

Class 9 Maths: Formula and Concept Sheet

Every chapter's key results in short form. Based on the NCERT Class 9 syllabus.

1. Number systems

- Natural numbers N , whole W , integers Z , rational Q (p/q , $q \neq 0$), irrational (cannot be written as p/q , e.g. $\sqrt{2}$, π), real R = rational + irrational.
- Rational numbers have decimals that **terminate or repeat**. Irrational numbers have decimals that neither end nor repeat.

$$\sqrt{a} \times \sqrt{b} = \sqrt{ab} \mid \sqrt{a} \div \sqrt{b} = \sqrt{a/b} \mid (a + \sqrt{b})(a - \sqrt{b}) = a^2 - b$$

- Rationalising: $1/(a + \sqrt{b}) = (a - \sqrt{b})/(a^2 - b)$. Multiply top and bottom by the conjugate.

$$\text{Laws of exponents } (a > 0): a^m \times a^n = a^{m+n} \mid (a^m)^n = a^{mn} \mid a^m/a^n = a^{m-n} \mid a^{1/n} = \text{nth root of } a$$

2. Polynomials

- Degree = highest power of the variable. Zero of $p(x)$: the value k for which $p(k) = 0$.

Remainder theorem: if $p(x)$ is divided by $(x - a)$, the remainder is $p(a)$.

Factor theorem: $(x - a)$ is a factor of $p(x)$ if and only if $p(a) = 0$.

$$(x + y)^2 = x^2 + 2xy + y^2 \mid (x - y)^2 = x^2 - 2xy + y^2 \mid x^2 - y^2 = (x + y)(x - y)$$

$$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$$

$$(x + y)^3 = x^3 + y^3 + 3xy(x + y) \mid (x - y)^3 = x^3 - y^3 - 3xy(x - y)$$

$$x^3 + y^3 = (x + y)(x^2 - xy + y^2) \mid x^3 - y^3 = (x - y)(x^2 + xy + y^2)$$

$$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx); \text{ if } x + y + z = 0 \text{ then } x^3 + y^3 + z^3 = 3xyz$$

3. Coordinate geometry

- The plane has 4 quadrants. Signs of (x, y) : I $(+, +)$, II $(-, +)$, III $(-, -)$, IV $(+, -)$.
- Abscissa = x-coordinate; ordinate = y-coordinate. A point on the x-axis is $(a, 0)$; on the y-axis is $(0, b)$.

4. Linear equations in two variables

- Form: $ax + by + c = 0$. It has infinitely many solutions; its graph is a straight line.
- $x = k$ is a line parallel to the y-axis; $y = k$ is parallel to the x-axis.

5. Introduction to Euclid's geometry

- Axioms are general truths; postulates are about geometry. Euclid gave 5 postulates.
- Example axioms: things equal to the same thing are equal; the whole is greater than the part.
- Playfair's form of the fifth postulate: through a point outside a line, exactly one line can be drawn parallel to it.

6. Lines and angles

- Linear pair adds to 180° . Vertically opposite angles are equal.
- Parallel lines + transversal: corresponding angles equal, alternate interior equal, interior angles on the same side add to 180° .

$$\text{Angle sum of a triangle} = 180^\circ \mid \text{Exterior angle} = \text{sum of the two interior opposite angles}$$

7. Triangles

- Congruence rules: **SAS, ASA, AAS, SSS, RHS**.
- Angles opposite equal sides are equal, and sides opposite equal angles are equal.
- Inequalities: sum of two sides > third side; the longer side is opposite the larger angle.

8. Quadrilaterals

Angle sum of a quadrilateral = 360°

- A diagonal divides a parallelogram into two congruent triangles. Opposite sides and angles are equal; diagonals bisect each other.
- A quadrilateral with one pair of opposite sides equal and parallel is a parallelogram.

Mid-point theorem: the line joining the mid-points of two sides of a triangle is parallel to the third side and half as long.

9. Circles

- Equal chords subtend equal angles at the centre (and the converse is true). The perpendicular from the centre to a chord bisects it.
- Equal chords are equally distant from the centre.

Angle at the centre = $2 \times$ angle at the remaining circumference (same arc)

- Angles in the same segment are equal. Angle in a semicircle = 90° .

Cyclic quadrilateral: opposite angles add to 180° . The exterior angle equals the interior opposite angle.

10. Heron's formula

Area = $\sqrt{s(s-a)(s-b)(s-c)}$, where $s = (a + b + c) / 2$

Equilateral triangle: area = $(\sqrt{3} / 4) \times a^2$ | Isosceles with equal sides a and base b : area = $(b/4) \times \sqrt{(4a^2 - b^2)}$

11. Surface areas and volumes

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

Cone slant height $l = \sqrt{(r^2 + h^2)}$

12. Statistics

- Raw data is arranged into a frequency table. Class mark = (upper limit + lower limit) / 2.
- Graphs: bar graph (separate bars), histogram (touching bars for continuous classes), frequency polygon.

Mean = $\Sigma(f \times x) \div \Sigma f$ | Median = middle value of the ordered data | Mode = most frequent value

Tip: Learn the theorems with their diagrams. In board answers, write "Given, To prove, Construction, Proof" for every theorem.

Marks plan

- Number systems, polynomials, coordinate geometry and linear equations are the algebra base for Class 10. Master them first.
- Geometry chapters need practice with proofs: write one proof every day.