frac{1+\tan x}{1-\tan x}\right)^2$$

Solution:

Consider

$$.L.H.S. = \frac{\tan\left(\frac{\pi}{4}+x\right)}{\tan\left(\frac{\pi}{4}-x\right)}$$

By using the formula

$\tan(A+B) = \frac{\tan A + \tan B}{1-\tan A \tan B}$ and $\tan(A-B) = \frac{\tan A - \tan B}{1+\tan A \tan B}$

So we get

$$= \frac{\left(\frac{\tan\frac{\pi}{4}+\tan x}{1-\tan\frac{\pi}{4}\tan x}\right)}{\left(\frac{\tan\frac{\pi}{4}-\tan x}{1+\tan\frac{\pi}{4}\tan x}\right)}$$

It can be written as

$$= \frac{\left(\frac{1+\tan x}{1-\tan x}\right)}{\left(\frac{1-\tan x}{1+\tan x}\right)}$$

$$= \left(\frac{1+\tan x}{1-\tan x}\right)^2$$

= RHS

8.

$$\frac{\cos(\pi+x)\cos(-x)}{\sin(\pi-x)\cos\left(\frac{\pi}{2}+x\right)} = \cot^2 x$$

Solution:

Consider

$$\text{L.H.S.} = \frac{\cos(\pi + x)\cos(-x)}{\sin(\pi - x)\cos\left(\frac{\pi}{2} + x\right)}$$

It can be written as

$$= \frac{[-\cos x][\cos x]}{(\sin x)(-\sin x)}$$

So we get

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

$= \cot^2 x$

= RHS

9.

$$\cos\left(\frac{3\pi}{2} + x\right)\cos(2\pi + x)\left[\cot\left(\frac{3\pi}{2} - x\right) + \cot(2\pi + x)\right] = 1$$

Solution:

Consider

$$\text{L.H.S.} = \cos\left(\frac{3\pi}{2} + x\right)\cos(2\pi + x)\left[\cot\left(\frac{3\pi}{2} - x\right) + \cot(2\pi + x)\right]$$

It can be written as

$= \sin x \cos x (\tan x + \cot x)$

So we get

$$= \sin x \cos x\left(\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}\right)$$

$$= (\sin x \cos x)\left[\frac{\sin^2 x + \cos^2 x}{\sin x \cos x}\right]$$

$= 1$

= RHS

10. sin (n + 1)x sin (n + 2)x + cos (n + 1)x cos (n + 2)x = cos x

Solution:

LHS = sin (n + 1)x sin (n + 2)x + cos (n + 1)x cos (n + 2)x

By multiplying and dividing by 2

$$=\frac{1}{2}\left[2\sin(n+1)x\sin(n+2)x+2\cos(n+1)x\cos(n+2)x\right]$$

Using the formula

$- 2 \sin A \sin B = \cos (A + B) - \cos (A - B)$

$2 \cos A \cos B = \cos (A + B) + \cos (A - B)$

$$=\frac{1}{2}\begin{bmatrix}\cos\{(n+1)x-(n+2)x\}-\cos\{(n+1)x+(n+2)x\}\\+\cos\{(n+1)x+(n+2)x\}+\cos\{(n+1)x-(n+2)x\}\end{bmatrix}$$

By further calculation

$$=\frac{1}{2}\times 2\cos\{(n+1)x-(n+2)x\}$$

$= \cos (- x)$

$= \cos x$

= RHS

11.

$$\cos\left(\frac{3\pi}{4}+x\right)-\cos\left(\frac{3\pi}{4}-x\right)=-\sqrt{2}\sin x$$

Solution:

Consider

$$\text{L.H.S.} = \cos\left(\frac{3\pi}{4}+x\right)-\cos\left(\frac{3\pi}{4}-x\right)$$

Using the formula

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

$$= -2\sin\left\{\frac{\left(\frac{3\pi}{4}+x\right)+\left(\frac{3\pi}{4}-x\right)}{2}\right\}.\sin\left\{\frac{\left(\frac{3\pi}{4}+x\right)-\left(\frac{3\pi}{4}-x\right)}{2}\right\}$$

So we get

$$= -2\sin\left(\frac{3\pi}{4}\right)\sin x$$

It can be written as

$$= -2\sin\left(\pi - \frac{\pi}{4}\right)\sin x$$

By further calculation

$$= -2\sin\frac{\pi}{4}\sin x$$

Substituting the values

$$= -2 \times \frac{1}{\sqrt{2}} \times \sin x$$

$= -\sqrt{2}\sin x$

= RHS

12. $\sin^2 6x - \sin^2 4x = \sin 2x \sin 10x$

Solution:

