Affiliated to CBSE, New Delhi (Affiliation No. 1030642)

GNPS

GOMTI NANDAN PUBLIC SCHOOL

Gandhi Ward, Bina (M.P.) 470113. | 9165 609 333. | info@mygnps.com | www.mygnps.com

CLASS X · MATHEMATICS STANDARD (041) · CBSE BOARD EXAMINATION 2027

CHAPTER 8

Introduction to Trigonometry

Chapter Practice Booklet · Questions only · Answers in the separate Answer Booklet

58 practice questions | 4 case studies | Board question index | Original diagrams

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STUDENT DETAILS

NAME _____

CLASS & SECTION _____

ROLL NO. _____

BOOKLET STARTED ON _____

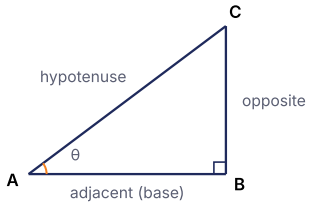
CHAPTER TEST SCORE _____ / 20

1 Chapter Notes

READ THIS FIRST

The whole chapter in short-note form: every definition, formula, method and model answer. Revise from here – you should not need the textbook again.

1 The six trigonometric ratios



In a triangle right-angled at B, for the acute angle $A = \theta$:

$$\sin\theta = \frac{\text{opp}}{\text{hyp}} = \frac{BC}{AC}$$
$$\cos\theta = \frac{\text{adj}}{\text{hyp}} = \frac{AB}{AC}$$
$$\tan\theta = \frac{\text{opp}}{\text{adj}} = \frac{BC}{AB}$$
$$\operatorname{cosec}\theta = \frac{1}{\sin\theta} \quad \sec\theta = \frac{1}{\cos\theta} \quad \cot\theta = \frac{1}{\tan\theta}$$

- Also $\tan\theta = \dfrac{\sin\theta}{\cos\theta}$ and $\cot\theta = \dfrac{\cos\theta}{\sin\theta}$.
- "Opposite" and "adjacent" depend on the angle you are looking from: from C, the opposite side is AB.
- $\sin\theta$ means one number. $\sin^2\theta$ means $(\sin\theta)^2$.

EXAMPLE

$AB = 12$, $BC = 5$, so $AC = 13$: $\sin A = \dfrac{5}{13}$, $\cos A = \dfrac{12}{13}$, $\tan A = \dfrac{5}{12}$, $\sin C = \dfrac{12}{13}$.

2 Why the ratios are well defined

- Two right triangles with the same acute angle θ are similar (AA), so their sides are in proportion. The ratios depend only on θ, not on the size of the triangle.
- The hypotenuse is the longest side, so for an acute angle $0 < \sin\theta < 1$ and $0 < \cos\theta < 1$. Hence $\sec\theta > 1$ and $\operatorname{cosec}\theta > 1$.
- $\tan\theta$ can be any positive number: it is less than 1 below 45° and more than 1 above 45°.

EXAMPLE

$\sin\theta = \dfrac{4}{3}$ is impossible, because the opposite side cannot be longer than the hypotenuse.

3 One ratio given: find all the others

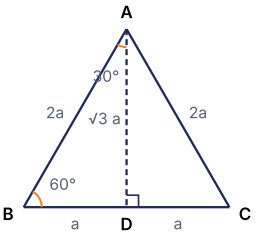
Draw a right triangle, write the two sides you know as multiples of k, find the third side by Pythagoras, then read off every ratio.

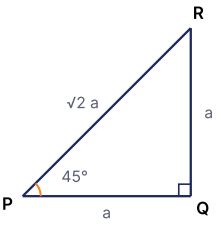
EXAMPLE

$\tan A = \dfrac{8}{15}$: opposite $= 8k$, adjacent $= 15k$, hypotenuse $= \sqrt{64k^2 + 225k^2} = 17k$. So $\sin A = \dfrac{8}{17}$, $\cos A = \dfrac{15}{17}$, $\operatorname{cosec} A = \dfrac{17}{8}$, $\sec A = \dfrac{17}{15}$, $\cot A = \dfrac{15}{8}$.

Shortcut for expressions: if $\tan\theta$ is given and the expression has only $\sin\theta$ and $\cos\theta$ in every term, divide the top and bottom by $\cos\theta$.

