



CBSE gives no formula booklet: learn every result on this sheet. Organised by the chapters of the CBSE curriculum.

1 Number System

$\mathbb{N} \subset \mathbb{W} \subset \mathbb{Z} \subset \mathbb{Q} \subset \mathbb{R}$; $\frac{p}{q}$ terminates iff q (lowest terms) has only the primes 2, 5

Recurring decimal, e.g.: $0.\overline{47} = \frac{47}{99}$,
 $0.\overline{16} = \frac{16}{90} = \frac{8}{45}$

Surds: $\sqrt{ab} = \sqrt{a}\sqrt{b}$, $(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b$

Rationalise: $\frac{1}{\sqrt{a} + \sqrt{b}} = \frac{\sqrt{a} - \sqrt{b}}{a - b}$

Exponents: $a^m a^n = a^{m+n}$, $(a^m)^n = a^{mn}$,
 $a^{-m} = \frac{1}{a^m}$, $a^{\frac{p}{q}} = (\sqrt[q]{a})^p$

2 Polynomials

Polynomial: degree = highest power; linear polynomial and its zero:

$p(x) = ax + b$ ($a \neq 0$); $x = -\frac{b}{a}$

Line $y = ax + b$: slope a , y -intercept b :
 $a = \frac{y_2 - y_1}{x_2 - x_1}$

Linear growth ($a > 0$) / decay ($a < 0$): equal change per equal step

3 Sequences and Progressions

AP; GP: $a_n = a + (n - 1)d$; $a_n = ar^{n-1}$

Sum of naturals; of odd numbers:

$1 + 2 + \dots + n = \frac{n(n+1)}{2}$;
 $1 + 3 + \dots + (2n - 1) = n^2$

Fibonacci; Tower of Hanoi:

$F_{n+1} = F_n + F_{n-1}$;
 $M_n = 2M_{n-1} + 1 = 2^n - 1$

4 Algebraic Identities

Squares: $(a \pm b)^2 = a^2 \pm 2ab + b^2$,
 $(a + b)(a - b) = a^2 - b^2$

Product:

$(x + a)(x + b) = x^2 + (a + b)x + ab$

Three terms:

$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$

Cubes: $(a \pm b)^3 = a^3 \pm b^3 \pm 3ab(a \pm b)$

Sum/difference of cubes:

$a^3 \pm b^3 = (a \pm b)(a^2 \mp ab + b^2)$

5 Linear Equations in Two Variables

$ax + by + c = 0$ (a, b not both 0): infinitely many solutions, all on one straight line

$x = a \parallel y$ -axis; $y = b \parallel x$ -axis; intercepts: put $y = 0$, then $x = 0$

A point is on the line exactly when its coordinates satisfy the equation; $y = mx$ passes through the origin

6 Coordinate Geometry

Quadrants I to IV: $(+, +)$, $(-, +)$, $(-, -)$, $(+, -)$
; on the x -axis $y = 0$, on the y -axis $x = 0$

Distance: $AB = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$;
 $OP = \sqrt{x^2 + y^2}$

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

Parallelogram: diagonals share a mid-point;
equidistant point P : $PA^2 = PB^2$

7 Euclid's Geometry

Axioms: things equal to the same thing are equal; equals added to (or taken from) equals give equals; the whole is greater than the part

Postulates: a line through any two points; extend a segment; a circle with any centre and radius; all right angles equal

Postulate 5: interior angles on one side $< 180^\circ$
 $\Rightarrow$ lines meet on that side. Playfair: one parallel through a point not on a line

Measurement: C between $A, B \Rightarrow$
 $AC + CB = AB$; a segment has exactly one mid-point

8 Lines and Angles

Linear pair sums to 180° ; vertically opposite angles are equal; reflex angle of θ is $360^\circ - \theta$

Parallel lines: corresponding and alternate angles equal, co-interior angles sum to 180° (and conversely); $l \parallel m, m \parallel n \Rightarrow l \parallel n$

