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CLASS X · MATHEMATICS BASIC (241) · CBSE BOARD EXAMINATION 2027

CHAPTER 8 BASIC

Introduction to Trigonometry

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

6 guided method questions | 33 practice questions | 3 case studies | Basic (430 series) board question index

INSIDE THIS BOOKLET

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STUDENT DETAILS

NAME _____

CLASS & SECTION _____

ROLL NO. _____

BOOKLET STARTED ON _____

CHAPTER TEST SCORE ____ / 20

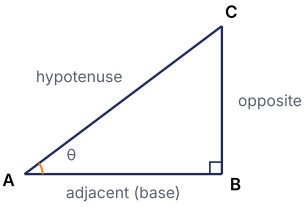
1

READ THIS FIRST · MATHEMATICS BASIC

Chapter Notes

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

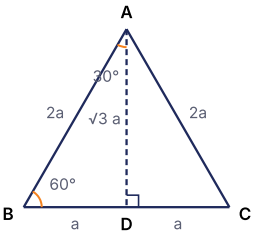
Draw a right triangle, write the two sides you know as multiples of k, find the third side by Pythagoras, then read off every ratio.

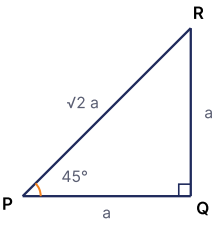
EXAMPLE

$\tan A = \dfrac{8}{15}$: 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 together. Basic papers give two or three 1-mark questions on standard values (find an angle, spot the false statement), a 2-mark question on values or one given ratio, and sometimes a 3-mark identity.

MOST ASKED IN BASIC BOARD PAPERS + SAMPLE PAPER 2026–27 (3 PAPERS CHECKED)

How often	Question type	Marks	Papers
★★★	Standard values: evaluate, find an angle, spot the false statement	1–2	3 of 3
★☆☆	One ratio or two sides given: other ratios, an expression	2–3	1 of 3
★☆☆	Identities: simplify (1 mark) or prove (3 marks)	1–3	1 of 3

MISTAKES THAT COST MARKS

- Using the adjacent side for sin: $\sin = \frac{\text{opp}}{\text{hyp}}$.
- Forgetting to find the third side by Pythagoras before writing the ratios.
- Swapping $\sin 30^\circ$ and $\sin 60^\circ$.
- Reading $\sin^2 \theta$ as $\sin \theta^2$.
- Writing $\tan 90^\circ = 1$. It is not defined.
- Not writing "LHS = … = RHS" in a proof.

HOW TO USE THIS BOOKLET

1. **Day 1:** Notes, then Part A (guided methods) – fill every blank.
2. **Day 2:** Part B (NCERT practice). Do every MUST DO question first.
3. **Day 3:** Part C (board pattern), Part D (case studies) and the real board questions in Part E.
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	$\sin 30^\circ = \cos 60^\circ = \frac{1}{2}$, $\tan 45^\circ = 1$, $\tan 60^\circ = \sqrt{3}$

A

PART A · LEARN THE METHODS

Guided Practice

Fill in the blanks to learn each board method step by step. Then use the same steps on your own in Part B.

Ratios in a right triangle

A1. In $\triangle ABC$, right-angled at B, $AB = 5$ cm and $BC = 12$ cm. Complete the steps. MUST DO [2]

$AC^2 = AB^2 + BC^2 = __ + __ = __ \rightarrow AC = __$ cm

$\sin A = \frac{BC}{AC} = __$, $\cos A = \frac{AB}{AC} = __$, $\tan A = \frac{BC}{AB} = __$

A2. Given $\sin A = \frac{3}{5}$, complete the steps to find $\cos A$ and $\tan A$. MUST DO [2]

Opposite $= 3k$, hypotenuse $= __$. Adjacent $= \sqrt{(5k)^2 - (3k)^2} = __$

$\cos A = \frac{\text{adj}}{\text{hyp}} = __$, $\tan A = \frac{\text{opp}}{\text{adj}} = __$