4 Values at 0°, 30°, 45°, 60° and 90°





θ	0°	30°	45°	60°	90°
sin	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
cos	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
tan	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	—
cosec	—	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
sec	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	—
cot	—	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

Memory trick: sin of 0°, 30°, 45°, 60°, 90° is $\frac{\sqrt{0}}{2}, \frac{\sqrt{1}}{2}, \frac{\sqrt{2}}{2}, \frac{\sqrt{3}}{2}, \frac{\sqrt{4}}{2}$; cos is the same list backwards. "—" means not defined.

5 Using the values: evaluate, and find angles

- Put in the values, then simplify: $2\sin 30^\circ \cos 30^\circ = 2 \cdot \frac{1}{2} \cdot \frac{\sqrt{3}}{2} = \frac{\sqrt{3}}{2} = \sin 60^\circ$.
- To find an angle, get one ratio alone, then match it with the table: $2\cos\theta = 1 \to \cos\theta = \frac{1}{2} \to \theta = 60^\circ$.
- Two equations such as $A + B = 90^\circ$ and $A - B = 30^\circ$: add them to get A, subtract to get B.
- $\sin(A + B)$ is **not** $\sin A + \sin B$: $\sin(30^\circ + 60^\circ) = 1$ but $\sin 30^\circ + \sin 60^\circ = \frac{1+\sqrt{3}}{2}$.

EXAMPLE

$\tan(A + B) = \sqrt{3}$ and $\sin(A - B) = \frac{1}{2}$ give $A + B = 60^\circ$, $A - B = 30^\circ$, so $A = 45^\circ$, $B = 15^\circ$.

6 The three identities

From $AB^2 + BC^2 = AC^2$, divide by AC^2, by AB^2 and by BC^2:

$$\sin^2\theta + \cos^2\theta = 1$$
$$1 + \tan^2\theta = \sec^2\theta$$
$$1 + \cot^2\theta = \operatorname{cosec}^2\theta$$

- Useful forms: $1 - \sin^2\theta = \cos^2\theta$, $\sec^2\theta - \tan^2\theta = 1$, $\operatorname{cosec}^2\theta - \cot^2\theta = 1$.
- Factorised: $(\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$, so if $\sec\theta + \tan\theta = p$ then $\sec\theta - \tan\theta = \frac{1}{p}$.
- The identities hold for every acute angle; the ratios with tan and sec need $\theta \neq 90^\circ$.

7 How to prove an identity

1. Start with the more complicated side and work towards the other side. Never move terms across the "=".
2. If stuck, change everything into sin and cos.
3. Add fractions with a common denominator; then look for $\sin^2\theta + \cos^2\theta$.
4. With $1 \pm \sin\theta$, $1 \pm \cos\theta$ or $\sec\theta \pm 1$ below the line, multiply top and bottom by the conjugate.
5. Use $a^2 - b^2 = (a - b)(a + b)$ and $(a \pm b)^2$ freely.

EXAMPLE

$\tan\theta + \cot\theta = \frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta} = \frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta} = \frac{1}{\sin\theta\cos\theta} = \sec\theta\operatorname{cosec}\theta$.

8 Model answer: prove an identity (3 marks)

Prove that $\frac{\tan\theta}{\sec\theta - 1} = \frac{\sec\theta + 1}{\tan\theta}$.

1. LHS $= \frac{\tan\theta}{\sec\theta - 1} \times \frac{\sec\theta + 1}{\sec\theta + 1} = \frac{\tan\theta(\sec\theta + 1)}{\sec^2\theta - 1}$ 1
2. $= \frac{\tan\theta(\sec\theta + 1)}{\tan^2\theta}$ (since $\sec^2\theta - 1 = \tan^2\theta$) 1
3. $= \frac{\sec\theta + 1}{\tan\theta} =$ RHS 1

9 Model answer: one ratio given (2 marks)

If $4\tan\theta = 3$, **find** $\frac{4\sin\theta - \cos\theta}{4\sin\theta + \cos\theta}$.

1. Divide the top and bottom by $\cos\theta$: $\frac{4\tan\theta - 1}{4\tan\theta + 1}$ 1
2. $= \frac{3 - 1}{3 + 1} = \frac{1}{2}$ 1

10 Checks that save marks

- Write "LHS =" and work on one side only; finish with "= RHS".
- $\sin^2\theta$ is $(\sin\theta)^2$, not $\sin(\theta^2)$. And $\frac{\sin\theta}{\theta}$ cannot be "cancelled".
- Check a found ratio: sin and cos of an acute angle lie between 0 and 1.
- Rationalise if asked: $\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$.
- Learn the table by heart: most 1- and 2-mark questions only need it.

