Number line, natural numbers, whole numbers, integers, rational numbers, irrational numbers, quotient, representation, recurring, terminating, decimal expansion, co-prime, Pythagoras, Pythagoreans, Hippacus, Croton, ratio, circumference, spiral, non-terminating, square root, cube root, nth root, radical sign, associative, commutative, distributive, rationalise, real number, Theodorus, Cyrene, Dedekind, Cantor, Sulbasutras, approximation, exponential, exponent, laws of exponents, identity, symmetrical, geometrically, construction, denominator, numerator, contradiction, visualisation, arithmetic, decimal representation, simplification, irrationality, reciprocals, representation, irrational expansion, simplification, justification

9th, Maths (1)

Number Systems

Topic	Formula / Rule
Definition	A number r is rational if it can be written as p/q, where p and q are integers and $q \neq 0$
Definition	A number is irrational if it cannot be written as p/q where p, q are integers and $q \neq 0$
Decimal Expansion	Terminating if remainder becomes 0
Decimal Expansion	Non-terminating recurring if remainder repeats
Irrational Number	Decimal expansion is non-terminating and non-recurring
Real Numbers	Real numbers = Rational numbers + Irrational numbers
Square Root	$\sqrt{a} = b$ means $b^2 = a$ and $b > 0$
Identities	$\sqrt{ab} = \sqrt{a} \times \sqrt{b}$
Identities	$\sqrt{(a/b)} = \sqrt{a} / \sqrt{b}$
Identities	$(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b$
Identities	$(a + b)^2 = a^2 + 2ab + b^2$
Rationalisation	Multiply numerator and denominator by the conjugate of the denominator
Exponent Laws	$a^m \times a^n = a^{(m+n)}$
Exponent Laws	$(a^m)^n = a^{(m \times n)}$
Exponent Laws	$a^0 = 1$
Exponent Laws	$a^{(-m)} = 1 / a^m$
Exponent Laws	$a^p \times b^p = (a \times b)^p$
Root Form	$a^{(1/n)} = \sqrt[n]{a}$
General Exponent Form	$a^{(m/n)} = \sqrt[n]{(a^m)} = (\sqrt[n]{a})^m$

polynomial, terminology, variable, expression, coefficient, exponent, monomial, binomial, trinomial, constant, degree, linear, quadratic, cubic, zero, root, identity, algebraic, factorisation, remainder, theorem, real, situation, denote, factor, expanded, substitution, rearranging, simplification, verification, computation, observe,

evaluation, application, simplification, equation, product, solution, convention, defined, algebra, identities, factorise, substitution, representation, classification, standardised, middle term, splitting method, zero polynomial, expression, dimension, volume, identity, expanded form.

9th, Maths (2)

Polynomials

Topic	Formula
Algebraic Identities	$(x + y)^2 = x^2 + 2xy + y^2$
Algebraic Identities	$(x - y)^2 = x^2 - 2xy + y^2$
Algebraic Identities	$x^2 - y^2 = (x + y)(x - y)$
Algebraic Identities	$(x + a)(x + b) = x^2 + (a + b)x + ab$
Algebraic Identities	$(x + y + z)^2 = x^2 + y^2 + z^2 + 2xy + 2yz + 2zx$
Algebraic Identities	$(x + y)^3 = x^3 + y^3 + 3xy(x + y)$
Algebraic Identities	$(x - y)^3 = x^3 - y^3 - 3xy(x - y)$
Algebraic Identities	$x^3 + y^3 + z^3 - 3xyz = (x + y + z)(x^2 + y^2 + z^2 - xy - yz - zx)$
Standard Form	$p(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_1 x + a_0$
Linear Polynomial	$ax + b = 0 \Rightarrow x = -b/a$
Quadratic Polynomial	$ax^2 + bx + c$
Cubic Polynomial	$ax^3 + bx^2 + cx + d$
Zero of a Polynomial	$p(c) = 0 \Rightarrow c$ is a zero of $p(x)$
Factor Theorem	If $p(a) = 0$, then $(x - a)$ is a factor of $p(x)$
Splitting the Middle Term	$ax^2 + bx + c = (px + q)(rx + s)$, where $pr = a$, $qs = c$, and $ps + qr = b$

