RD Sharma Solutions Class 10 Maths Chapter 5 Exercise 5.3: Chapter 5, Exercise 5.3 in RD Sharma's Class 10 Maths book focuses on trigonometric ratios, a key concept in trigonometry. This exercise introduces the fundamental ratios—sine, cosine, tangent, cotangent, secant, and cosecant—defined based on the sides of a right triangle.

It guides students to calculate these ratios using given angles and triangle side lengths, helping them understand relationships among these ratios. Through step-by-step problem-solving, students enhance their ability to find and apply trigonometric ratios in various mathematical and real-world contexts.

RD Sharma Solutions Class 10 Maths Chapter 5 Exercise 5.3 Overview

Chapter 5, Exercise 5.3 in RD Sharma's Class 10 Maths emphasizes the importance of trigonometric ratios—sine, cosine, tangent, and their reciprocals (cosecant, secant, and cotangent)—which are fundamental in solving geometry and physics problems.

Understanding these ratios allows students to relate the angles of a right triangle to its sides, which is crucial for calculating heights, distances, and slopes in real-world applications, such as navigation, architecture, and engineering. Mastery of trigonometric ratios forms the basis for advanced studies in calculus and analytical geometry, providing essential tools for problem-solving in various scientific and mathematical fields.

RD Sharma Solutions Class 10 Maths Chapter 5 Exercise 5.3 Trigonometric Ratios

Below is the RD Sharma Solutions Class 10 Maths Chapter 5 Exercise 5.3 Trigonometric Ratios -

1. Evaluate the following:

(i) $\sin 20^\circ / \cos 70^\circ$

(ii) $\cos 19^\circ / \sin 71^\circ$

(iii) $\sin 21^\circ / \cos 69^\circ$

(iv) $\tan 10^\circ / \cot 80^\circ$

(v) $\sec 11^\circ / \operatorname{cosec} 79^\circ$

Solution:

(i) We have,

sin 20°/ cos 70° = sin (90° – 70°)/ cos 70° = cos 70°/ cos70° = 1 [∵ sin (90 – θ) = cos θ]

(ii) We have,

cos 19°/ sin 71° = cos (90° – 71°)/ sin 71° = sin 71°/ sin 71° = 1 [∵ cos (90 – θ) = sin θ]

(iii) We have,

sin 21°/ cos 69° = sin (90° – 69°)/ cos 69° = cos 69°/ cos69° = 1 [∵ sin (90 – θ) = cos θ]

(iv) We have,

tan 10°/ cot 80° = tan (90° – 10°) / cot 80° = cot 80°/ cos80° = 1 [∵ tan (90 – θ) = cot θ]

(v) We have,

sec 11°/ cosec 79° = sec (90° – 79°)/ cosec 79° = cosec 79°/ cosec 79° = 1

[∵ sec (90 – θ) = cosec θ]

2. Evaluate the following:

(i) $\left(\frac{\sin 49^\circ}{\cos 41^\circ}\right)^2 + \left(\frac{\cos 41^\circ}{\sin 49^\circ}\right)^2$

Solution:

We have, [∵ sin (90 – θ) = cos θ and cos (90 – θ) = sin θ]

$$\left(\frac{\sin 49^\circ}{\cos 41^\circ}\right)^2 + \left(\frac{\cos 41^\circ}{\sin 49^\circ}\right)^2$$

$$= \left(\frac{\sin(90^\circ - 41^\circ)}{\cos 41^\circ}\right)^2 + \left(\frac{\cos(90^\circ - 49^\circ)}{\sin 49^\circ}\right)^2$$

$$= \left(\frac{\cos 41^\circ}{\cos 41^\circ}\right)^2 + \left(\frac{\sin 49^\circ}{\sin 49^\circ}\right)^2$$

$= 1^2 + 1^2 = 1 + 1$

= 2

(ii) cos 48°- sin 42°

Solution:

We know that cos (90° − θ) = sin θ.

