

Class 10 Maths: Complete Formula Sheet

All 14 NCERT chapters · CBSE syllabus 2026-27 (Standard and Basic) · NCERT textbook (Reprint 2026-27)

How to use this sheet. Plain boxes cover the CBSE 2026-27 board-exam syllabus. The syllabus content is the **same for Maths Standard (041) and Maths Basic (241)**; only the question papers differ. Grey boxes marked $\diamond$ **Not in 2026-27 syllabus** hold results that have been removed from the current syllabus or book. They are kept because they appear in older papers and are needed again in Class 11.

- | | |
|--|--------------------------------------|
| 1. Real Numbers | 8. Introduction to Trigonometry |
| 2. Polynomials | 9. Some Applications of Trigonometry |
| 3. Pair of Linear Equations in Two Variables | 10. Circles |
| 4. Quadratic Equations | 11. Areas Related to Circles |
| 5. Arithmetic Progressions | 12. Surface Areas and Volumes |
| 6. Triangles | 13. Statistics |
| 7. Coordinate Geometry | 14. Probability |

1 Real Numbers

FUNDAMENTAL THEOREM OF ARITHMETIC

- Every composite number can be written as a product of primes, and this factorisation is unique apart from the order of the factors
- HCF = product of the **smallest** power of each **common** prime factor
- LCM = product of the **greatest** power of **each** prime factor involved
- For two positive integers: $\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b$

The product rule works for two numbers only, not for three or more.

IRRATIONAL NUMBERS

- If a prime p divides a^2 , then p divides a (a a positive integer)
- $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ (and $\sqrt{p}$ for any prime p) are irrational
- Proof method (contradiction): assume $\sqrt{p} = \frac{a}{b}$ with a, b coprime, then show p divides both a and b
- Rational $\pm$ irrational is irrational; non-zero rational $\times$ irrational is irrational (e.g. $3 + 2\sqrt{5}$, $7\sqrt{5}$)

$\diamond$ NOT IN 2026-27 SYLLABUS: DECIMAL EXPANSIONS

- A rational $\frac{p}{q}$ (in lowest terms) has a terminating decimal expansion $\iff q$ is of the form $2^n 5^m$; otherwise it is non-terminating repeating. Irrational numbers are non-terminating non-repeating.

2 Polynomials

BASICS

- Degree 1, 2, 3: linear, quadratic, cubic
- Quadratic: $ax^2 + bx + c$, $a \neq 0$
- k is a zero of $p(x)$ if $p(k) = 0$
- Zeros of $p(x)$ = x-coordinates of the points where $y = p(x)$ meets the x-axis
- A polynomial of degree n has at most n zeroes
- Graph of $ax^2 + bx + c$ is a parabola: opens upward if $a > 0$, downward if $a < 0$

ZEROES AND COEFFICIENTS (QUADRATIC)

- If α, β are the zeroes of $ax^2 + bx + c$:
- $\alpha + \beta = -\frac{b}{a} = -\frac{\text{coefficient of } x}{\text{coefficient of } x^2}$
- $\alpha\beta = \frac{c}{a} = \frac{\text{constant term}}{\text{coefficient of } x^2}$
- Quadratic with given zeroes:
 $k[x^2 - (\alpha + \beta)x + \alpha\beta]$, $k \neq 0$
- Useful: $\alpha^2 + \beta^2 = (\alpha + \beta)^2 - 2\alpha\beta$; $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{\alpha + \beta}{\alpha\beta}$



◇ NOT IN 2026-27 SYLLABUS: CUBIC POLYNOMIALS (STILL IN THE NCERT BOOK)

- If α, β, γ are the zeroes of $ax^3 + bx^2 + cx + d$: $\alpha + \beta + \gamma = -\frac{b}{a}$, $\alpha\beta + \beta\gamma + \gamma\alpha = \frac{c}{a}$, $\alpha\beta\gamma = -\frac{d}{a}$

