CLASS 10 · MATHEMATICS · CHAPTER 8

Introduction to Trigonometry - NCERT Examples

Examples 1-12 with independently verified solutions.

CHAPTER	RESOURCE	SOURCE
Introduction to Trigonometry	NCERT Examples	NCERT Mathematics, Reprint 2026-27

PART 1

Verified NCERT questions and solutions

Verified NCERT questions and solutions

Solutions are checked independently and follow the supplied NCERT chapter edition.

NCERT EXAMPLE

Example 1

trigonometric ratios · Pythagoras theorem

Given tan A = 4/3, find the other trigonometric ratios of angle A.

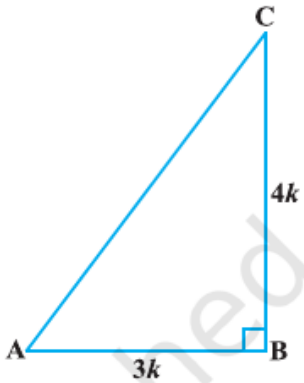


Fig. 8.8

Figure 8-8 from the supplied NCERT chapter.

Solution

Board-exam working:

$$\tan A = \frac{BC}{AB} = \frac{4}{3}$$

Let BC = 4k and AB = 3k.

$$AC = \sqrt{AB^2 + BC^2} = \sqrt{(3k)^2 + (4k)^2} = 5k$$

$$\sin A = \frac{BC}{AC} = \frac{4}{5}$$

$$\cos A = \frac{AB}{AC} = \frac{3}{5}$$

$$\cot A = \frac{3}{4}$$

$$\operatorname{cosec} A = \frac{5}{4}$$

$$\sec A = \frac{5}{3}$$

Final answer

$$\sin A = \frac{4}{5},\ \cos A = \frac{3}{5},\ \cot A = \frac{3}{4},\ \operatorname{cosec} A = \frac{5}{4},\ \sec A = \frac{5}{3}$$

NCERT EXAMPLE

Example 2

equal sine ratios · similar triangles

If B and Q are acute angles such that sin B = sin Q, prove that B = Q.

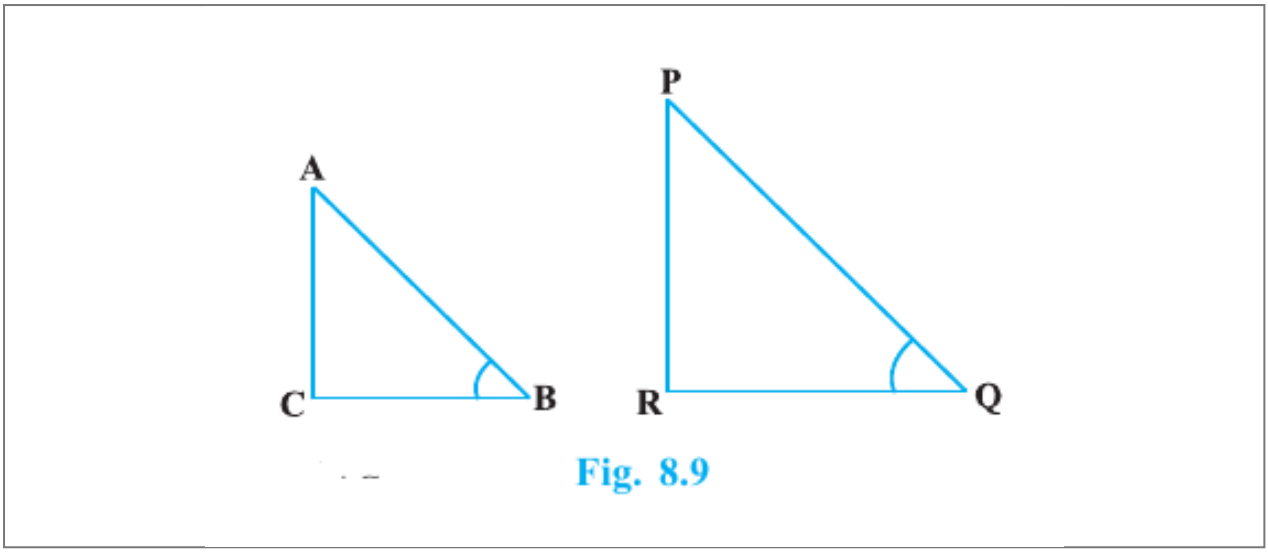


Fig. 8.9

Figure 8-9 from the supplied NCERT chapter.