Exam snapshot

What the board asks, and how to prepare

SYLLABUS 2026–27

- Trigonometric ratios of an acute angle of a right triangle; why they are well defined.
- Values at 30°, 45° and 60° (and 0°, 90°); relations between the ratios.
- **Identities:** proof and use of $\sin^2 A + \cos^2 A = 1$ (only simple identities are set).

Not asked: trigonometric ratios of complementary angles (deleted).

BOARD WEIGHTAGE

12 / 80

Unit V Trigonometry (this chapter and Some Applications of Trigonometry) together. Every paper checked had a 3-mark identity proof from this chapter, plus 1- and 2-mark questions on standard values or on one given ratio. The 4–5 mark question comes from heights and distances.

MOST ASKED IN BOARD PAPERS, 2024–2026 + SAMPLE PAPER 2026–27 (4 PAPERS CHECKED)

How often	Question type	Marks	Papers
★★★	3 marks: prove a trigonometric identity (often a choice of two)	3	4 of 4
★★★	Standard values: evaluate an expression, or find an angle	1–2	4 of 4
★★☆	One ratio given: find another ratio or evaluate an expression	1–2	2 of 4
★★☆	1 mark: use $\sec^2\theta - \tan^2\theta = 1$ (for example $\sec\theta - \tan\theta = m$)	1	2 of 4

MISTAKES THAT COST MARKS

- Taking the wrong side as "opposite" when the angle is at the other vertex.
- Writing $\sin(A + B) = \sin A + \sin B$, or $\sin 2A = 2\sin A$.
- Moving terms across the "=" in a proof. Work on one side only.
- Missing the factor form $(\sec\theta - \tan\theta)(\sec\theta + \tan\theta) = 1$.
- Mixing up $\cos 30^\circ$ and $\cos 60^\circ$.
- Squaring term by term: $(\sin\theta + \cos\theta)^2 \neq \sin^2\theta + \cos^2\theta$.

HOW TO USE THIS BOOKLET

1. **Day 1:** Notes, then Part A (NCERT) and Part B (Exemplar). Do every MUST DO question first.
2. **Day 2:** Part C (board pattern) and Part D (case studies).
3. **Day 3:** Part E (challenge) and the real board questions in Part F.
4. **Sun 3 Jan: Sunday chapter test – 20 marks in 40 minutes, without the booklet.**
5. Check every answer in the Answer Booklet. Write each mistake on the My Mistakes page.

RULES AT A GLANCE

Ratios	$\sin = \frac{\text{opp}}{\text{hyp}}$, $\cos = \frac{\text{adj}}{\text{hyp}}$, $\tan = \frac{\text{opp}}{\text{adj}}$
Reciprocals	$\text{cosec} = \frac{1}{\sin}$, $\sec = \frac{1}{\cos}$, $\cot = \frac{1}{\tan}$
Quotients	$\tan = \frac{\sin}{\cos}$, $\cot = \frac{\cos}{\sin}$
Identities	$\sin^2 + \cos^2 = 1$, $\sec^2 - \tan^2 = 1$, $\text{cosec}^2 - \cot^2 = 1$
Key values	$\sin 30^\circ = \cos 60^\circ = \frac{1}{2}$, $\tan 45^\circ = 1$, $\tan 60^\circ = \sqrt{3}$

PART A · NCERT PRACTICE

A NCERT Practice

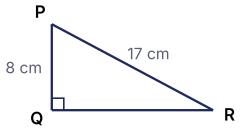
The same skills as the NCERT examples and exercises, with new numbers. Finish every question before moving on.