3 Pair of Linear Equations in Two Variables

CONSISTENCY FOR $a_1x + b_1y + c_1 = 0$ AND $a_2x + b_2y + c_2 = 0$

Condition	Graph	Solutions	Type
$\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$	intersecting lines	exactly one (unique)	consistent
$\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$	coincident lines	infinitely many	dependent (consistent)
$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$	parallel lines	none	inconsistent

ALGEBRAIC METHODS

- Substitution:** express one variable in terms of the other from one equation, substitute into the other
- Elimination:** multiply the equations to make the coefficients of one variable equal, then add or subtract to eliminate it
- A false statement (e.g. $0 = 5$) means no solution; a true statement (e.g. $0 = 0$) means infinitely many

REDUCIBLE EQUATIONS AND WORD PROBLEMS

- Equations like $\frac{2}{x} + \frac{3}{y} = 13$: put $u = \frac{1}{x}$, $v = \frac{1}{y}$ to make them linear
- Speed = $\frac{\text{distance}}{\text{time}}$; downstream speed = $u + v$, upstream = $u - v$
- Two-digit number with digits x (tens) and y (units) = $10x + y$

◇ NOT IN 2026-27 SYLLABUS: CROSS-MULTIPLICATION

- $\frac{x}{b_1c_2 - b_2c_1} = \frac{y}{c_1a_2 - c_2a_1} = \frac{1}{a_1b_2 - a_2b_1}$, provided $a_1b_2 - a_2b_1 \neq 0$

4 Quadratic Equations

STANDARD FORM AND ROOTS

- $ax^2 + bx + c = 0$, $a \neq 0$ (a, b, c real)
- α is a root if $a\alpha^2 + b\alpha + c = 0$
- Roots of $ax^2 + bx + c = 0$ = zeroes of the polynomial $ax^2 + bx + c$
- Factorisation: split the middle term (find two numbers with sum b and product ac), then set each factor to 0

QUADRATIC FORMULA

- $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$, $b^2 - 4ac \geq 0$
- Sum of roots = $-\frac{b}{a}$, product of roots = $\frac{c}{a}$

NATURE OF ROOTS (DISCRIMINANT $D = b^2 - 4ac$)

$D > 0$	$D = 0$	$D < 0$
two distinct real roots	two equal (coincident) real roots, each = $-\frac{b}{2a}$	no real roots

Word problems: area of rectangle = length $\times$ breadth; consecutive integers $x, x + 1$; consecutive odd/even integers $x, x + 2$; time = distance $\div$ speed. Reject answers that make no sense (e.g. negative lengths).



5 Arithmetic Progressions

TERMS

- General form: $a, a + d, a + 2d, a + 3d, \dots; d = a_{k+1} - a_k$ (same for all k)
- n th term: $a_n = a + (n - 1)d$
- n th term from the end: $l - (n - 1)d, l = \text{last term}$
- a, b, c are in AP $\iff 2b = a + c$
- Three terms in AP: $a - d, a, a + d$

SUM OF FIRST n TERMS

- $S_n = \frac{n}{2} [2a + (n - 1)d]$
- $S_n = \frac{n}{2} (a + l), l = \text{last } (n\text{th}) \text{ term}$
- $a_n = S_n - S_{n-1}$
- Sum of first n natural numbers: $1 + 2 + \dots + n = \frac{n(n+1)}{2}$

6 Triangles

SIMILAR FIGURES

- Same shape, not necessarily the same size
- All congruent figures are similar; the converse is not true
- Two polygons with the same number of sides are similar if corresponding angles are equal **and** corresponding sides are in the same ratio
- All circles, all squares, all equilateral triangles are similar

BASIC PROPORTIONALITY THEOREM (THALES)

- If $DE \parallel BC$ in $\triangle ABC$ (D on AB, E on AC), then $\frac{AD}{DB} = \frac{AE}{EC}$
- Also $\frac{AD}{AB} = \frac{AE}{AC}$ and $\frac{DE}{BC} = \frac{AD}{AB}$
- Converse: if $\frac{AD}{DB} = \frac{AE}{EC}$, then $DE \parallel BC$

