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FORMULA POSTER

CBSE Class 10 Mathematics

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formula-sheet-cbse10
Interactive version

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 → Write composite numbers as a unique product of prime powers

HCF = product of the smallest power of each common prime; LCM = product of the greatest power of each prime → HCF and LCM by comparing the powers of each prime

For two positive integers: $\text{HCF}(a,b) \times \text{LCM}(a,b) = a \times b$ → A missing HCF or LCM; when two bells next ring together

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

Watch for Show the formula, the substitution and the simplification

2 Polynomials

Zeroes α, β of ax^2+bx+c: $\alpha+\beta = -\frac{b}{a}$, $\alpha\beta = \frac{c}{a}$ → Symmetric expressions such as $\alpha^2+\beta^2$ without finding the zeroes

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Quadratic with zeroes α, β: $k\left[x^2 - (\alpha+\beta)x + \alpha\beta\right]$ → Form a quadratic polynomial from the sum and product of its zeroes

Zeroes of $p(x)$ = x-coordinates where $y = p(x)$ meets the x-axis; degree n ⇒ at most n zeroes → Read the number of zeroes from a graph

3 Pair of Linear Equations

$a_1x + b_1y + c_1 = 0$, $a_2x + b_2y + c_2 = 0$ → Graph a pair of linear equations; read the solution

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Unique solution (lines intersect): $\frac{a_1}{a_2} \neq \frac{b_1}{b_2}$ → Compare $\frac{a_1}{a_2}$, $\frac{b_1}{b_2}$, $\frac{c_1}{c_2}$ to decide one, no or infinitely many solutions

No solution (parallel, inconsistent): $\frac{a_1}{a_2} = \frac{b_1}{b_2} \neq \frac{c_1}{c_2}$ → Decide from the ratios whether a pair is inconsistent

Infinitely many (coincident): $\frac{a_1}{a_2} = \frac{b_1}{b_2} = \frac{c_1}{c_2}$ → Find unknown constants for infinitely many solutions

Solve by substitution or elimination; consistent = at least one solution → Word problems about ages, numbers and speeds

4 Quadratic Equations

$ax^2+bx+c=0$, $a \neq 0$: $x = \frac{-b \pm \sqrt{D}}{2a}$, $D = b^2 - 4ac$ → Solve with the formula, checking the discriminant first

Watch for: Bracket negatives when substituting

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Nature of roots: $D > 0$ two distinct real; $D = 0$ two equal real $\left(x = -\frac{b}{2a}\right)$; $D < 0$ no real roots → The value of k for equal or real roots

5 Arithmetic Progressions

nth term: $a_n = a + (n-1)d$ → Any term of an AP; find a or d from given terms

Watch for: $a_n = a + (n-1)d$: check your formula with $n = 1$

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Sum of first n terms: $S_n = \frac{n}{2}\left[2a + (n-1)d\right] = \frac{n}{2}(a+l)$ → Unknown n, a or d, such as how many terms give 300

From S_n: $a_n = S_n - S_{n-1}$ → Find the nth term from a given sum formula

nth term from the end (last term l): $l - (n-1)d$ → A term counted from the end

Three terms in AP; middle term: $a-d$, a, $a+d$; $b = \frac{a+c}{2}$ → Decide whether a given list forms an AP

Natural numbers: $1 + 2 + \cdots + n = \frac{n(n+1)}{2}$ → Sums of consecutive natural numbers

Watch for Check $a_n = a + (n-1)d$ with $n = 1$

6 Triangles

Basic Proportionality Theorem: if $DE \parallel BC$ in $\triangle ABC$: $\frac{AD}{DB} = \frac{AE}{EC}$ → Unknown lengths when a line is parallel to one side

Converse: if a line divides two sides in the same ratio, it is parallel to the third side → Show a line is parallel to a side from given ratios

Similar triangles (AA, SSS, SAS): corresponding angles equal, corresponding sides in the same ratio → Shadows, heights and ladders with similar triangles

Pythagoras (right angle at B): $AC^2 = AB^2 + BC^2$ → Any right-angled triangle, in 2D or 3D

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7 Coordinate Geometry

Distance: $PQ = \sqrt{(x_2-x_1)^2 + (y_2-y_1)^2}$; $OP = \sqrt{x^2+y^2}$ → Show points are collinear or form a given triangle

Section formula, ratio $m:n$ (internal): $\left(\frac{mx_2+nx_1}{m+n}, \frac{my_2+ny_1}{m+n}\right)$ → A point dividing a segment internally in a given ratio

Midpoint: $\left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$ → Missing vertices of parallelograms: diagonals bisect each other

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Ratio in which a line or axis divides AB: take $k:1$ and solve for k → The ratio in which an axis divides a segment

8 Introduction to Trigonometry

Ratios (right $\triangle$): $\sin A = \frac{P}{H}$, $\cos A = \frac{B}{H}$, $\tan A = \frac{P}{B} = \frac{\sin A}{\cos A}$ → All the ratios when one is given, such as $\sin A = \frac{3}{5}$

Reciprocals: $\text{cosec}\, A = \frac{1}{\sin A}$, $\sec A = \frac{1}{\cos A}$, $\cot A = \frac{1}{\tan A}$ → Write each ratio from a right-angled triangle

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Identities: $\sin^2 A + \cos^2 A = 1$, $1 + \tan^2 A = \sec^2 A$, $1 + \cot^2 A = \text{cosec}^2 A$ → Prove identities from one side to the other

Watch for: Name each identity used and end with "= RHS"