So,

cos 48° – sin 42° = cos (90° − 42°) – sin 42° = sin 42° – sin 42°= 0

Thus, the value of cos 48° – sin 42° is 0.

$$\text{(iii)}\ \frac{\cot 40^\circ}{\tan 50^\circ} - \frac{1}{2}\left(\frac{\cos 35^\circ}{\sin 55^\circ}\right)$$

Solution:

We have, [∵ cot (90 – θ) = tan θ and cos (90 – θ) = sin θ]

$$\frac{\cot 40^\circ}{\tan 50^\circ} - \frac{1}{2}\left(\frac{\cos 35^\circ}{\sin 55^\circ}\right)$$

$$= \frac{\cot(90^\circ - 50^\circ)}{\tan 50^\circ} - \frac{1}{2}\left(\frac{\cos(90^\circ - 55^\circ)}{\sin 55^\circ}\right)$$

$$= \frac{\tan 50^\circ}{\tan 50^\circ} - \frac{1}{2}\left(\frac{\sin 55^\circ}{\sin 55^\circ}\right)$$

= 1 – 1/2(1)

= 1/2

$$\text{(iv)}\ \left(\frac{\sin 27^\circ}{\cos 63^\circ}\right)^2 - \left(\frac{\cos 63^\circ}{\sin 27^\circ}\right)^2$$

Solution:

We have, [∵ sin (90 – θ) = cos θ and cos (90 – θ) = sin θ]

$$\left(\frac{\sin 27°}{\cos 63°}\right)^2 - \left(\frac{\cos 63°}{\sin 27°}\right)^2$$

$$= \left(\frac{\sin(90° - 63°)}{\cos 63°}\right)^2 - \left(\frac{\cos(90° - 27°)}{\sin 27°}\right)^2$$

$$= \left(\frac{\cos 63°}{\cos 63°}\right)^2 - \left(\frac{\sin 27°}{\sin 27°}\right)^2$$

= 1 – 1

= 0

$$\text{(v)}\ \frac{\tan 35°}{\cot 55°} + \frac{\cot 78°}{\tan 12°} - 1$$

Solution:

We have, [∵ cot (90 – θ) = tan θ and tan (90 – θ) = cot θ]

$$\frac{\tan 35°}{\cot 55°} + \frac{\cot 78°}{\tan 12°} - 1$$

= tan (90° – 35°)/ cot 55° + cot (90° – 12°)/ tan 12° – 1

= cot 55°/ cot 55° + tan 12°/ tan 12° – 1

= 1 + 1 – 1

= 1

$$\text{(vi)}\ \frac{\sec 70°}{\operatorname{cosec} 20°} + \frac{\sin 59°}{\cos 31°}$$

Solution:

We have , [∵ sin (90 – θ) = cos θ and sec (90 – θ) = cosec θ]

$$\frac{\sec 70°}{\text{cosec } 20°} + \frac{\sin 59°}{\cos 31°}$$

= sec (90° – 20°)/ cosec 20° + sin (90° – 31°)/ cos 31°

= cosec 20°/ cosec 20° + cos 12°/ cos 12°

= 1 + 1

= 2

(vii) cosec 31° – sec 59°

Solution:

We have,

cosec 31° – sec 59°

Since, cosec (90 – θ) = cos θ

So,

cosec 31° – sec 59° = cosec (90° – 59°) – sec 59° = sec 59° – sec 59° = 0

Thus,

cosec 31° – sec 59° = 0

(viii) (sin 72° + cos 18°) (sin 72° – cos 18°)

Solution:

We know that,

sin (90 – θ) = cos θ

So, the given can be expressed as

(sin 72° + cos 18°) (sin (90 – 18)° – cos 18°)

= (sin 72° + cos 18°) (cos 18° – cos 18°)

= (sin 72° + cos 18°) x 0

= 0

(ix) sin 35° sin 55° – cos 35° cos 55°

Solution:

We know that,

sin (90 – θ) = cos θ

So, the given can be expressed as

sin (90 – 55)° sin (90 – 35)° – cos 35° cos 55°

= cos 55° cos 35° – cos 35° cos 55°

= 0

(x) tan 48° tan 23° tan 42° tan 67°

Solution:

We know that,

tan (90 – θ) = cot θ

So, the given can be expressed as

tan (90 – 42)° tan (90 – 67)° tan 42° tan 67°

= cot 42° cot 67° tan 42° tan 67°

= (cot 42° tan 42°)(cot 67° tan 67°)

= 1 x 1 [∵ tan θ x cot θ = 1]

= 1

(xi) sec 50° sin 40° + cos 40° cosec 50°

Solution:

We know that,

sin (90 – θ) = cos θ and cos (90 – θ) = sin θ

So, the given can be expressed as

sec 50° sin (90 – 50)° + cos (90 – 50)° cosec 50°

= sec 50° cos 50° + sin 50° cosec 50°

= 1 + 1 [∵ sin θ x cosec θ = 1 and cos θ x sec θ = 1]

= 2

3. Express each one of the following in terms of trigonometric ratios of angles lying between 0º and 45º

(i) sin 59º + cos 56º (ii) tan 65º + cot 49º (iii) sec 76º + cosec 52º

(iv) cos 78º + sec 78º (v) cosec 54 + sin 72º (vi) cot 85º + cos 75º

(vii) sin 67º + cos 75º

Solution:

Using the below trigonometric ratios of complementary angles, we find the required

sin (90 – θ) = cos θ cosec (90 – θ) = sec θ

cos (90 – θ) = sin θ sec (90 – θ) = cosec θ

tan (90 – θ) = cot θ cot (90 – θ) = tan θ

(i) sin 59º + cos 56º = sin (90 – 31)º + cos (90 – 34)º = cos 31º + sin 34

(ii) tan 65º + cot 49º = tan (90 – 25)º + cot (90 -41)º = cot 25º + tan 41º

(iii) sec 76º + cosec 52º = sec (90 – 14)º + cosec (90 – 38)º = cosec 14 + sec 38º

(iv) cos 78º + sec 78º = cos (90 – 12)º + sec (90 – 12)º = sin 12º + cosec 12º

(v) cosec 54 + sin 72º = cosec (90 – 36)º + sin (90 – 18)º = sec 36º + cos 18º

(vi) cot 85º + cos 75º = cot (90 – 5)º + cos (90 – 15)º = tan 5º + sin 15º

4. Express cos 75º + cot 75º in terms of angles between 0º and 30º.

Solution:

Given,

cos 75º + cot 75º

Since, cos (90 – θ) = sin θ and cot (90 – θ) = tan θ

cos 75º + cot 75º = cos (90 – 15)º + cot (90 – 15)º = sin 15º + tan 15º

Hence, cos 75° + cot 75° can be expressed as sin 15° + tan 15°

5. If sin 3A = cos (A – 26°), where 3A is an acute angle, find the value of A.

Solution:

Given,

sin 3A = cos (A – 26°)

Using cos (90 – θ) = sin θ, we have

sin 3A = sin (90° – (A – 26°))

Now, comparing both L.H.S and R.H.S

3A = 90° – (A – 26°)

3A + (A – 26°) = 90°

4A – 26° = 90°

4A = 116°

A = 116°/4

∴ A = 29°

6. If A, B, C are the interior angles of a triangle ABC, prove that

(i) tan ((C + A)/ 2) = cot (B/2) (ii) sin ((B + C)/ 2) = cos (A/2)

Solution:

We know that in triangle ABC, the sum of the angles, i.e., A + B + C = 180°

So, C + A = 180° – B ⇒ (C + A)/2 = 90° – B/2 …… (i)

And, B + C = 180° – A ⇒ (B + C)/2 = 90° – A/2 ……. (ii)

(i) L.H.S = tan ((C + A)/ 2)

⇒ tan ((C + A)/ 2) = tan (90° – B/2) [From (i)]

= cot (B/2) [∵ tan (90 – θ) = cot θ]