Trigonometric ratios

A1. In $\triangle ABC$, right-angled at B, $AB = 9$ cm and $BC = 40$ cm. Find: MUST DO [2]

(i) $\sin A$, $\cos A$ (ii) $\sin C$, $\cos C$

A2. In the figure, $\angle Q = 90^\circ$, $PQ = 8$ cm and $PR = 17$ cm. Find $\tan P - \cot R$. [2]



A3. If $\sin A = \frac{5}{13}$, find $\cos A$ and $\tan A$. MUST DO [2]

A4. Given $7 \cot A = 24$, find $\sin A$ and $\sec A$. [2]

A5. Given $\sec \theta = \frac{25}{7}$, find all the other trigonometric ratios. MUST DO [3]

A6. If $\tan \theta = \frac{3}{4}$, evaluate $\frac{(1 + \sin\theta)(1 - \sin\theta)}{(1 + \cos\theta)(1 - \cos\theta)}$. [2]

A7. If $\sin A = \frac{1}{2}$, then $\cot A$ is: [1]

(a) $\sqrt{3}$ (b) $\frac{1}{\sqrt{3}}$ (c) $\frac{\sqrt{3}}{2}$ (d) 1

A8. Which statement is true for an acute angle A? [1]

(a) $\tan A$ is always less than 1 (b) $\sec A = \frac{12}{5}$ is possible

(c) $\cos A$ means "cos" multiplied by A (d) $\sin A = \frac{4}{3}$ is possible

Values at 0°, 30°, 45°, 60°, 90°

A9. Evaluate: MUST DO [2]

(i) $\cos 60^\circ \cos 30^\circ - \sin 60^\circ \sin 30^\circ$

(ii) $4\cos^2 60^\circ + 3\sec^2 30^\circ - \tan^2 45^\circ$

A10. Evaluate $\dfrac{2\sin^2 45^\circ + 3\cot^2 60^\circ}{\tan^2 45^\circ + \cos^2 30^\circ}$. [2]

A11. $\dfrac{1-\tan^2 30^\circ}{1+\tan^2 30^\circ}$ is equal to: [1]

(a) $\cos 60^\circ$ (b) $\tan 60^\circ$ (c) $\sin 60^\circ$ (d) $\cos 30^\circ$

A12. If $\sin(A+B) = 1$ and $\cos(A-B) = \dfrac{\sqrt{3}}{2}$, with $A > B$ and $A + B \le 90^\circ$, find A and B. [2]

MUST DO

A13. Show that $\sin 2A = 2\sin A \cos A$ when $A = 30^\circ$. [2]

Identities

A14. Write $\sin A$ and $\tan A$ in terms of $\sec A$. [2]

A15. $5\,\mathrm{cosec}^2\,\theta - 5\cot^2\theta$ is equal to: [1]

(a) 1 (b) 5 (c) 0 (d) 10

A16. $(1-\sin^2 A)(1+\tan^2 A)$ is equal to: [1]

(a) $\sin^2 A$ (b) $\tan^2 A$ (c) 0 (d) 1

A17. Prove that $(1+\cot^2\theta)(1-\cos\theta)(1+\cos\theta) = 1$. MUST DO [2]

A18. Prove that $\tan\theta + \cot\theta = \sec\theta\,\mathrm{cosec}\,\theta$. [2]

A19. Prove that $\dfrac{1-\sin A}{1+\sin A} = (\sec A - \tan A)^2$. MUST DO [3]

B Exemplar Practice

PART B · EXEMPLAR PRACTICE

Exemplar-style questions on the same ideas, one step harder. Give a reason for every 2-mark answer.

Multiple choice

1 mark each

B1. If $\cos A = \dfrac{8}{17}$, then $\tan A$ is: [1]

(a) $\dfrac{8}{15}$ (b) $\dfrac{15}{17}$ (c) $\dfrac{15}{8}$ (d) $\dfrac{17}{8}$

B2. If $\sin\theta = \dfrac{2}{3}$, then $\sec\theta$ is: [1]

(a) $\dfrac{3}{\sqrt{5}}$ (b) $\dfrac{\sqrt{5}}{3}$ (c) $\dfrac{3}{2}$ (d) $\dfrac{2}{\sqrt{5}}$

B3. $\sin 45^\circ + \cos 45^\circ$ is equal to: [1]

(a) $\dfrac{1}{\sqrt{2}}$ (b) $\sqrt{2}$ (c) $\dfrac{\sqrt{3}}{2}$ (d) 1

B4. If $\sec\theta + \tan\theta = 3$, then $\sec\theta - \tan\theta$ is: [1]

(a) 3 (b) -3 (c) $\frac{1}{3}$ (d) 9

B5. If $2\sin 2\theta = \sqrt{3}$, then θ is: [1]

(a) $30°$ (b) $60°$ (c) $45°$ (d) $15°$

B6. $4(\sin^4 30^\circ + \cos^4 60^\circ) - 3(\cos^2 45^\circ - \sin^2 90^\circ)$ is equal to: [1]

(a) 1 (b) 0 (c) $\frac{3}{2}$ (d) 2

B7. If $x = 3\sec\theta$ and $y = 3\tan\theta$, then $x^2 - y^2$ is: [1]

(a) 3 (b) 9 (c) 1 (d) 0

B8. ASSERTION–REASON [1]

Assertion (A): For an acute angle θ, $\sin\theta = \frac{5}{4}$ is not possible.

