

Class 10 Maths: Formula and Concept Sheet

All 14 chapters of Class 10 Mathematics (NCERT) in short form for board revision.

1. Real numbers

Euclid's division lemma: $a = bq + r$, with $0 \leq r < b$

- **Fundamental theorem of arithmetic:** every composite number is a product of primes in exactly one way (apart from order).

$$\text{HCF}(a, b) \times \text{LCM}(a, b) = a \times b$$

- $\sqrt{2}$, $\sqrt{3}$, $\sqrt{5}$ are irrational. (Proof method: assume rational, reach a contradiction.)
- p/q (in lowest terms) has a terminating decimal if q has only 2 and/or 5 as prime factors; otherwise it repeats.

2. Polynomials

- Number of zeros of a polynomial $\leq$ its degree. A graph of a quadratic is a parabola; real zeros are where it cuts the x-axis.

For $ax^2 + bx + c$ with zeros α and β : $\alpha + \beta = -b/a$ | $\alpha\beta = c/a$

Quadratic with given zeros: $x^2 - (\text{sum of zeros})x + (\text{product of zeros})$

Division algorithm: $p(x) = g(x) \times q(x) + r(x)$, degree of $r <$ degree of g

3. Pair of linear equations in two variables

Condition	Lines	Solutions
$a_1/a_2 \neq b_1/b_2$	Intersect	Exactly one (consistent)
$a_1/a_2 = b_1/b_2 \neq c_1/c_2$	Parallel	None (inconsistent)
$a_1/a_2 = b_1/b_2 = c_1/c_2$	Coincident	Infinitely many (consistent)

- Methods: graphical, substitution, elimination, cross-multiplication.

$$x / (b_1c_2 - b_2c_1) = y / (c_1a_2 - c_2a_1) = 1 / (a_1b_2 - a_2b_1)$$

4. Quadratic equations

Standard form $ax^2 + bx + c = 0$ ($a \neq 0$). Roots: $x = [-b \pm \sqrt{(b^2 - 4ac)}] / 2a$

Discriminant $D = b^2 - 4ac$. $D > 0$: two distinct real roots. $D = 0$: two equal roots. $D < 0$: no real roots.

- Methods: factorisation, completing the square, the quadratic formula.

5. Arithmetic progressions

n th term: $a_n = a + (n - 1)d$ | Common difference $d = a_{n+1} - a_n$

Sum of n terms: $S_n = (n/2)[2a + (n - 1)d] = (n/2)(a + l)$, where l is the last term

- Also $a_n = S_n - S_{n-1}$. Three numbers in AP can be taken as $a - d$, a , $a + d$.

6. Triangles

- **Basic proportionality theorem (Thales):** if $DE \parallel BC$ in triangle ABC , then $AD/DB = AE/EC$ (and the converse).
- Similarity rules: **AA, SSS, SAS**. Similar triangles have equal angles and proportional sides.

Area ratio of similar triangles = (ratio of corresponding sides)²

Pythagoras theorem: in a right triangle, $\text{hypotenuse}^2 = \text{base}^2 + \text{height}^2$; and its converse.

7. Coordinate geometry

Distance = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Section formula (ratio $m : n$): $(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n})$

Mid-point = $(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2})$

Area of triangle = $\frac{1}{2} |x_1(y_2 - y_3) + x_2(y_3 - y_1) + x_3(y_1 - y_2)|$. Three points are collinear if this area is 0.