SIMILARITY CRITERIA FOR $\triangle ABC \sim \triangle DEF$

Criterion	Condition
AAA	$\angle A = \angle D, \angle B = \angle E, \angle C = \angle F$
AA	two pairs of corresponding angles equal (the third pair is then equal too)
SSS	$\frac{AB}{DE} = \frac{BC}{EF} = \frac{CA}{FD}$
SAS	$\angle A = \angle D$ and $\frac{AB}{DE} = \frac{AC}{DF}$

If two triangles are similar, all corresponding sides, perimeters, altitudes and medians are in the same ratio. Write vertices in matching order.

◇ NOT IN 2026-27 SYLLABUS: AREAS AND PYTHAGORAS

- Ratio of areas of similar triangles = square of the ratio of corresponding sides: $\frac{\text{ar}(\triangle ABC)}{\text{ar}(\triangle DEF)} = \left(\frac{AB}{DE}\right)^2$
- Pythagoras: in a right triangle, $\text{hypotenuse}^2 = \text{base}^2 + \text{perpendicular}^2$ (still used throughout Class 10)



7 Coordinate Geometry

DISTANCE FORMULA

- $PQ = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
- Distance from origin: $OP = \sqrt{x^2 + y^2}$
- Uses: check collinearity ($AB + BC = AC$), identify a square, rhombus, rectangle or the type of triangle

SECTION FORMULA (INTERNAL, RATIO $m_1 : m_2$)

$$P = \left(\frac{m_1x_2 + m_2x_1}{m_1 + m_2}, \frac{m_1y_2 + m_2y_1}{m_1 + m_2} \right)$$

- Mid-point: $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$
- Ratio $k : 1$ form: $\left(\frac{kx_2 + x_1}{k + 1}, \frac{ky_2 + y_1}{k + 1} \right)$
- Points of trisection divide in ratios $1 : 2$ and $2 : 1$

◇ NOT IN 2026-27 SYLLABUS: AREA AND CENTROID

- Area of triangle = $\frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$; the points are collinear if this is 0
- Centroid = $\left(\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3} \right)$

8 Introduction to Trigonometry

RATIOS (RIGHT ANGLE AT B)

- $\sin A = \frac{\text{opposite}}{\text{hypotenuse}}$
- $\cos A = \frac{\text{adjacent}}{\text{hypotenuse}}$
- $\tan A = \frac{\text{opposite}}{\text{adjacent}}$
- $\operatorname{cosec} A = \frac{1}{\sin A}, \sec A = \frac{1}{\cos A}, \cot A = \frac{1}{\tan A}$
- $\tan A = \frac{\sin A}{\cos A}, \cot A = \frac{\cos A}{\sin A}$
- $\sin A, \cos A \leq 1; \sec A, \operatorname{cosec} A \geq 1$ (for acute A)

Knowing one ratio lets you find the rest (draw the triangle and use Pythagoras).

IDENTITIES

- $\sin^2 A + \cos^2 A = 1$
- $\sec^2 A - \tan^2 A = 1$ ($0^\circ \leq A < 90^\circ$)
- $\operatorname{cosec}^2 A - \cot^2 A = 1$ ($0^\circ < A \leq 90^\circ$)
- Rearranged: $\sin^2 A = 1 - \cos^2 A, \sec^2 A = 1 + \tan^2 A,$
 $\operatorname{cosec}^2 A = 1 + \cot^2 A, (\sec A - \tan A)(\sec A + \tan A) = 1$

VALUES OF STANDARD ANGLES

$\angle A$	0°	30°	45°	60°	90°
$\sin A$	0	$\frac{1}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{\sqrt{3}}{2}$	1
$\cos A$	1	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{2}}$	$\frac{1}{2}$	0
$\tan A$	0	$\frac{1}{\sqrt{3}}$	1	$\sqrt{3}$	not defined
$\operatorname{cosec} A$	not defined	2	$\sqrt{2}$	$\frac{2}{\sqrt{3}}$	1
$\sec A$	1	$\frac{2}{\sqrt{3}}$	$\sqrt{2}$	2	not defined
$\cot A$	not defined	$\sqrt{3}$	1	$\frac{1}{\sqrt{3}}$	0

As A increases from 0° to 90° , $\sin A$ increases from 0 to 1 and $\cos A$ decreases from 1 to 0.