Reason (R): The hypotenuse is the longest side of a right triangle.

Short answer with reasons

2–3 marks

B9. If $\sqrt{3}\tan\theta = 3$, find the value of $2\sin^2\theta - \cos^2\theta$. [2]

B10. If $5\sin\theta = 3$, find $\dfrac{\sec\theta - \tan\theta}{\sec\theta + \tan\theta}$. [2]

B11. Prove that $\dfrac{1+\cos A}{\sin A} = \dfrac{\sin A}{1-\cos A}$. [2]

B12. Prove that $\sin^4\theta - \cos^4\theta = 1 - 2\cos^2\theta$. [2]

Long answer

3–4 marks

B13. In $\triangle PQR$, right-angled at Q, $PQ = 3$ cm and $PR = 6$ cm. Find $\angle QPR$, $\angle PRQ$ and QR. [3]

B14. If $A = 60^\circ$ and $B = 30^\circ$, verify that (i) $\cos(A-B) = \cos A\cos B + \sin A\sin B$ and (ii) $\tan(A - B) = \dfrac{\tan A - \tan B}{1 + \tan A\tan B}$. [4] MUST DO

B15. Prove that $\dfrac{1+\sec\theta-\tan\theta}{1+\sec\theta+\tan\theta} = \dfrac{1-\sin\theta}{\cos\theta}$. [3]

C

PART C · BOARD PATTERN

Board Pattern Practice

Question types from real 2024–2026 board papers and the 2026–27 Sample Paper, grouped by type. ★★★ = asked in 3 or 4 of the 4 papers checked · ★★ = 2 papers · ★ = 1 paper.

ASSERTION–REASON: HOW TO ANSWER

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Standard values: evaluate and find angles

★★★ 4 of 4 papers · 1–2 marks

C1. If $\cos A = \frac{1}{2}$, then $\sin^2 A + 3\cos^2 A$ is: MUST DO [1]

(a) $\frac{3}{2}$ (b) $\frac{5}{4}$ (c) 1 (d) $\frac{7}{4}$

C2. If $3 + 4\cos\theta = 5$, then θ is: MUST DO [1]

(a) $30°$ (b) $45°$ (c) $60°$ (d) $90°$

C3. If $\sin(\alpha + \beta) = 1$, then $\sin\frac{\alpha + \beta}{3}$ is: [1]

(a) $\frac{\sqrt{3}}{2}$ (b) 1 (c) 0 (d) $\frac{1}{2}$

C4. Which of these is **not** true? MUST DO [1]

(a) $\sin 60^\circ = 2\sin 30^\circ \cos 30^\circ$
(b) $\cos 60^\circ = 1 - 2\sin^2 30^\circ$
(c) $\tan 60^\circ = 2\tan 30^\circ$
(d) $\sin 90^\circ = 1$

C5. ASSERTION–REASON [1]

Assertion (A): $\sec\theta$ can be less than 1 for an acute angle θ.

Reason (R): $\cos\theta \le 1$ for every acute angle θ.

C6. Evaluate $\frac{3\tan^2 30^\circ + \sec^2 45^\circ}{\operatorname{cosec}^2 30^\circ - \cot^2 45^\circ}$. MUST DO [2]

C7. If $x\sin^2 30^\circ + 2\cos^2 45^\circ = \tan^2 60^\circ$, find x. [2]

C8. If $\cos(A - B) = \frac{\sqrt{3}}{2}$ and $\sin(A + B) = \frac{\sqrt{3}}{2}$, with $A > B$ and $A + B \le 90^\circ$, find A and B. [2]
MUST DO

One ratio given: other ratios and expressions

★★☆ 2 of 4 papers · 1–2 marks

C9. If $\tan\theta = \frac{p}{q}$, then $\sin\theta$ is: [1]