Solution

Board-exam working:

Consider right triangles ABC and PQR as shown.

$$\sin B = \frac{AC}{AB}, \qquad \sin Q = \frac{PR}{PQ}$$

$$\frac{AC}{AB} = \frac{PR}{PQ}$$

$$\frac{AC}{PR} = \frac{AB}{PQ} = k$$

By the Pythagoras theorem:

$$BC = \sqrt{AB^2 - AC^2}, \qquad QR = \sqrt{PQ^2 - PR^2}$$

$$\frac{BC}{QR} = \frac{\sqrt{k^2PQ^2 - k^2PR^2}}{\sqrt{PQ^2 - PR^2}} = k$$

$$\frac{AC}{PR} = \frac{AB}{PQ} = \frac{BC}{QR}$$

Therefore, △ACB ~ △PRQ by SSS similarity. Corresponding angles are equal.

$$\angle B = \angle Q$$

Final answer

Hence, ∠B = ∠Q.

NCERT EXAMPLE

Example 3

trigonometric ratios · squares

In right triangle ACB, AB = 29 units, BC = 21 units and angle ABC = θ. Find (i) $\cos^2\theta + \sin^2\theta$ and (ii) $\cos^2\theta - \sin^2\theta$.

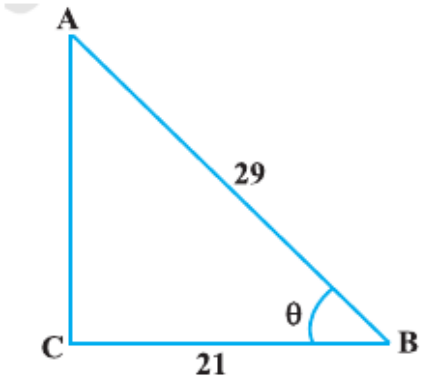


Fig. 8.10

Figure 8-10 from the supplied NCERT chapter.

Solution

Board-exam working:

$$AC = \sqrt{AB^2 - BC^2} = \sqrt{29^2 - 21^2} = 20$$

$$\sin\theta = \frac{20}{29}, \qquad \cos\theta = \frac{21}{29}$$

(i)

$$\cos^2\theta + \sin^2\theta = \left(\frac{21}{29}\right)^2 + \left(\frac{20}{29}\right)^2 = \frac{841}{841} = 1$$

(ii)

$$\cos^2\theta - \sin^2\theta = \frac{21^2 - 20^2}{29^2} = \frac{41}{841}$$

Final answer

(i) 1

(ii) $\frac{41}{841}$

NCERT EXAMPLE

Example 4

tan A · verification

In right triangle ABC, right-angled at B, tan A = 1. Verify that 2 sin A cos A = 1.

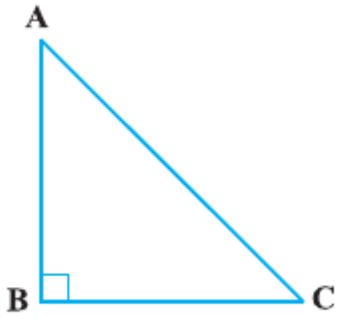


Fig. 8.11

Figure 8-11 from the supplied NCERT chapter.

Solution

Board-exam working:

$$\tan A = \frac{BC}{AB} = 1 \Rightarrow BC = AB$$

Let AB = BC = k.

$$AC = \sqrt{k^2 + k^2} = k\sqrt{2}$$

$$\sin A = \frac{k}{k\sqrt{2}} = \frac{1}{\sqrt{2}}$$

$$\cos A = \frac{k}{k\sqrt{2}} = \frac{1}{\sqrt{2}}$$

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

Final answer

Verified: 2 sin A cos A = 1.

NCERT EXAMPLE

Example 5

right triangle · trigonometric ratios

In right triangle OPQ, right-angled at P, OP = 7 cm and OQ − PQ = 1 cm. Find sin Q and cos Q.

