

CLASS 8

MATHS

FORMULAS HANDBOOK

Class 8 Maths Formulas Handbook (Chapter-wise)

Chapter-wise formulas and key results for Class 8 Mathematics (Ganita Prakash), updated as each chapter is added.

Contents

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Chapter 1: A Square and A Cube

Square of n : $n^2 = n \times n$. Perfect square condition (prime factorisation): every prime's exponent is even.

Cube of n : $n^3 = n \times n \times n$. Perfect cube condition (prime factorisation): every prime's exponent is a multiple of 3.

Numbers between n^2 and $(n+1)^2$: $2n$.

Sum of first n consecutive odd numbers: $1+3+5+\dots+(2n-1) = n^2$.

n th run of n consecutive odd numbers sums to n^3 (e.g. $7+9+11 = 3^3$).

Trailing zeros: squares always have an even number of trailing zeros; cubes always have a multiple-of-3 number of trailing zeros.

Last-digit rule for cube roots: $1 \rightarrow 1$, $8 \rightarrow 2$, $7 \rightarrow 3$, $4 \rightarrow 4$, $5 \rightarrow 5$, $6 \rightarrow 6$, $3 \rightarrow 7$, $2 \rightarrow 8$, $9 \rightarrow 9$ (last digit of n maps to last digit of n^3 , and vice versa for the cube root).

$(a+1)^2$ shortcut: $(a+1)^2 = a^2 + 2a + 1$.

Chapter 2: Power Play

Product rule: $a^m \times a^n = a^{m+n}$

Quotient rule: $a^m \div a^n = a^{m-n}$ ($a \neq 0$)

Power of a power: $(a^m)^n = a^{mn}$

Power of a product/quotient: $a^m \times b^m = (ab)^m$; $a^m \div b^m = (a \div b)^m$

Zero exponent: $a^0 = 1$ ($a \neq 0$)

Negative exponent: $a^{-n} = 1/a^n$

Standard form: $x \times 10^y$, where $1 \leq x < 10$

See full [Chapter 2 Solutions](#)

Chapter 3: A Story of Numbers

Landmark numbers of a base- n system: $n^0=1$, n , n^2 , n^3 ...

Place-value system: a symbol's position determines its value (e.g. Mesopotamian base-60, Hindu base-10)

Zero: acts as a placeholder AND a number, resolving the ambiguity of additive/landmark systems

Any number can be converted to any base by repeated division and taking remainders

See full [Chapter 3 Solutions](#)

Chapter 4: Quadrilaterals

Angle sum of a quadrilateral = 360 degrees

Rectangle: diagonals equal and bisect each other

Square: diagonals equal, bisect each other, perpendicular, bisect vertex angles

Rhombus: diagonals perpendicular bisectors of each other (not necessarily equal)

Kite: one diagonal is perpendicular bisector of the other (adjacent sides equal, not opposite)

Trapezium: co-interior angles on the parallel sides sum to 180 degrees

See full [Chapter 4 Solutions](#)

Chapter 5: Number Play

Divisibility by 9: digit sum divisible by 9

Divisibility by 11: alternating digit-sum difference is 0 or a multiple of 11

Digital root: repeatedly sum digits until one digit remains; equals remainder mod 9 (digital root 9 = remainder 0)

Product of n consecutive integers is always divisible by n! (2 consec: div by 2, 3 consec: div by 6, 4 consec: div by 24, 5 consec: div by 120)

Numbers leaving remainder r on division by d: general form $dn+r$

See full [Chapter 5 Solutions](#)

Chapter 6: We Distribute, Yet Things Multiply

Distributive property: $a(b+c) = ab+ac$ — expands any product of multi-term expressions term by term

Identity 1A: $(a+b)^2 = a^2+2ab+b^2$

Identity 1B: $(a-b)^2 = a^2 - 2ab + b^2$; also $(a-b)^2 = (b-a)^2$ always

Identity 1C: $(a+b)(a-b) = a^2 - b^2$ — used for fast mental multiplication of numbers equidistant from a round number