◇ NOT IN 2026-27 SYLLABUS: COMPLEMENTARY ANGLES

- $\sin(90^\circ - A) = \cos A, \cos(90^\circ - A) = \sin A, \tan(90^\circ - A) = \cot A, \cot(90^\circ - A) = \tan A, \sec(90^\circ - A) = \operatorname{cosec} A, \operatorname{cosec}(90^\circ - A) = \sec A$



9 Some Applications of Trigonometry

DEFINITIONS

- Line of sight: line from the observer's eye to the object
- Angle of elevation: between the line of sight and the horizontal, object **above** eye level
- Angle of depression: between the line of sight and the horizontal, object **below** eye level
- The angle of elevation of B from A equals the angle of depression of A from B (alternate angles)

SOLVING HEIGHTS AND DISTANCES

- $\tan \theta = \frac{\text{height}}{\text{horizontal distance}}$ (most used)
- $\sin \theta = \frac{\text{height}}{\text{slant length}}$ (e.g. a ladder, kite string)
- Add the observer's height if the eye is above the ground
- Board problems use only $30^\circ, 45^\circ, 60^\circ$ and at most two right triangles. $\sqrt{3} \approx 1.732, \sqrt{2} \approx 1.414$.

10 Circles

TANGENTS

- A tangent meets the circle at exactly one point (the point of contact); a secant meets it at two
- Point inside the circle: no tangent; on the circle: exactly one; outside: exactly two
- Theorem 1:** the tangent at any point is perpendicular to the radius through the point of contact
- Theorem 2:** the two tangents from an external point are equal in length

USEFUL RESULTS

- Tangent length from P , distance d from centre: $\sqrt{d^2 - r^2}$
- Tangents from an external point subtend equal angles at the centre and are equally inclined to the line joining the point to the centre
- Angle between two tangents from P + angle between the radii to the contact points = 180°
- Tangents at the ends of a diameter are parallel

11 Areas Related to Circles

CIRCLE, SECTOR AND ARC (ANGLE θ IN DEGREES)

- Circumference = $2\pi r$; area = πr^2
- Arc length: $l = \frac{\theta}{360^\circ} \times 2\pi r$
- Area of sector: $\frac{\theta}{360^\circ} \times \pi r^2 = \frac{1}{2} l r$
- Perimeter of sector = $2r + l$
- Major sector area = $\pi r^2 - \text{minor sector area (angle } 360^\circ - \theta)$
- Semicircle area = $\frac{\pi r^2}{2}$; quadrant = $\frac{\pi r^2}{4}$

SEGMENT

- Minor segment = area of sector – area of triangle OAB
- Major segment = $\pi r^2 - \text{minor segment}$

θ	Area of $\triangle OAB$
60°	$\frac{\sqrt{3}}{4} r^2$ (equilateral)
90°	$\frac{1}{2} r^2$
120°	$\frac{\sqrt{3}}{4} r^2$

Board problems on segments use only $60^\circ, 90^\circ, 120^\circ$. Clock: the minute hand turns 6° per minute. Use $\pi = \frac{22}{7}$ or 3.14 as instructed.



12 Surface Areas and Volumes

BASIC SOLIDS

Solid	Curved / lateral surface area	Total surface area	Volume
Cuboid $l \times b \times h$	$2h(l + b)$	$2(lb + bh + hl)$	lbh
Cube, side a	$4a^2$	$6a^2$	a^3
Cylinder	$2\pi rh$	$2\pi r(r + h)$	$\pi r^2 h$
Cone, $l = \sqrt{r^2 + h^2}$	πrl	$\pi r(l + r)$	$\frac{1}{3}\pi r^2 h$
Sphere	$4\pi r^2$	$4\pi r^2$	$\frac{4}{3}\pi r^3$
Hemisphere	$2\pi r^2$	$3\pi r^2$	$\frac{2}{3}\pi r^3$

Diagonal of a cuboid = $\sqrt{l^2 + b^2 + h^2}$; of a cube = $\sqrt{3}a$.