Standard values

A3. Complete the table of values. MUST DO [2]

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

A4. Complete the steps to evaluate $\sin 30^\circ + \cos 60^\circ - \tan 45^\circ$. [2]

$\sin 30^\circ = __$, $\cos 60^\circ = __$, $\tan 45^\circ = __$. Value $= __ + __ - __ = __$

A5. Complete the steps to find the acute angle θ if $2\cos\theta = 1$. [2]

$\cos\theta = __$. From the table, $\cos __ = \frac{1}{2}$, so $\theta = __$

Identity

A6. Complete the steps to prove $(1 - \cos^2 A)\,\text{cosec}^2 A = 1$. MUST DO [2]

From $\sin^2 A + \cos^2 A = 1$: $1 - \cos^2 A =$ ____. $\text{cosec}^2 A = \dfrac{1}{\text{____}}$

LHS $=$ ____ $\times \dfrac{1}{\text{____}} =$ ___ $=$ RHS

B

PART B · NCERT PRACTICE

NCERT Practice

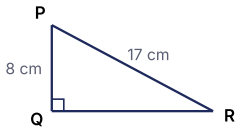
The same skills as the NCERT examples and exercises, with new numbers. Basic papers are built on NCERT, so finish every question.

Trigonometric ratios

B1. In $\triangle ABC$, right-angled at B, $AB = 9$ cm and $BC = 40$ cm. Find: MUST DO [2]

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

B2. In the figure, $\angle Q = 90^\circ$, $PQ = 8$ cm and $PR = 17$ cm. Find $\tan P - \cot R$. [2]



B3. If $\sin A = \dfrac{5}{13}$, find $\cos A$ and $\tan A$. MUST DO [2]

B4. Given $7 \cot A = 24$, find $\sin A$ and $\sec A$. [2]

B5. Given $\sec \theta = \dfrac{25}{7}$, find all the other trigonometric ratios. MUST DO [3]

B6. If $\tan \theta = \dfrac{3}{4}$, evaluate $\dfrac{(1 + \sin\theta)(1 - \sin\theta)}{(1 + \cos\theta)(1 - \cos\theta)}$. [2]

B7. If $\sin A = \dfrac{1}{2}$, then $\cot A$ is: [1]

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

B8. Which statement is true for an acute angle A? [1]

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

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

Values at 0°, 30°, 45°, 60°, 90°

B9. Evaluate: MUST DO [2]

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

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

B10. Evaluate $\dfrac{2\sin^2 45^\circ + 3\cot^2 60^\circ}{\tan^2 45^\circ + \cos^2 30^\circ}$. [2]

B11. $\dfrac{1-\tan^2 30^\circ}{1+\tan^2 30^\circ}$ is equal to: [1]

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

B12. 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

B13. Show that $\sin 2A = 2\sin A\cos A$ when $A=30^\circ$. [2]

Identities

B14. Write $\sin A$ and $\tan A$ in terms of $\sec A$. [2]

B15. $5\,\mathrm{cosec}^2\theta - 5\cot^2\theta$ is equal to: [1]

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

B16. $(1-\sin^2 A)(1+\tan^2 A)$ is equal to: [1]

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

B17. Prove that $(1+\cot^2\theta)(1-\cos\theta)(1+\cos\theta)=1$. MUST DO [2]

B18. Prove that $\tan\theta+\cot\theta=\sec\theta\,\mathrm{cosec}\,\theta$. [2]

B19. Prove that $\dfrac{1-\sin A}{1+\sin A}=(\sec A-\tan A)^2$. MUST DO [3]

C

PART C · BOARD PATTERN (BASIC)

Board Pattern Practice

Question types from real Mathematics Basic papers (430 series) and the 2026–27 Sample Paper. ★★★ = asked in all 3 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

★★★ 3 of 3 papers · 1–2 marks

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

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

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

(a) 30° (b) 45° (c) 60° (d) 90°

C3. 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) $\sin 90^\circ = 1$

C4. 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.