Coordinate Geometry

Mercator, Equators, Tropics, Meridian, conventional, precisely, perpendicular, coordinate, Cartesian, philosopher, René Descartes, latitude, longitude, origin, quadrant, abscissa, ordinate, intersection, horizontal, vertical, axes, quadrant, coordinates, uniquely, anticlockwise, positive, negative, convention, rectangular, cross-street, model, axis, distance, system, graph, plane, location, observer, distance, representation, unit, real number, number line, form, notation.

Coordinate Geometry

Formula Name	Formula
Coordinates of a point	(x, y)
Abscissa	x = Distance from y-axis
Ordinate	y = Distance from x-axis
Coordinates on x-axis	(x, 0)
Coordinates on y-axis	(0, y)
Coordinates of origin	(0, 0)
1st Quadrant	(+, +)
2nd Quadrant	(-, +)
3rd Quadrant	(-, -)
4th Quadrant	(+, -)
Coordinate order	(x, y) ≠ (y, x) unless x = y

Linear Equations in Two Variables

Analytic, exhibit, unique, represent, Cartesian, variables, customary, equation, respectively, denote, root, reduced, expression, infinitely, inspection, substituted, solution, ordered, corresponding, simultaneously, interpretation, consistently, verification, substituted,

demonstration, particular, required, interpretation, satisfy, reduces, reduces, obtain, instance, simplifies, graphical, plotted, pattern, consistent, identity, visualization, understand, representation, comparison, construct, convenient, proportion, accurate, numerical

9th, Maths (4)	Linear Equations in Two Variables
Formula/Concept	**Expression**
Standard form of linear equation in two variables	$ax + by + c = 0$
Solution is a pair (x, y) that satisfies the equation	Substitute x and y into the equation
To find solution: choose x, solve for y	e.g., $2x + 3y = 12 \Rightarrow$ choose $x = 0 \Rightarrow y = 4$
To convert any linear equation to standard form	Rearrange to $ax + by + c = 0$
Number of solutions	Infinitely many
Example: $2x = y$	$2x - y + 0 = 0$
Graph of linear equation	A straight line
Every point on the line is a solution	Each (x, y) on the line satisfies $ax + by + c = 0$

Geometry, metrein, civilisation, constructions, granaries, truncated, isosceles, subsidiary, mensuration, kiln, Sulbasutras, altars, vedis, trapeziums, sriyantra, interwoven, unsystematic, deductive, treatise, abstract, breadthless, dimension, coincide, axioms, postulates, plane, surface, common notions, magnitude,

superposition, terminated, segment, equilateral, theorem, proposition, construct, unique, consistent, contradict, proving, deduce, radius, assumption, validity, universal truths, proof, statement, principle, concept, physical models, mid-point, intersect, rigorous, notion

9th, Maths (5)

Introduction to Euclid's Geometry

Formula / Statement	Use / Explanation
AB + BC = AC (when B lies between A and C)	Used in proving the concept of segment addition
Things which are equal to the same thing are equal to one another	Basic axiom used in many logical proofs
If equals are added to equals, the wholes are equal	Used in arithmetic and geometric additions
If equals are subtracted from equals, the remainders are equal	Used in subtractions in logical proofs
Things which coincide with one another are equal to one another	Used for justification of superposition
The whole is greater than the part: $A = B + C \Rightarrow A > B$	Defines comparison between parts and wholes
Things which are double of the same things are equal to one another	Used to compare doubles of equal quantities
Things which are halves of the same things are equal to one another	Used to compare halves of equal quantities
Two distinct lines cannot have more than one point in common	Used in uniqueness of intersection
AC = ½ AB (if C is the midpoint of AB)	Mid-point formula of a line segment
If AB = AC and AB = BC ⇒ AB = BC = AC (Equilateral triangle sides)	Used in construction of equilateral triangle