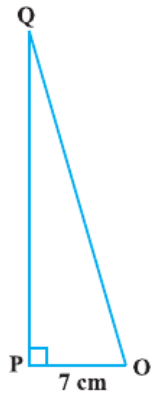


Fig. 8.12

Figure 8-12 from the supplied NCERT chapter.

Solution

Board-exam working:

Let PQ = x cm. Then OQ = x + 1 cm.

$$OQ^2 = OP^2 + PQ^2$$

$$(x+1)^2 = 7^2 + x^2$$

$$x^2 + 2x + 1 = 49 + x^2$$

$$2x = 48 \Rightarrow x = 24$$

$$PQ = 24 \text{ cm}, \qquad OQ = 25 \text{ cm}$$

$$\sin Q = \frac{OP}{OQ} = \frac{7}{25}$$

$$\cos Q = \frac{PQ}{OQ} = \frac{24}{25}$$

Final answer

$$\sin Q = \frac{7}{25}, \qquad \cos Q = \frac{24}{25}$$

NCERT EXAMPLE

Example 6

special angles · 30 degrees

In right triangle ABC, right-angled at B, AB = 5 cm and angle ACB = 30°. Find BC and AC.

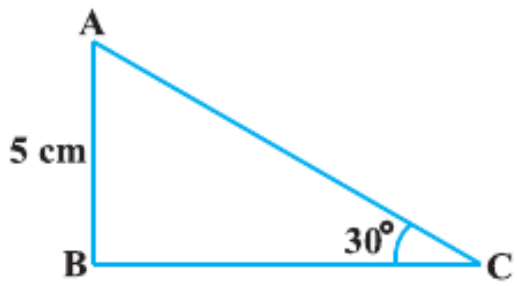


Fig. 8.19

Figure 8-19 from the supplied NCERT chapter.

Solution

Board-exam working:

$$\tan 30^\circ = \frac{AB}{BC}$$

$$\frac{1}{\sqrt{3}} = \frac{5}{BC}$$

$$BC = 5\sqrt{3}\ \text{cm}$$

$$\sin 30^\circ = \frac{AB}{AC}$$

$$\frac{1}{2} = \frac{5}{AC}$$

$$AC = 10\ \text{cm}$$

Final answer

BC = 5√3 cm and AC = 10 cm.

NCERT EXAMPLE

Example 7

special angles · complementary angles

In right triangle PQR, right-angled at Q, PQ = 3 cm and PR = 6 cm. Find angles QPR and PRQ.

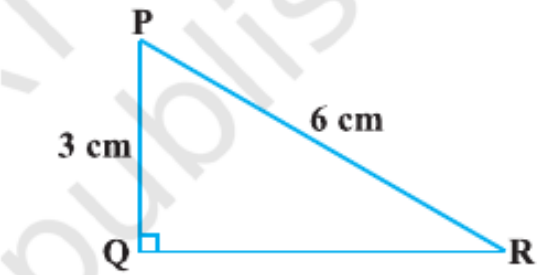


Fig. 8.20

Figure 8-20 from the supplied NCERT chapter.

Solution

Board-exam working:

$$\sin R = \frac{PQ}{PR} = \frac{3}{6} = \frac{1}{2}$$

$$\angle PRQ = 30^\circ$$

The two acute angles of a right triangle are complementary.

$$\angle QPR = 90^\circ - 30^\circ = 60^\circ$$

Final answer

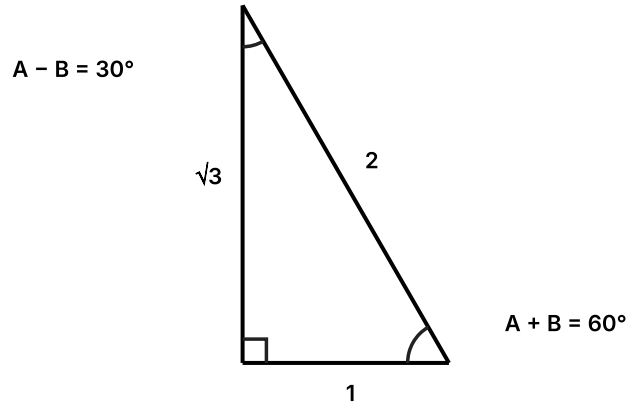
∠QPR = 60° and ∠PRQ = 30°.