COMBINATIONS OF TWO SOLIDS

- **Surface area** of the combined solid = sum of the surface areas that are **visible** (outside); hidden joining faces are not counted
- **Volume** of the combined solid = sum of the volumes of the parts
- Hollowed out (e.g. a cone scooped from a cylinder): volume = difference

COMMON EXAMPLES

- Capsule (cylinder + 2 hemispheres): $SA = 2\pi rh + 4\pi r^2$
- Cone on a hemisphere (toy): $SA = \pi rl + 2\pi r^2$
- Cylinder with a hemisphere scooped out of one end: $SA = 2\pi rh + \pi r^2 + 2\pi r^2$

◇ NOT IN 2026-27 SYLLABUS: FRUSTUM AND CONVERSION

- Frustum (radii r_1, r_2 , height h): $V = \frac{1}{3}\pi h(r_1^2 + r_2^2 + r_1 r_2)$; slant height $l = \sqrt{h^2 + (r_1 - r_2)^2}$; $CSA = \pi l(r_1 + r_2)$; $TSA = \pi l(r_1 + r_2) + \pi r_1^2 + \pi r_2^2$
- Melting and recasting: the volume stays the same

13 Statistics

MEAN OF GROUPED DATA

Method	Formula	When to use
Direct	$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$	small numbers
Assumed mean	$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$, $d_i = x_i - a$	large x_i
Step deviation	$\bar{x} = a + \left(\frac{\sum f_i u_i}{\sum f_i} \right) \times h$, $u_i = \frac{x_i - a}{h}$	equal class sizes, large x_i

x_i = class mark = $\frac{\text{upper limit} + \text{lower limit}}{2}$; a = assumed mean (usually a central x_i); h = class size. All three methods give the same answer.



MODE OF GROUPED DATA

$$\text{Mode} = l + \left(\frac{f_1 - f_0}{2f_1 - f_0 - f_2} \right) \times h$$

- Modal class = class with the highest frequency
- l = lower limit of the modal class, h = class size
- f_1 = frequency of the modal class; f_0 = of the class before it; f_2 = of the class after it

MEDIAN OF GROUPED DATA

$$\text{Median} = l + \left(\frac{\frac{n}{2} - cf}{f} \right) \times h$$

- $n = \sum f_i$; median class = class whose cumulative frequency first exceeds $\frac{n}{2}$
- l = lower limit of the median class, cf = cumulative frequency of the class **before** it, f = frequency of the median class, h = class size

EMPIRICAL RELATIONSHIP

- $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$
- Make classes continuous before using the mode or median formula (e.g. 10–19, 20–29 becomes 9.5–19.5, 19.5–29.5).

14 Probability**CLASSICAL PROBABILITY**

$$P(E) = \frac{\text{number of outcomes favourable to } E}{\text{number of all possible outcomes}}$$

- Assumes the outcomes are equally likely
- $0 \leq P(E) \leq 1$
- Sure (certain) event: $P = 1$; impossible event: $P = 0$
- $P(E) + P(\bar{E}) = 1$, where $\bar{E}$ = "not E " (complementary events)
- Elementary event: only one outcome; the probabilities of all elementary events add up to 1

COMMON EXPERIMENTS

- One coin: 2 outcomes; two coins: 4; three coins: 8
- One die: 6 outcomes; two dice: $6 \times 6 = 36$
- Deck of 52 cards: 4 suits (spades ♠, clubs ♣ black; hearts ♥, diamonds ♦ red) of 13 cards each; 26 red, 26 black
- Face cards: king, queen, jack, so 12 in total (3 per suit); 4 aces
- Prime numbers on a die: 2, 3, 5

Made by StudyOS · Free CBSE study kit · studyos.co.in