(a) $\frac{q}{\sqrt{p^2 + q^2}}$ (b) $\frac{p}{\sqrt{p^2 + q^2}}$ (c) $\frac{p}{q}$ (d) $\frac{\sqrt{p^2 + q^2}}{p}$

C10. If $\sec\theta = \frac{13}{5}$, find $\frac{2\sin\theta - 3\cos\theta}{4\sin\theta - 9\cos\theta}$. MUST DO [2]

C11. If $\operatorname{cosec}\theta = \frac{17}{8}$, find $\frac{1 - \tan^2\theta}{1 + \tan^2\theta}$. [2]

C12. In $\triangle PQR$, right-angled at Q, $PR = 41$ cm and $QR = 9$ cm. If $\angle QPR = \theta$, find (i) $1 + \cot^2\theta$ (ii) $\cos^2\theta - \sin^2\theta$. [3]

Identities: simplify and prove

★★★ 4 of 4 papers · 1–3 marks

C13. $\cot^2\theta - \dfrac{1}{\sin^2\theta}$ is equal to: MUST DO [1]

(a) 1 (b) 0 (c) -1 (d) 2

C14. $(1 + \cot^2 A)\sin^2 A$ is equal to: [1]

(a) $\sin^2 A$ (b) 1 (c) $\cos^2 A$ (d) 0

C15. Prove that $\dfrac{\cos A}{1 - \tan A} + \dfrac{\sin A}{1 - \cot A} = \sin A + \cos A$. MUST DO [3]

C16. Prove that $\sec A(1 - \sin A)(\sec A + \tan A) = 1$. [2]

C17. If $x = 2\sec\theta$ and $y = 3\tan\theta$, prove that $9x^2 - 4y^2 = 36$. [2]

C18. A student simplified $\dfrac{1 + \cos\theta}{\sin\theta} + \dfrac{\sin\theta}{1 + \cos\theta}$ like this. Find the wrong step and complete the working correctly. [3]

Step 1: $= \dfrac{(1 + \cos\theta)^2 + \sin^2\theta}{\sin\theta(1 + \cos\theta)}$ Step 2: $= \dfrac{1 + \cos^2\theta + \sin^2\theta}{\sin\theta(1 + \cos\theta)}$ Step 3: $= \dfrac{2}{\sin\theta(1 + \cos\theta)}$

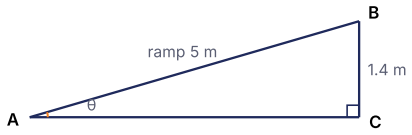
D — Case-Based Questions

PART D · SECTION E STYLE

Each case carries 4 marks (1 + 1 + 2), as in Section E of the board paper. Read the situation carefully before answering.

D1. Case Study · Wheelchair Ramp [4]

A ramp AB, 5 m long, leads up to a doorway B that is 1.4 m above the ground. The ramp makes an angle θ with the ground.



(i) Find the horizontal distance AC. [1]

(ii) Find $\tan\theta$. [1]

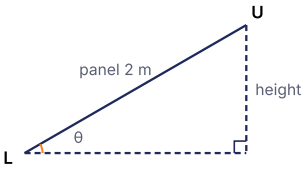
(iii) Find $\operatorname{cosec}\theta + \cot\theta$. [2]

OR

(iii) A safety rule says $\tan\theta$ must not exceed $\dfrac{1}{12}$. Does this ramp meet the rule? For the same rise, how long must the horizontal distance be to give $\tan\theta = \dfrac{1}{12}$? [2]

D2. Case Study · Solar Panel [4]

A solar panel 2 m long rests on the ground along its lower edge and is tilted at an angle θ to the ground. Its upper edge is 1 m above the ground.



(i) Find θ. [1]

(ii) Find the horizontal distance covered by the panel. [1]

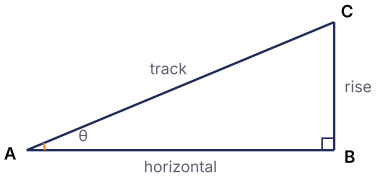
(iii) In winter the tilt is changed to 45°. How high is the upper edge now? [2]

OR

(iii) For what tilt is the upper edge $\sqrt{3}$ m above the ground? What horizontal distance does the panel then cover? [2]

D3. Case Study · Cycle Track [4]

A cycle track goes up a slope. For the angle θ that the track makes with the horizontal, $\tan\theta = \dfrac{5}{12}$.