8. Introduction to trigonometry

$\sin \theta = \text{Perpendicular} / \text{Hypotenuse}$ | $\cos \theta = \text{Base} / \text{Hypotenuse}$ | $\tan \theta = \text{Perpendicular} / \text{Base}$

$\operatorname{cosec} \theta = 1 / \sin \theta$ | $\sec \theta = 1 / \cos \theta$ | $\cot \theta = 1 / \tan \theta = \cos \theta / \sin \theta$

θ	0°	30°	45°	60°	90°
$\sin \theta$	0	$1/2$	$1/\sqrt{2}$	$\sqrt{3}/2$	1
$\cos \theta$	1	$\sqrt{3}/2$	$1/\sqrt{2}$	$1/2$	0
$\tan \theta$	0	$1/\sqrt{3}$	1	$\sqrt{3}$	not defined

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

$\sin(90^\circ - \theta) = \cos \theta$ | $\cos(90^\circ - \theta) = \sin \theta$ | $\tan(90^\circ - \theta) = \cot \theta$

Tip: To remember the table: *sin values go 0, 1/2, 1/√2, √3/2, 1 (write as √0/2, √1/2, √2/2, √3/2, √4/2).*
Cos is sin in reverse.

9. Some applications of trigonometry

- Angle of elevation: line of sight above the horizontal. Angle of depression: line of sight below the horizontal (equal to the angle of elevation from below, by alternate angles).
- Draw a right triangle, mark the angle, and choose $\tan \theta = \text{height} / \text{distance}$ in most problems.

10. Circles

- A tangent touches the circle at exactly one point. The tangent is **perpendicular to the radius** at the point of contact.
- From an external point, exactly two tangents can be drawn, and they are **equal in length**.
- Number of tangents: from a point inside the circle 0; on the circle 1; outside 2.

11. Areas related to circles

Circumference = $2\pi r$ | Area = πr^2

Length of an arc = $(\theta / 360^\circ) \times 2\pi r$ | Area of a sector = $(\theta / 360^\circ) \times \pi r^2$

Area of a segment = area of sector – area of triangle

- Use $\pi = 22/7$ when the radius is a multiple of 7, otherwise follow the question.

12. Surface areas and volumes

- For combined solids: total surface area = sum of the exposed curved surfaces (do not add the joined faces).
- Volume stays the same when a solid is melted and recast into another shape.

Frustum of a cone (radii r_1, r_2 ; height h ; slant l): Volume = $(1/3)\pi h(r_1^2 + r_1 r_2 + r_2^2)$

$$\text{Slant height } l = \sqrt{h^2 + (r_1 - r_2)^2} \mid \text{CSA} = \pi l(r_1 + r_2) \mid \text{TSA} = \pi l(r_1 + r_2) + \pi r_1^2 + \pi r_2^2$$

13. Statistics

Mean = $\Sigma f x / \Sigma f$ | Assumed mean: Mean = $a + \Sigma f d / \Sigma f$ | Step deviation: Mean = $a + (\Sigma f u / \Sigma f) \times h$

Median = $l + [(n/2 - cf) / f] \times h$

Mode = $l + [(f_1 - f_0) / (2f_1 - f_0 - f_2)] \times h$

Empirical relation: Mode = 3 Median – 2 Mean

- l = lower limit of the median/modal class, h = class size, cf = cumulative frequency before the class, f = its frequency.
- Ogive (cumulative frequency curve): the intersection of "less than" and "more than" ogives gives the median.

14. Probability

$P(E)$ = Number of favourable outcomes ÷ Total number of outcomes

- $0 \leq P(E) \leq 1$. Impossible event: 0. Sure event: 1. $P(E) + P(\text{not } E) = 1$.
- A deck has 52 cards: 4 suits of 13; 26 red, 26 black; 12 face cards; 4 aces.
- A die has 6 faces. Two coins have 4 outcomes. Two dice have 36 outcomes.

Tip: Board paper tip: attempt the 1-mark and 2-mark questions first, then the case study, then the long answers. Always show steps, because marks are given for steps.

30-day board revision plan

- Week 1: Algebra (chapters 1-5). Week 2: Geometry (6, 7, 10). Week 3: Trigonometry and mensuration (8, 9, 11, 12). Week 4: Statistics, probability, then full sample papers.
- Solve at least 5 previous-year or sample papers in exam time. Check where you lose marks and fix those chapters.