Consider

L.H.S. = $\sin^2 6x - \sin^2 4x$

Using the formula

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

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

So we get

$= (\sin 6x + \sin 4x)(\sin 6x - \sin 4x)$

By further calculation

$$= \left[2\sin\left(\frac{6x+4x}{2}\right)\cos\left(\frac{6x-4x}{2}\right)\right]\left[2\cos\left(\frac{6x+4x}{2}\right).\sin\left(\frac{6x-4x}{2}\right)\right]$$

We get

$= (2 \sin 5x \cos x) (2 \cos 5x \sin x)$

It can be written as

$= (2 \sin 5x \cos 5x) (2 \sin x \cos x)$

$= \sin 10x \sin 2x$

= RHS

13. $\cos^2 2x - \cos^2 6x = \sin 4x \sin 8x$

Solution:

Consider

L.H.S. $= \cos^2 2x - \cos^2 6x$

Using the formula

$$\cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

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

So we get

$= (\cos 2x + \cos 6x) (\cos 2x - 6x)$

By further calculation

$$= \left[2\cos\left(\frac{2x+6x}{2}\right)\cos\left(\frac{2x-6x}{2}\right)\right]\left[-2\sin\left(\frac{2x+6x}{2}\right)\sin\frac{(2x-6x)}{2}\right]$$

We get

$= [2 \cos 4x \cos (-2x)] [-2 \sin 4x \sin (-2x)]$

It can be written as

$= [2 \cos 4x \cos 2x] [-2 \sin 4x (-\sin 2x)]$

So we get

$= (2 \sin 4x \cos 4x) (2 \sin 2x \cos 2x)$

= sin 8x sin 4x

= RHS

14. sin 2x + 2sin 4x + sin 6x = 4cos² x sin 4x

Solution:

Consider

L.H.S. = $\sin 2x + 2\sin 4x + \sin 6x$

$= [\sin 2x + \sin 6x] + 2\sin 4x$

Using the formula

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

$$= \left[2\sin\left(\frac{2x+6x}{2}\right)\cos\left(\frac{2x-6x}{2}\right)\right] + 2\sin 4x$$

By further simplification

= 2 sin 4x cos (– 2x) + 2 sin 4x

It can be written as

= 2 sin 4x cos 2x + 2 sin 4x

Taking common terms

= 2 sin 4x (cos 2x + 1)

Using the formula

= 2 sin 4x (2 $\cos^2$ x – 1 + 1)

We get

= 2 sin 4x (2 $\cos^2$ x)

= 4$\cos^2$ x sin 4x

= R.H.S.

15. cot 4*x* (sin 5*x* + sin 3*x*) = cot *x* (sin 5*x* – sin 3*x*)

Solution:

Consider

LHS = cot 4x (sin 5x + sin 3x)

It can be written as

$$= \frac{\cos 4x}{\sin 4x}\left[2\sin\left(\frac{5x+3x}{2}\right)\cos\left(\frac{5x-3x}{2}\right)\right]$$

Using the formula

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

$$= \left(\frac{\cos 4x}{\sin 4x}\right)\left[2\sin 4x \cos x\right]$$

So we get

= 2 cos 4x cos x

Similarly

R.H.S. = cot x (sin $5x$ – sin $3x$)

It can be written as

$$= \frac{\cos x}{\sin x}\left[2\cos\left(\frac{5x+3x}{2}\right)\sin\left(\frac{5x-3x}{2}\right)\right]$$

Using the formula

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

$$= \frac{\cos x}{\sin x}\left[2\cos 4x \sin x\right]$$

So we get

= 2 cos 4x cos x

Hence, LHS = RHS.

16.

$$\frac{\cos 9x - \cos 5x}{\sin 17x - \sin 3x} = -\frac{\sin 2x}{\cos 10x}$$

Solution:

Consider

$$L.H.S = \frac{\cos 9x - \cos 5x}{\sin 17x - \sin 3x}$$

Using the formula

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

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

$$= \frac{-2\sin\left(\frac{9x+5x}{2}\right).\sin\left(\frac{9x-5x}{2}\right)}{2\cos\left(\frac{17x+3x}{2}\right).\sin\left(\frac{17x-3x}{2}\right)}$$

By further calculation

$$= \frac{-2\sin 7x.\sin 2x}{2\cos 10x.\sin 7x}$$

So we get

$$= -\frac{\sin 2x}{\cos 10x}$$

= RHS

17.