General pattern: $(a-b)(a^n + a^{n-1}b + \dots + b^n) = a^{n+1} - b^{n+1}$

$2(a^2 + b^2) = (a+b)^2 + (a-b)^2$ — holds for integers, negatives and fractions alike

See full [Chapter 6 Solutions](#)

Chapter 7: Proportional Reasoning-1

Ratio: $a:b = a/b$; must express both terms in the same unit before comparing

Proportion: $a:b::c:d$ is true when $a \times d = b \times c$ (cross products equal)

Simplest form: divide both terms of a ratio by their HCF

Rule of Three (unitary method): find the value for one unit first, then scale to the required amount

Direct proportion: ratio between the two quantities stays constant as both increase together

Inverse proportion: product of the two quantities stays constant (one increases as the other decreases) — e.g. speed $\times$ time = fixed distance

Sharing in ratio $a:b$: divide total into $(a+b)$ equal parts, then give a parts and b parts respectively

See full [Chapter 7 Solutions](#)

Chapter 8: Fractions in Disguise

Percentage: $x\% = x/100$ of a quantity.

$x\% \text{ of } y = y\% \text{ of } x = xy/100$.

Profit%/Loss% = (Profit or Loss / CP) $\times$ 100.

Discount: $SP = MP \times (1 - \text{discount}\%/100)$.

Successive % changes multiply as factors, not add.

Simple Interest: $SI = P \times r \times t / 100$.

Compound Interest: Amount = $P(1 + r/100)^t$.

GST/tax: Final price = Price $\times (1 + \text{GST}\%/100)$.

Reverse percentage: Original = Final / $(1 \pm r/100)$.

See full [Chapter 8 Solutions](#).

Chapter 9: The Baudhayana-Pythagoras Theorem

Baudhayana-Pythagoras theorem: $(\text{hypotenuse})^2 = (\text{leg } 1)^2 + (\text{leg } 2)^2$.

Isosceles right triangle: $\text{hypotenuse} = \text{side} \times \sqrt{2}$.

Baudhayana (Pythagorean) triple: (a, b, c) with $a^2 + b^2 = c^2$.

Primitive triple: $\text{HCF}(a, b, c) = 1$, e.g. $(3, 4, 5)$, $(5, 12, 13)$, $(8, 15, 17)$.

Odd-square method: for odd n , $(n, (n^2-1)/2, (n^2+1)/2)$ is a primitive triple.

Hypotenuse is always the longest side of a right triangle.

Lattice-grid square rule: area x is possible exactly when $x = p^2 + q^2$ for integers p, q .

Area of equilateral triangle (side a) via altitude: $(\sqrt{3}/4) \times a^2$.

See full [Chapter 9 Solutions](#).

Chapter 10: Proportional Reasoning 2

Dividing a whole in a ratio: $\text{each share} = (\text{part's ratio number} / \text{sum of ratio numbers}) \times \text{total}$.

Pie chart angle for a category = $(\text{category count} / \text{total count}) \times 360$ degrees.

Direct proportion: $x/y = \text{constant}$. Inverse proportion: $x \text{ times } y = \text{constant}$.

Test for inverse proportion: check $x_1y_1 = x_2y_2 = x_3y_3 \dots$ for every pair.

Common inverse cases: workers vs days, taps vs fill-time, speed vs time (fixed distance), machines vs days.

Common direct cases: quantity bought vs price (fixed rate), pages vs reading time (fixed speed).

Combined work rate = sum of individual rates ($1/\text{time each}$); total time = $1 / \text{combined rate}$.

See full [Chapter 10 Solutions](#).

Chapter 11: Exploring Some Geometric Themes

Fractal: a shape built by repeating the same rule at smaller scales (Sierpinski Triangle, Sierpinski Carpet, Koch Snowflake).