= R.H.S

- Hence Proved

(ii) L.H.S = sin ((B + C)/2)

⇒ sin ((B + C)/ 2) = sin (90º – A/2) [From (ii)]

= cos (A/2)

= R.H.S

- Hence Proved

7. Prove that:

(i) tan 20° tan 35° tan 45° tan 55° tan 70° = 1

(ii) sin 48° sec 48° + cos 48° cosec 42° = 2

$$\text{(iii)}\ \frac{\sin 70^\circ}{\cos 20^\circ}+\frac{\operatorname{cosec} 20^\circ}{\sec 70^\circ}-2\cos 70^\circ \quad \operatorname{cosec} 42^\circ=0$$

$$\text{(iv)}\ \frac{\cos 80^\circ}{\sin 10^\circ}+\cos 59^\circ \quad \operatorname{cosec} 31^\circ=2$$

Solution:

(i) Taking L.H.S = tan 20° tan 35° tan 45° tan 55° tan 70°

= tan (90° − 70°) tan (90° − 55°) tan 45°tan 55° tan70°

= cot 70°cot 55° tan 45° tan 55° tan 70° [∵ tan (90 – θ) = cot θ]

= (tan 70°cot 70°)(tan 55°cot 55°) tan 45° [∵ tan θ x cot θ = 1]

= 1 × 1 × 1 = 1

- Hence proved

(ii) Taking L.H.S = sin 48° sec 48° + cos 48° cosec 42°

= sin 48° sec (90° − 48°) + cos 48° cosec (90° − 48°)

[∵sec (90 – θ) = cosec θ and cosec (90 – θ) = sec θ]

= sin 48°cosec 48° + cos 48°sec 48° [∵ cosec θ x sin θ = 1 and cos θ x sec θ = 1]

= 1 + 1 = 2

- Hence proved

(iii) Taking the L.H.S,

$$\frac{\sin 70°}{\cos 20°} + \frac{\operatorname{cosec} 20°}{\sec 70°} - 2\cos 70° \operatorname{cosec} 20°$$

$$= \frac{\sin(90° - 20°)}{\cos 20°} + \frac{\operatorname{cosec}(90° - 70°)}{\sec 70°} - 2\cos(90° - 20°)\operatorname{cosec} 20°$$

$$= \frac{\cos 20°}{\cos 20°} + \frac{\sec 70°}{\sec 70°} - 2\sin 20° \times \frac{1}{\sin 20°} \qquad \begin{bmatrix} \sin(90° - \theta) = \cos\theta \\ \operatorname{cosec}(90° - \theta) = \sec\theta \\ \cos(90° - \theta) = \sin\theta \end{bmatrix}$$

= 1 + 1 – 2

= 2 – 2

= 0

- Hence proved

(iv) Taking L.H.S,

$$\frac{\cos 80°}{\sin 10°} + \cos 59° \operatorname{cosec} 31°$$

$$= \frac{\cos(90° - 10°)}{\sin 10°} + \cos 59° \operatorname{cosec}(90° - 59°)$$

$$= \frac{\sin 10°}{\sin 10°} + \cos 59° \sec 59°$$

= 1 + 1

= 2

- Hence proved

8. Prove the following:

(i) sinθ sin (90° – θ) – cos θ cos (90° – θ) = 0

Solution:

Taking the L.H.S,

sinθ sin (90° – θ) – cos θ cos (90° – θ)

= sin θ cos θ – cos θ sin θ [∵ sin (90 – θ) = cos θ and cos (90 – θ) = sin θ]

= 0

$$\frac{\cos(90^\circ-\theta)\sec(90^\circ-\theta)\tan\theta}{\operatorname{cosec}(90^\circ-\theta)\sin(90^\circ-\theta)\cot(90^\circ-\theta)} + \frac{\tan(90^\circ-\theta)}{\cot\theta} = 2$$

(ii)

Solution:

Taking the L.H.S,

$$\frac{\cos(90^\circ-\theta)\sec(90^\circ-\theta)\tan\theta}{\operatorname{cosec}(90^\circ-\theta)\sin(90^\circ-\theta)\cot(90^\circ-\theta)} + \frac{\tan(90^\circ-\theta)}{\cot\theta}$$

$$= \frac{\sin\theta \operatorname{cosec}\theta \tan\theta}{\sec\theta\cos\theta\tan\theta} + \frac{\cot\theta}{\cot\theta}$$

$$= \frac{1\times\tan\theta}{1\times\tan\theta} + 1 = \frac{\tan\theta}{\tan\theta} + 1$$

[∵ cosec θ x sin θ = 1 and cos θ x sec θ = 1]

= 1 + 1

= 2 = R.H.S

- Hence Proved

$$\frac{\tan(90^\circ-A)\cot A}{\operatorname{cosec}^2 A} - \cos^2 A = 0$$

(iii)

Solution:

Taking the L.H.S, [∵ tan (90° – θ) = cot θ]

$$\text{L.H.S.} = \frac{\tan(90^\circ - A)\cot A}{\text{cosec}^2 A} - \cos^2 A$$

$$= \frac{\cot A \cot A}{\text{cosec}^2 A} - \cos^2 A$$

$$= \frac{\cot^2 A}{\text{cosec}^2 A} - \cos^2 A = \frac{\frac{\cos^2 A}{\sin^2 \theta}}{\frac{1}{\sin^2 A}} - \cos^2 A$$

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

= 0 = R.H.S

- Hence Proved

$$\frac{\cos(90^\circ - A)\sin(90^\circ - A)}{\tan(90^\circ - A)} = \sin^2 A$$ **(iv)**

Solution:

Taking L.H.S, [∵ sin (90 – θ) = cos θ and cos (90 – θ) = sin θ]

$$\text{L.H.S.} = \frac{\cos(90^\circ - A)\sin(90^\circ - A)}{\tan(90^\circ - A)}$$

$$= \frac{\sin A \cos A}{\cot A} = \frac{\sin A \cos A}{\frac{\cos A}{\sin A}}$$

$$= \frac{\sin A \cos A \times \sin A}{\cos A} = \sin A \times \sin A$$

= $\sin^2 A$ = R.H.S

- Hence Proved

(v) sin (50º + θ) – cos (40º – θ) + tan 1º tan 10º tan 20º tan 70º tan 80º tan 89º = 1

Solution:

Taking the L.H.S,

= sin (50º + θ) – cos (40º – θ) + tan 1º tan 10º tan 20º tan 70º tan 80º tan 89º

= [sin (90º – (40º – θ))] – cos (40º – θ) + tan (90 – 89)º tan (90 – 80)º tan (90 – 70)º tan 70º tan 80º tan 89º [∵ sin (90 – θ) = cos θ]

= cos (40º – θ) – cos (40º – θ) + cot 89º cot 80º cot 70º tan 70º tan 80º tan 89º

[∵ tan (90º – θ) = cot θ]

= 0 + (cot 89º x tan 89º) (cot 80º x tan 80º) (cot 70º x tan 70º)

= 0 + 1 x 1 x 1 [∵ tan θ x cot θ = 1]

= 1= R.H.S

- Hence Proved

Benefits of Solving RD Sharma Solutions Class 10 Maths Chapter 5 Exercise 5.3

The RD Sharma Solutions for Class 10 Maths, Chapter 5, Exercise 5.3 on Trigonometric Ratios offer several benefits:

Concept Clarity: The solutions break down trigonometric concepts step-by-step, helping students grasp fundamental ideas effectively.

Practice and Accuracy: Solving diverse problems enhances accuracy and builds confidence in handling trigonometric calculations.

Exam Preparation: Detailed solutions align with board exam standards, preparing students for various question patterns.

Foundation for Advanced Maths: Mastery in trigonometry is essential for higher-level math studies, making these solutions valuable for long-term learning.

Error-Free Learning: With precise answers, students can check their work and avoid common mistakes.