$0°, 30°, 45°, 60°, 90°$: sin : $0, \frac{1}{2}, \frac{1}{\sqrt{2}}, \frac{\sqrt{3}}{2}, 1$; cos : $1, \frac{\sqrt{3}}{2}, \frac{1}{\sqrt{2}}, \frac{1}{2}, 0$ → Evaluate expressions such as $2\sin 30° \cos 60° + \tan^2 45°$

tan at the same angles: $0, \frac{1}{\sqrt{3}}, 1, \sqrt{3}$, not defined → Exact answers from the ratios of standard angles

Watch for Work from one side to the other and end with "= RHS"

9 Applications of Trigonometry

Height and distance: $\tan\theta = \frac{\text{height}}{\text{horizontal distance}}$ → Height of a tower from an angle of elevation

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Angle of elevation (looking up) = angle of depression (looking down) between the same two points; use 30°, 45°, 60° → How far a boat is from the foot of a lighthouse

10 Circles

Tangent ⊥ radius at the point of contact → Use the tangent ⊥ radius result to find angles

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Tangents from an external point are equal: $PA = PB$ → Quadrilaterals and triangles that circumscribe a circle

Length of tangent from P, distance d from centre: $\sqrt{d^2 - r^2}$ → Length of a tangent from the radius and the distance from the centre

Tangents from a point: inside 0, on the circle 1, outside 2 → How many tangents from points inside, on and outside

11 Areas Related to Circles

Circle: $C = 2\pi r$, $A = \pi r^2$ → Circles, sectors, cylinders and compound shapes

Watch for: Square r, use the π given, finish with the unit

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Arc length; sector area (angle θ): $l = \frac{\theta}{360°} \times 2\pi r$, $A = \frac{\theta}{360°} \times \pi r^2$ → Distance moved by a clock hand; areas swept

Segment: area = sector $- \frac{1}{2}r^2 \sin\theta$ → Minor or major segment: sector minus triangle

Segment, $\theta = 60°, 90°, 120°$: subtract $\frac{\sqrt{3}}{4}r^2$, $\frac{1}{2}r^2$, $\frac{\sqrt{3}}{4}r^2$ → Segments for sectors of 60° and 90°

Perimeter of sector; ring: $2r + l$; $\pi(R^2 - r^2)$ → Combined figures with circles, sectors and squares

Minute hand sweeps 6° per minute; hour hand 0.5° per minute → Distance moved by the tip of a clock hand

Watch for Square r, use the π given and finish with the unit

12 Surface Areas and Volumes

Cuboid l, b, h: $\text{TSA} = 2(lb + bh + hl)$, $\text{LSA} = 2h(l+b)$, $V = lbh$ → Surface area and volume of single solids

Cube, edge a: $\text{TSA} = 6a^2$, $V = a^3$ → Surface area and volume of single solids

Cylinder: $\text{CSA} = 2\pi rh$, $\text{TSA} = 2\pi r(r+h)$, $V = \pi r^2 h$ → Surface area and volume of single solids

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Cone, $l = \sqrt{r^2+h^2}$: $\text{CSA} = \pi rl$, $\text{TSA} = \pi r(l+r)$, $V = \frac{1}{3}\pi r^2 h$ → Combined solids, such as a cone on a hemisphere

Sphere: $\text{SA} = 4\pi r^2$, $V = \frac{4}{3}\pi r^3$ → How many small solids can be made from a larger one

Hemisphere: $\text{CSA} = 2\pi r^2$, $\text{TSA} = 3\pi r^2$, $V = \frac{2}{3}\pi r^3$ → Combined solids, such as a cone on a hemisphere

Combined solids: add only the surfaces you can see; volumes simply add (or subtract) → Tents, toys and capsules: which surfaces to include

Watch for Write the formula, square r and give the right unit

13 Statistics

Class mark: $x_i = \frac{\text{upper+lower limit}}{2}$ → Mean of grouped data using class marks

Mean: direct: $\bar{x} = \frac{\sum f_i x_i}{\sum f_i}$ → Mean of grouped data by the direct method

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Assumed mean, $d_i = x_i - a$: $\bar{x} = a + \frac{\sum f_i d_i}{\sum f_i}$ → Mean of grouped data by the assumed-mean method

Step deviation, $u_i = \frac{x_i - a}{h}$: $\bar{x} = a + \frac{\sum f_i u_i}{\sum f_i} \times h$ → Mean of grouped data by step deviation

Mode: $l + \frac{f_1 - f_0}{2f_1 - f_0 - f_2} \times h$ → Mode of grouped data from the modal class

Watch for: Modal class: the highest frequency

Median: $l + \frac{\frac{n}{2} - cf}{f} \times h$ → Median from the cumulative frequency table

Watch for: Median class: the first $cf \geq \frac{n}{2}$

Empirical relation: $3\,\text{Median} = \text{Mode} + 2\,\text{Mean}$ → One measure of central tendency from the other two

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.

Watch for Median class: first $cf \geq \frac{n}{2}$; modal class: highest frequency

14 Probability

Classical probability: $P(E) = \frac{\text{favourable outcomes}}{\text{total outcomes}}$ → Probability from equally likely outcomes

Watch for: List equally likely outcomes first, then count favourable ones

Complement; range: $P(E) + P(\bar{E}) = 1$; $0 \leq P(E) \leq 1$ → Complementary, sure and impossible events

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Sure event 1, impossible event 0; probabilities of all elementary events add to 1 → Complementary, sure and impossible events

Cards: 52 = 4 suits × 13; 26 red, 26 black; 12 face cards. Two dice: 36 outcomes → Probabilities with a deck of 52 cards or two dice

Watch for Count equally likely outcomes before favourable ones

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