(i) Find $\sin\theta$ and $\cos\theta$. [1]

(ii) A cyclist rides 26 m along the track. How much height does she gain? [1]

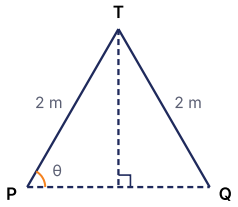
(iii) Using your values, show that $\sec^2\theta - \tan^2\theta = 1$. [2]

OR

(iii) Find the value of $\dfrac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta}$. [2]

D4. Case Study · Step-Ladder [4]

A step-ladder has two legs, each 2 m long, hinged at the top T. When it stands open, the feet P and Q are 2 m apart on level ground.



(i) What angle does each leg make with the ground? [1]

(ii) How high is the top of the ladder? [1]

(iii) The feet are moved apart until the top is $\sqrt{2}$ m high. Find the angle each leg now makes with the ground, and the distance PQ. [2]

OR

(iii) If each leg makes $30°$ with the ground, find the height of the top and the distance between the feet. [2]

E PART E · FOR 95+ Challenge Questions

Harder than the usual board question. Try these after Parts A–D: they stretch the same methods to the toughest 3- and 5-mark questions.

E1. Prove that $\dfrac{\cot\theta + \operatorname{cosec}\theta - 1}{\cot\theta - \operatorname{cosec}\theta + 1} = \dfrac{1+\cos\theta}{\sin\theta}$. [3]

E2. If $\operatorname{cosec}\theta + \cot\theta = q$, show that $\cos\theta = \dfrac{q^2-1}{q^2+1}$. [3]

E3. If $3\sin\theta + 4\cos\theta = 5$, find $\tan\theta$. [3]

E4. Find the acute angle θ if $\dfrac{\cos\theta + \sin\theta}{\cos\theta - \sin\theta} = \dfrac{\sqrt{3}+1}{\sqrt{3}-1}$. [3]

E5. Prove that $\sin^6\theta + \cos^6\theta = 1 - 3\sin^2\theta\cos^2\theta$. [3]

E6. Find θ $(0^\circ < \theta < 90^\circ)$ if $2\sin^2\theta - 3\sin\theta + 1 = 0$. [3]

F

PART F · REAL BOARD QUESTIONS

Board PYQ Index

Real questions from recent Maths Standard board papers and the 2026–27 Sample Paper, by type. Open the official paper and solve the listed questions.

Frequency	Question type	Marks	Where asked (year: paper code, question number)	Practise here
★★★	**Prove a trigonometric identity**	3	**2026:** 30/1/1 Q28(A), Q28(B) · **2025:** 30/1/1 Q27(a), Q27(b) · **2024:** 30/1/1 Q28 · **SQP 2026–27:** Q31(A), Q31(B)	A14–A19, C13–C18
★★★	**Standard values: evaluate, find an angle**	1–2	**2026:** 30/1/1 Q10 · **2025:** 30/1/1 Q4, Q21(a), Q21(b) · **2024:** 30/1/1 Q12, Q23(A), Q23(B) · **SQP 2026–27:** Q8	A9–A13, C1–C8, D2, D4
★★☆	**One ratio given: another ratio or an expression**	1–2	**2026:** 30/1/1 Q9, Q24(A), Q24(B) · **SQP 2026–27:** Q23	A1–A8, C9–C12, D1, D3
★★☆	**Use $\sec^2\theta - \tan^2\theta = 1$ in 1 mark**	1	**2025:** 30/1/1 Q5 · **2024:** 30/1/1 Q7	A14–A19, C13–C18

PAPERS CHECKED

- **2026:** 30/1/1 (Delhi, Set 1)
- **2025:** 30/1/1 (Delhi, Set 1)
- **2024:** 30/1/1 (Delhi, Set 1)
- **CBSE Sample Paper 2026–27** (Mathematics Standard)

Sets of one code family (30/1/1, 30/1/2, 30/1/3) share most questions, so each counts as one paper. Download the official papers from cbse.gov.in → Previous Year Question Papers, and solve the exact questions listed above.

PART G · YOUR RECORD

G My Mistakes

Write down each mistake from this chapter, including the chapter test.

Every wrong answer is a free lesson. Write it here, find the rule you missed, and redo the question after three days. Bring this page to class before the next test.

Date	Part & Q No.	What went wrong	Correct rule or method	Redone ✓