NCERT EXAMPLE

Example 8

special angles · simultaneous equations

If sin(A − B) = 1/2 and cos(A + B) = 1/2, where 0° < A + B ≤ 90° and A > B, find A and B.



Special angles in A − B and A + B — explanatory sketch (not to scale).

Solution

Board-exam working:

$$\sin(A-B)=\frac{1}{2}\Rightarrow A-B=30^\circ$$

$$\cos(A+B)=\frac{1}{2}\Rightarrow A+B=60^\circ$$

Adding the equations:

$$2A=90^\circ\Rightarrow A=45^\circ$$

Substituting in A + B = 60°:

$$45^\circ+B=60^\circ\Rightarrow B=15^\circ$$

Final answer

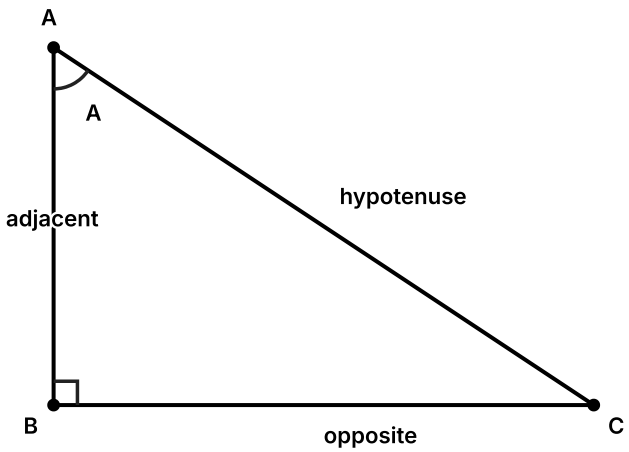
A = 45° and B = 15°.

NCERT EXAMPLE

Example 9

trigonometric identities · in terms of sin

Express cos A, tan A and sec A in terms of sin A.



Expressing ratios through sin A — explanatory sketch (not to scale).

Solution

Board-exam working:

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

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

Since A is acute, cos A is positive.

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

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

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

Final answer

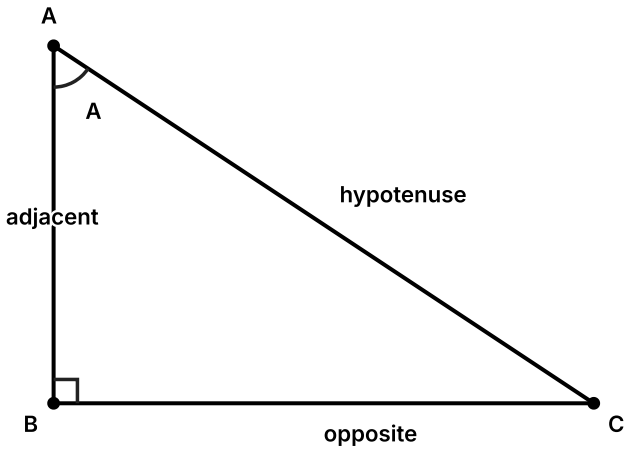
$$\cos A = \sqrt{1 - \sin^2 A}, \quad \tan A = \frac{\sin A}{\sqrt{1 - \sin^2 A}}, \quad \sec A = \frac{1}{\sqrt{1 - \sin^2 A}}$$

NCERT EXAMPLE

Example 10

trigonometric identity · proof

Prove that sec A(1 – sin A)(sec A + tan A) = 1.



Identity using sin A, tan A and sec A — explanatory sketch (not to scale).

Solution

Board-exam working:

Start with the left-hand side:

$$\text{LHS} = \sec A(1 - \sin A)(\sec A + \tan A)$$

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

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

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

$$= \frac{\cos^2 A}{\cos^2 A} = 1 = \text{RHS}$$

Final answer

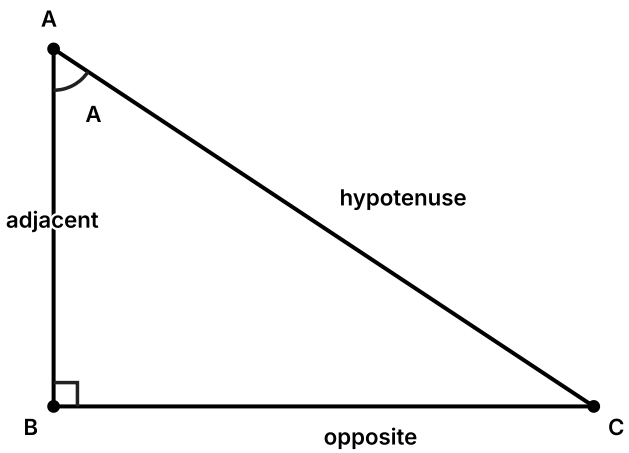
Hence proved.