$$\frac{\sin 5x + \sin 3x}{\cos 5x + \cos 3x} = \tan 4x$$

Solution:

Consider

$$\text{L.H.S.} = \frac{\sin 5x + \sin 3x}{\cos 5x + \cos 3x}$$

Using the formula

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

$$\cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$= \frac{2\sin\left(\frac{5x+3x}{2}\right).\cos\left(\frac{5x-3x}{2}\right)}{2\cos\left(\frac{5x+3x}{2}\right).\cos\left(\frac{5x-3x}{2}\right)}$$

By further calculation

$$= \frac{2\sin 4x.\cos x}{2\cos 4x.\cos x}$$

So we get

$$= \frac{\sin 4x}{\cos 4x}$$

= tan 4x

= RHS

18.

$$\frac{\sin x - \sin y}{\cos x + \cos y} = \tan\frac{x-y}{2}$$

Solution:

Consider

$$\text{L.H.S.} = \frac{\sin x - \sin y}{\cos x + \cos y}$$

Using the formula

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

$$\cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$= \frac{2\cos\left(\frac{x+y}{2}\right).\sin\left(\frac{x-y}{2}\right)}{2\cos\left(\frac{x+y}{2}\right).\cos\left(\frac{x-y}{2}\right)}$$

By further calculation

$$= \frac{\sin\left(\frac{x-y}{2}\right)}{\cos\left(\frac{x-y}{2}\right)}$$

So we get

$$= \tan\left(\frac{x-y}{2}\right)$$

= RHS

19.

$$\frac{\sin x + \sin 3x}{\cos x + \cos 3x} = \tan 2x$$

Solution:

Consider

$$.L.H.S. = \frac{\sin x + \sin 3x}{\cos x + \cos 3x}$$

Using the formula

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

$$\cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

$$= \frac{2\sin\left(\frac{x+3x}{2}\right)\cos\left(\frac{x-3x}{2}\right)}{2\cos\left(\frac{x+3x}{2}\right)\cos\left(\frac{x-3x}{2}\right)}$$

By further calculation

$$= \frac{\sin 2x}{\cos 2x}$$

So we get

= tan 2x

= RHS

20.

$$\frac{\sin x - \sin 3x}{\sin^2 x - \cos^2 x} = 2\sin x$$

Solution:

Consider

$$L.H.S. = \frac{\sin x - \sin 3x}{\sin^2 x - \cos^2 x}$$

Using the formula

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

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

$$= \frac{2\cos\left(\frac{x+3x}{2}\right)\sin\left(\frac{x-3x}{2}\right)}{-\cos 2x}$$

By further calculation

$$= \frac{2\cos 2x \sin(-x)}{-\cos 2x}$$

So we get

= - 2 (-sin x)

= 2 sin x

= RHS

21.

$$\frac{\cos 4x + \cos 3x + \cos 2x}{\sin 4x + \sin 3x + \sin 2x} = \cot 3x$$

Solution:

Consider

$$\text{L.H.S.} = \frac{\cos 4x + \cos 3x + \cos 2x}{\sin 4x + \sin 3x + \sin 2x}$$

It can be written as

$$= \frac{(\cos 4x + \cos 2x) + \cos 3x}{(\sin 4x + \sin 2x) + \sin 3x}$$

Using the formula

$$\cos A + \cos B = 2\cos\left(\frac{A+B}{2}\right)\cos\left(\frac{A-B}{2}\right)$$

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

$$= \frac{2\cos\left(\frac{4x+2x}{2}\right)\cos\left(\frac{4x-2x}{2}\right) + \cos 3x}{2\sin\left(\frac{4x+2x}{2}\right)\cos\left(\frac{4x-2x}{2}\right) + \sin 3x}$$

By further calculation

$$= \frac{2\cos 3x \cos x + \cos 3x}{2\sin 3x \cos x + \sin 3x}$$

So we get

$$= \frac{\cos 3x(2\cos x + 1)}{\sin 3x(2\cos x + 1)}$$

= cot 3x

= RHS

22. cot *x* cot 2*x* – cot 2*x* cot 3*x* – cot 3*x* cot *x* = 1

Solution:

Consider

LHS = cot x cot $2x$ – cot $2x$ cot $3x$ – cot $3x$ cot x

It can be written as

= cot x cot $2x$ – cot $3x$ (cot $2x$ + cot x)

= cot x cot $2x$ – cot $(2x + x)$ (cot $2x$ + cot x)

Using the formula

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

$$= \cot x \cot 2x - \left[\frac{\cot 2x \cot x - 1}{\cot x + \cot 2x}\right](\cot 2x + \cot x)$$

