



CBSE gives no formula booklet: learn every result on this sheet. Organised by NCERT chapter.

1 Real Numbers

Fundamental Theorem of Arithmetic: every composite number is a product of primes, uniquely apart from order

HCF = product of the smallest power of each common prime; LCM = product of the greatest power of each prime

For two positive integers:

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

$\sqrt{2}, \sqrt{3}, \sqrt{5}$ and $\sqrt{p}$ (p prime) are irrational: prove by contradiction ($p \mid a^2 \Rightarrow p \mid a$)

2 Polynomials

Zeros α, β of $ax^2 + bx + c$: $\alpha + \beta = -\frac{b}{a}$, $\alpha\beta = \frac{c}{a}$

Quadratic with zeros α, β :

$$k[x^2 - (\alpha + \beta)x + \alpha\beta]$$

Zeros of $p(x) = x$ -coordinates where $y = p(x)$ meets the x -axis; degree $n \Rightarrow$ at most n zeros

3 Pair of Linear Equations

$$a_1x + b_1y + c_1 = 0, a_2x + b_2y + c_2 = 0$$

Unique solution (lines intersect): $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$

No solution (parallel, inconsistent):

$$\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$$

Infinitely many (coincident): $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$

Solve by substitution or elimination; consistent = at least one solution

4 Quadratic Equations

$$ax^2 + bx + c = 0, a \neq 0: x = \frac{-b \pm \sqrt{D}}{2a}, D = b^2 - 4ac$$

Nature of roots: $D > 0$ two distinct real; $D = 0$ two equal real ($x = -\frac{b}{2a}$); $D < 0$ no real roots

5 Arithmetic Progressions

$$n\text{th term: } a_n = a + (n - 1)d$$

Sum of first n terms:

$$S_n = \frac{n}{2}[2a + (n - 1)d] = \frac{n}{2}(a + l)$$

$$\text{From } S_n: a_n = S_n - S_{n-1}$$

n th term from the end (last term l):

$$l - (n - 1)d$$

Three terms in AP; middle term:

$$a - d, a, a + d; b = \frac{a+c}{2}$$

Natural numbers:

$$1 + 2 + \dots + n = \frac{n(n+1)}{2}$$

6 Triangles

Basic Proportionality Theorem: if $DE \parallel BC$ in $\triangle ABC$: $\frac{AD}{DB} = \frac{AE}{EC}$

Converse: if a line divides two sides in the same ratio, it is parallel to the third side

Similar triangles (AA, SSS, SAS):

corresponding angles equal, corresponding sides in the same ratio

Pythagoras (right angle at B):

$$AC^2 = AB^2 + BC^2$$

7 Coordinate Geometry

Distance:

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

$$OP = \sqrt{x^2 + y^2}$$

Section formula, ratio $m : n$ (internal):

$$\left(\frac{mx_2 + nx_1}{m+n}, \frac{my_2 + ny_1}{m+n} \right)$$

$$\text{Midpoint: } \left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2} \right)$$

Ratio in which a line or axis divides AB :

take $k : 1$ and solve for k

8 Introduction to Trigonometry

Ratios (right $\triangle$): $\sin A = \frac{P}{H}$, $\cos A = \frac{B}{H}$, $\tan A = \frac{P}{B} = \frac{\sin A}{\cos A}$

Reciprocals: $\operatorname{cosec} A = \frac{1}{\sin A}$, $\sec A = \frac{1}{\cos A}$, $\cot A = \frac{1}{\tan A}$

Identities: $\sin^2 A + \cos^2 A = 1$,

$$1 + \tan^2 A = \sec^2 A,$$

$$1 + \cot^2 A = \operatorname{cosec}^2 A$$

$0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ$: $\sin : 0, \frac{1}{2}, \frac{1}{\sqrt{2}}, \frac{\sqrt{3}}{2}, 1$;

$\cos : 1, \frac{\sqrt{3}}{2}, \frac{1}{\sqrt{2}}, \frac{1}{2}, 0$

$\tan$ at the same angles:

$0, \frac{1}{\sqrt{3}}, 1, \sqrt{3}$, not defined

9 Applications of Trigonometry

Height and distance:

$$\tan \theta = \frac{\text{height}}{\text{horizontal distance}}$$

Angle of elevation (looking up) = angle of depression (looking down) between the same two points; use $30^\circ, 45^\circ, 60^\circ$

10 Circles

Tangent $\perp$ radius at the point of contact

Tangents from an external point are equal:

$$PA = PB$$

Length of tangent from P , distance d from centre: $\sqrt{d^2 - r^2}$

Tangents from a point: inside 0, on the circle 1, outside 2

11 Areas Related to Circles

$$\text{Circle: } C = 2\pi r, A = \pi r^2$$

Arc length; sector area (angle θ):

$$l = \frac{\theta}{360^\circ} \times 2\pi r, A = \frac{\theta}{360^\circ} \times \pi r^2$$

Segment: area = sector $- \frac{1}{2}r^2 \sin \theta$

Segment, $\theta = 60^\circ, 90^\circ, 120^\circ$: subtract $\frac{\sqrt{3}}{4}r^2, \frac{1}{2}r^2, \frac{\sqrt{3}}{4}r^2$

Perimeter of sector; ring: $2r + l$;

$$\pi(R^2 - r^2)$$

Minute hand sweeps 6° per minute; hour hand 0.5° per minute

12 Surface Areas and Volumes

Cuboid l, b, h : TSA = $2(lb + bh + hl)$,

$$\text{LSA} = 2h(l + b), V = lbh$$

Cube, edge a : TSA = $6a^2$, $V = a^3$

Cylinder: CSA = $2\pi rh$,

$$\text{TSA} = 2\pi r(r + h), V = \pi r^2 h$$

Cone, $l = \sqrt{r^2 + h^2}$: CSA = πrl ,

$$\text{TSA} = \pi r(l + r), V = \frac{1}{3}\pi r^2 h$$

Sphere: SA = $4\pi r^2$, $V = \frac{4}{3}\pi r^3$

Hemisphere: CSA = $2\pi r^2$, TSA = $3\pi r^2$, $V = \frac{2}{3}\pi r^3$

Combined solids: add only the surfaces you can see; volumes simply add (or subtract)

13 Statistics

Class mark: $x_i = \frac{\text{upper} + \text{lower limit}}{2}$

Mean: direct: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$

Assumed mean, $d_i = x_i - a$:

$$\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$$

Step deviation, $u_i = \frac{x_i - a}{h}$:

$$\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h$$

Mode: $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$

Median: $l + \frac{\frac{n}{2} - cf}{f} \times h$

Empirical relation: $3 \text{ Median} = \text{Mode} + 2 \text{ Mean}$

Mode: l , f_1 of the modal class, f_0, f_2 of the classes before/after. Median: l , f of the median class, cf = cumulative frequency before it.

14 Probability

Classical probability:

$$P(E) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$$

Complement; range: $P(E) + P(\bar{E}) = 1$;

$$0 \leq P(E) \leq 1$$

Sure event 1, impossible event 0;

probabilities of all elementary events add to 1

Cards: $52 = 4 \text{ suits} \times 13$; 26 red, 26 black; 12 face cards. Two dice: 36 outcomes