C5. Evaluate $\dfrac{3\tan^2 30^\circ + \sec^2 45^\circ}{\operatorname{cosec}^2 30^\circ - \cot^2 45^\circ}$. MUST DO [2]

C6. If $x \sin^2 30^\circ + 2\cos^2 45^\circ = \tan^2 60^\circ$, find x. [2]

C7. If $\cos(A - B) = \dfrac{\sqrt{3}}{2}$ and $\sin(A + B) = \dfrac{\sqrt{3}}{2}$, with $A > B$ and $A + B \leq 90^\circ$, find A and B. [2]
MUST DO

One ratio given: other ratios and expressions

★☆☆ 1 of 3 papers · 2–3 marks

C8. If $\tan\theta = \dfrac{p}{q}$, then $\sin\theta$ is: [1]

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

C9. If $\sec\theta = \dfrac{13}{5}$, find $\dfrac{2\sin\theta - 3\cos\theta}{4\sin\theta - 9\cos\theta}$. MUST DO [2]

C10. If $\operatorname{cosec}\theta = \dfrac{17}{8}$, find $\dfrac{1 - \tan^2\theta}{1 + \tan^2\theta}$. [2]

C11. 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

★☆☆ 1 of 3 papers · 1–3 marks

C12. $\cot^2\theta - \dfrac{1}{\sin^2\theta}$ is equal to: MUST DO [1]

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

C13. $(1 + \cot^2 A)\sin^2 A$ is equal to: [1]

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

C14. Prove that $\sec A(1 - \sin A)(\sec A + \tan A) = 1$. [2]

D

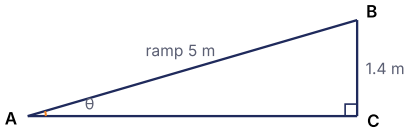
PART D · SECTION E STYLE

Case-Based Questions

Each case carries 4 marks (1 + 1 + 2), as in Section E of the board paper. Underline the numbers in the passage before you start.

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]

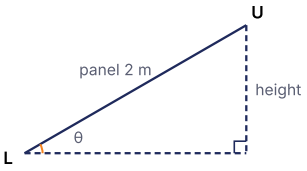
(iii) Find $\operatorname{cosec}\theta + \cot\theta$. [2]

OR

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

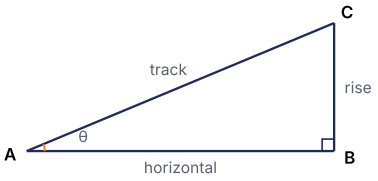
(iii) In winter the tilt is changed to 45°. How high is the upper edge now? [2]

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, $\tan\theta = \frac{5}{12}$.



(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 $\frac{\sin\theta + \cos\theta}{\sin\theta - \cos\theta}$. [2]

E

PART E · REAL BOARD QUESTIONS

Board PYQ Index (Basic)

Real questions from the Mathematics Basic (430 series) 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
★★★	**Standard values: evaluate, find an angle, false statement**	1–2	**2026:** 430/1/2 Q9, Q10 · **2025:** 430/1/1 Q10, Q24(a), Q24(b) · **SQP 2026–27:** Q14	A3–A5, B9–B13, C1–C7, D2
★☆☆	**One ratio or two sides given**	2–3	**SQP 2026–27:** Q22, Q29	A1–A2, B1–B8, C8–C11, D1, D3
★☆☆	**Identities: simplify or prove**	1–3	**2025:** 430/1/1 Q11, Q30	A6, B14–B19, C12–C14

Papers checked (3): 2026 – 430/1/2 (Section A only could be read online) · 2025 – 430/1/1 · CBSE Sample Paper 2026–27 (Mathematics Basic). Sets of one code family share most questions, so they count as one paper. Download the official papers from cbse.gov.in → Previous Year Question Papers → Mathematics Basic.

PART F · YOUR RECORD

F 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 ✓