Sierpinski Triangle holes at step $n = (3^n - 1)/2$. Area remaining = $(3/4)^n \times \text{original}$.

Koch Snowflake sides at step $n = 3 \times 4^n$. Perimeter = $3 \times (4/3)^n \times$ original side (grows without bound).

Cube has exactly 11 distinct nets.

Prism (n-sided base): Faces = $n+2$, Edges = $3n$, Vertices = $2n$.

Pyramid (n-sided base): Faces = $n+1$, Edges = $2n$, Vertices = $n+1$.

Euler's formula: Vertices – Edges + Faces = 2 for any convex polyhedron.

Cylinder net = rectangle ($2\pi r \times h$) + 2 circles of radius r . Cone net = sector (arc = $2\pi r$) + 1 circle of radius r .

See full [Chapter 11 Solutions](#).

Chapter 12: Tales by Dots and Lines

Mean = (sum of all values) / (number of values)

Mean of first n natural numbers = $(n+1)/2$; Mean of first n odd numbers = n

Median: middle value when data is sorted (odd count); average of two middle values (even count)

Adding a value above the mean raises the mean; adding a value below the mean lowers it. Median shifts only if the new value affects the middle position.

Combined mean of two groups is NOT simply the average of their means unless the groups are equal-sized — must weight by group size.

Mean is sensitive to outliers; median is more robust to extreme values (e.g. skewed salary data).

Dot plots and line graphs are used to visualise and interpret data trends.

See full [Chapter 12 Solutions](#).

Chapter 13: Algebra Play

“Think of a number” tricks: represent the number as x ; multiply/add/divide steps cancel the x -term, leaving a fixed constant.

3-row pyramid (bottom a, b, c): top = $a+2b+c$. 4-row pyramid (bottom a, b, c, d): top = $a+3b+3c+d$ (Pascal's triangle coefficients).

Virahanka-Fibonacci pyramid rule: if the first n Fibonacci numbers form the bottom row of an n -row pyramid, the top is the $(2n-1)$ th Fibonacci number.

3×3 grid sum = $9 \times$ centre value; 1×3 strip sum = $3 \times$ middle value.

Largest product (2-digit $\times$ 1-digit from 3 given digits): largest digit as the multiplier, remaining two digits in descending order.

Divisibility tricks: 2-digit number minus reverse $\div 9$; plus reverse $\div 11$; 3-digit number + 2 cyclic rotations $\div 37$ (and 3); 3-digit number repeated as 6 digits $\div 1001$ ($=7 \times 11 \times 13$).

See full [Chapter 13 Solutions](#).

Chapter 14: Area (final Class 8 Maths chapter)

Rectangle: Area = $l \times b$. Square: Area = side^2 . Triangle: Area = $\frac{1}{2} \times \text{base} \times \text{height}$.

Parallelogram: Area = base $\times$ perpendicular height (not the slant side).

Rhombus: Area = $\frac{1}{2} \times d_1 \times d_2$. Trapezium: Area = $\frac{1}{2} \times (\text{sum of parallel sides}) \times \text{height}$.

Regular hexagon: Area = $(3\sqrt{3}/2) \times \text{side}^2$. Equilateral triangle: Area = $(\sqrt{3}/4) \times \text{side}^2$.

Scaling rule: linear dimensions scaled by $k \rightarrow$ area scales by k^2 .

Path/border area = outer area – inner area; uniform border of width d around $l \times w$: Area = $2d(l+w)+4d^2$.

Midpoint triangle theorem: joining midpoints of two sides creates a triangle with $\frac{1}{4}$ the area.
Varignon parallelogram: midpoints of any quadrilateral form a parallelogram with half its area.

Unit conversions: 1 in = 2.54 cm; 1 ft^2 = 144 in^2 ; 1 km^2 = 1,000,000 m^2 .

See full [Chapter 14 Solutions](#).

This completes the Class 8 Maths Formulas Handbook (Chapters 1–14).