So we get

= cot x cot 2x – (cot 2x cot x – 1)

= 1

= RHS

23.

$$\tan 4x = \frac{4\tan x(1 - \tan^2 x)}{1 - 6\tan^2 x + \tan^4 x}$$

Solution:

Consider

LHS = tan 4x = tan 2(2x)

By using the formula

$$\tan 2A = \frac{2\tan A}{1-\tan^2 A}$$

$$= \frac{2\tan 2x}{1-\tan^2(2x)}$$

It can be written as

$$= \frac{2\left(\frac{2\tan x}{1-\tan^2 x}\right)}{1-\left(\frac{2\tan x}{1-\tan^2 x}\right)^2}$$

By further simplification

$$= \frac{\left(\frac{4\tan x}{1-\tan^2 x}\right)}{\left[1-\frac{4\tan^2 x}{(1-\tan^2 x)^2}\right]}$$

Taking LCM

$$= \frac{\left(\frac{4\tan x}{1-\tan^2 x}\right)}{\left[\frac{(1-\tan^2 x)^2-4\tan^2 x}{(1-\tan^2 x)^2}\right]}$$

On further simplification

$$= \frac{4\tan x\left(1-\tan^2 x\right)}{\left(1-\tan^2 x\right)^2 - 4\tan^2 x}$$

We get

$$= \frac{4\tan x\left(1-\tan^2 x\right)}{1+\tan^4 x - 2\tan^2 x - 4\tan^2 x}$$

It can be written as

$$= \frac{4\tan x\left(1-\tan^2 x\right)}{1-6\tan^2 x + \tan^4 x}$$

= RHS

24. cos 4*x* = 1 – 8sin² *x* cos² *x*

Solution:

Consider

LHS = cos 4x

We can write it as

= cos 2(2*x*)

Using the formula $\cos 2A = 1 - 2\sin^2 A$

$= 1 - 2\sin^2 2x$

Again by using the formula $\sin 2A = 2\sin A\cos A$

$= 1 - 2(2\sin x\cos x)^2$

So we get

$= 1 - 8\sin^2 x\cos^2 x$

= R.H.S.

25. $\cos 6x = 32\cos^6 x - 48\cos^4 x + 18\cos^2 x - 1$

Solution:

Consider

L.H.S. = cos 6*x*

It can be written as

= cos 3(2x)

Using the formula $\cos 3A = 4 \cos^3 A - 3 \cos A$

$= 4 \cos^3 2x - 3 \cos 2x$

Again by using formula $\cos 2x = 2 \cos^2 x - 1$

$= 4 [(2 \cos^2 x - 1)^3 - 3 (2 \cos^2 x - 1)$

By further simplification

$= 4 [(2 \cos^2 x)^3 - (1)^3 - 3 (2 \cos^2 x)^2 + 3 (2 \cos^2 x)] - 6\cos^2 x + 3$

We get

$= 4 [8\cos^6 x - 1 - 12 \cos^4 x + 6 \cos^2 x] - 6 \cos^2 x + 3$

By multiplication

$= 32 \cos^6 x - 4 - 48 \cos^4 x + 24 \cos^2 x - 6 \cos^2 x + 3$

On further calculation

$= 32 \cos^6 x - 48 \cos^4 x + 18 \cos^2 x - 1$

= R.H.S.

Benefits of Solving NCERT Solutions for Class 11 Maths Chapter 3 Exercise 3.3

Solving **NCERT Solutions for Class 11 Maths Chapter 3 Exercise 3.3** provide several benefits for students, helping them strengthen their understanding of trigonometric functions of sum and difference of two angles. Some key benefits include:

- **Concept Clarity**: By practicing these problems, students gain a deeper understanding of the fundamental trigonometric identities related to angle addition and subtraction. This forms the foundation for solving more complex problems in trigonometry and related topics.
- **Improved Problem-Solving Skills**: The step-by-step solutions provided in the exercise teach students how to approach and solve problems systematically, which enhances their problem-solving abilities.

- **Preparation for Exams**: Solving problems from this exercise ensures students are well-prepared for board exams, as the questions are designed to reflect the type and difficulty level of the questions asked in the exams.
- **Understanding Real-Life Applications**: Trigonometric identities are widely used in fields such as physics, engineering, and architecture. Solving these exercises gives students a practical understanding of how these identities can be applied in real-world scenarios.
- **Time Management**: Working through the problems efficiently helps students manage their time better during exams, allowing them to solve complex questions more quickly.