Angle sum 180° ; exterior angle = sum of the two interior opposite angles; at least two angles of a triangle are acute

9 Triangles – Congruence

Congruence: SSS, SAS, ASA/AAS, RHS (not SSA, not AAA); then CPCT. $\triangle ABC \cong \triangle PQR$:
 $A \leftrightarrow P, B \leftrightarrow Q, C \leftrightarrow R$

Isosceles: equal sides $\Leftrightarrow$ equal opposite angles; median to the base $\perp$ base and bisects the vertex angle

"If P then Q ": converse "if Q then P "; one counterexample disproves

10 Quadrilaterals

Parallelogram: opposite sides/angles equal, diagonals bisect; rhombus diagonals $\perp$; rectangle diagonals equal

Mid-point theorem: $DE \parallel BC, DE = \frac{1}{2}BC$

Centroid divides each median 2 : 1:

$AG = \frac{2}{3}AD, G = (\frac{x_1 + x_2 + x_3}{3}, \frac{y_1 + y_2 + y_3}{3})$

Joining mid-points of any quadrilateral gives a parallelogram, perimeter $AC + BD$, half the area

11 Circles

Chord $2l$ at distance d from the centre:
 $r^2 = l^2 + d^2$

$\perp$ from centre bisects a chord; equal chords $\Leftrightarrow$ equidistant from centre $\Leftrightarrow$ equal angles at centre

Angle at centre = $2 \times$ angle on the remaining arc; angles in the same segment are equal; angle in a semicircle = 90°

Cyclic quadrilateral: $\angle A + \angle C = \angle B + \angle D = 180^\circ$

12 Area and Perimeter

Arc; sector (angle θ°): $l = \frac{\theta}{360} \cdot 2\pi r$,
 $A = \frac{\theta}{360} \cdot \pi r^2$

Heron, $s = \frac{a+b+c}{2}$:

$A = \sqrt{s(s-a)(s-b)(s-c)}$

Inradius; equilateral triangle: $A = rs$;

$A = \frac{\sqrt{3}}{4}a^2$

Brahmagupta (cyclic quad., $s = \frac{a+b+c+d}{2}$):

$A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$

Trapezium; rhombus: $\frac{1}{2}(a+b)h$; $\frac{1}{2}d_1d_2$

13 Surface Area and Volume

Cuboid; cube: $2(lb + bh + hl)$, lbh ; $6a^2$, a^3

Cylinder: $CSA = 2\pi rh$, $TSA = 2\pi r(r + h)$,
 $V = \pi r^2 h$

Cone, $l = \sqrt{r^2 + h^2}$: $CSA = \pi rl$,
 $TSA = \pi r(l + r)$, $V = \frac{1}{3}\pi r^2 h$

Sphere; hemisphere: $4\pi r^2$, $\frac{4}{3}\pi r^3$;
 $2\pi r^2$ ($3\pi r^2$ total), $\frac{2}{3}\pi r^3$

$1 \text{ m}^3 = 1000 \text{ litres}$; scale factor k : areas $\times k^2$, volumes $\times k^3$

14 Statistics

Mean; weighted mean: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$;

$\bar{x}_w = \frac{\sum w_i x_i}{\sum w_i}$

Combined mean of two groups: $\frac{n_1 \bar{x}_1 + n_2 \bar{x}_2}{n_1 + n_2}$

Mixture concentration: $\frac{q_1 c_1 + q_2 c_2}{q_1 + q_2}$

Average speed = total distance $\div$ total time;
100% stacked bars compare proportions, not totals

Median: middle value in order (n even: mean of the two middle values); mode: most frequent value

15 Probability

Experimental: $P(E) = \frac{\text{trials with } E}{\text{total trials}}$

Theoretical (equally likely): $P(E) = \frac{\text{favourable}}{\text{total}}$;
 $P(\text{not } E) = 1 - P(E)$

$0 \leq P \leq 1$; tree diagram: one branch per stage; two coins 4, coin + die 12, two dice 36 outcomes