NCERT EXAMPLE

Example 11

trigonometric identity · proof

Prove that (cot A − cos A)/(cot A + cos A) = (cosec A − 1)/(cosec A + 1).



Identity using cot A and cosec A — explanatory sketch (not to scale).

Solution

Board-exam working:

$$\text{LHS} = \frac{\cot A - \cos A}{\cot A + \cos A}$$

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

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

$$= \frac{\operatorname{cosec} A - 1}{\operatorname{cosec} A + 1} = \text{RHS}$$

Final answer

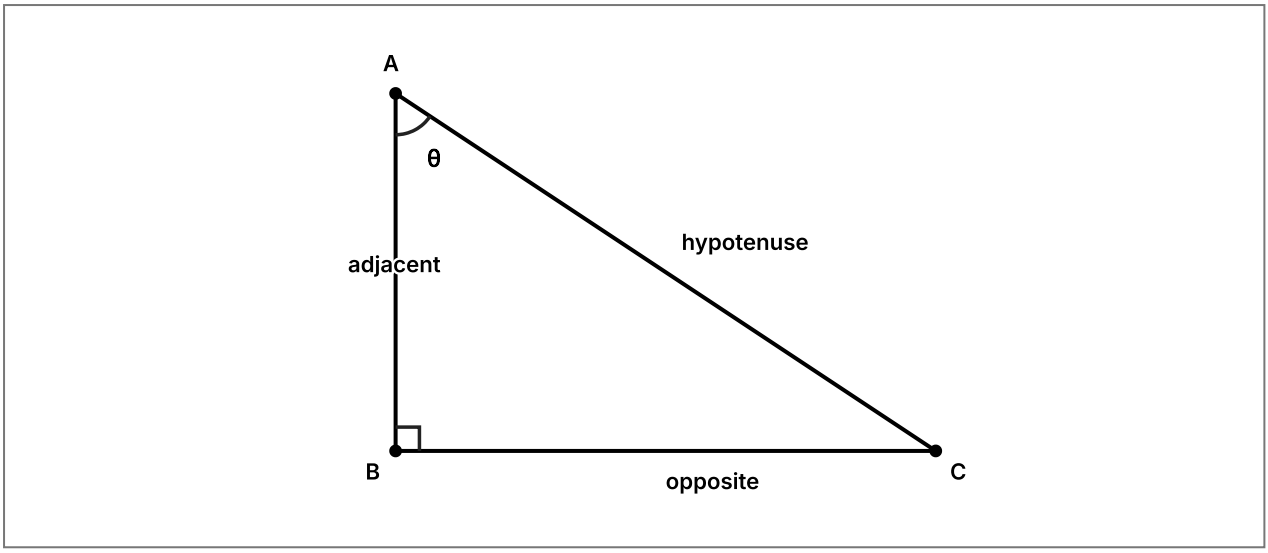
Hence proved.

NCERT EXAMPLE

Example 12

trigonometric identity · secant tangent

Prove that (sin θ − cos θ + 1)/(sin θ + cos θ − 1) = 1/(sec θ − tan θ), using sec²θ = 1 + tan²θ.



Identity using sec θ and tan θ — explanatory sketch (not to scale).

Solution

Board-exam working:

Divide the numerator and denominator of the left-hand side by cos θ:

$$\text{LHS} = \frac{\tan\theta - 1 + \sec\theta}{\tan\theta + 1 - \sec\theta}$$

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

Multiply numerator and denominator by tan θ − sec θ:

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

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

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

$$= \frac{-1}{\tan\theta - \sec\theta} = \frac{1}{\sec\theta - \tan\theta} = \text{RHS}$$

Final answer

Hence proved.