Lines and Angles

line, angle, intersect, parallel, axioms, statements, deductive, reasoning, plane, surfaces, architect, multistoried, refraction, diagram, medium, directed, segments, horizontal, vertex, acute, obtuse, straight, reflex, complementary, supplementary, adjacent, non-common, arms, linear pair, vertically opposite, collinear, non-collinear, perpendicular, transversal, corresponding, converse, bisector, conclusion,

theorem, measure, interior, alternate, quadrilateral, inclination, extensions, reflected, incidence, layout, verification, construction, direction, orientation, bisects, proportion, alternate, extension, equality, properties, geometry, activity, examination, notation, expression, figure, transformation, tower, height, layout, exhibition.

9th, Maths (6)

Lines and Angles

Topic	Formula / Theorem / Axiom	Explanation
Linear Pair Axiom	$\angle AOC + \angle BOC = 180^\circ$	If a ray stands on a line, the sum of adjacent angles is 180°
Converse of Linear Pair Axiom	If $\angle 1 + \angle 2 = 180^\circ$, then they form a linear pair	The non-common arms form a straight line
Vertically Opposite Angles	$\angle AOC = \angle BOD$	When two lines intersect, opposite angles are equal
Complementary Angles	$\angle 1 + \angle 2 = 90^\circ$	Sum of two angles is 90°
Supplementary Angles	$\angle 1 + \angle 2 = 180^\circ$	Sum of two angles is 180°
Sum of Angles around a Point	$\angle POQ + \angle QOR + \angle SOR + \angle POS = 360^\circ$	Sum of angles around a point is 360°
Angles on Straight Line	$\angle A + \angle B = 180^\circ$	Sum of angles on straight line is 180°
Parallel Lines – Corresponding Angles	$\angle 1 = \angle 2$	If two lines are parallel, corresponding angles are equal
Parallel Lines – Alternate Angles	$\angle 3 = \angle 4$	If two lines are parallel, alternate interior angles are equal
Parallel Lines – Interior Angles	$\angle 5 + \angle 6 = 180^\circ$	Interior angles on the same side of transversal are supplementary
Converse of Corresponding Angles Axiom	If $\angle 1 = \angle 2$, then lines are parallel	Used to prove lines are parallel

Triangles

congruence, congruent, depressions, correspondence, equilateral, transversal, vertically, opposite, sufficient, axiom, perpendicular, bisector, equidistant, construction, assumption, contradiction, converse, isosceles, intersection, altitudes, included, criteria, properties, inequalities, midpoint,

justification, symmetry, symbolically, criterion, RHS, SSS, ASA, SAS, AAS, theorem, appendix, common, proven, CPCT, equilateral, symbolic, assumption, activity, verification, halves, equalities, coincides, perpendiculars, construction, equidistant.

9th, Maths (7)	Triangles
Formula/Theorem	Description
SAS Congruence Rule	If two sides and the included angle of one triangle are equal to two sides and the included angle of another triangle, then the triangles are congruent.
ASA Congruence Rule	If two angles and the included side of one triangle are equal to two angles and the included side of another triangle, then the triangles are congruent.
AAS Congruence Rule	If two angles and a non-included side of one triangle are equal to two angles and the corresponding non-included side of another triangle, then the triangles are congruent.
SSS Congruence Rule	If three sides of one triangle are equal to three sides of another triangle, then the triangles are congruent.
RHS Congruence Rule	In two right-angled triangles, if the hypotenuse and one side of one triangle are equal to the hypotenuse and one side of another triangle, then the triangles are congruent.
Theorem 7.2	Angles opposite to equal sides of an isosceles triangle are equal.
Theorem 7.3	Sides opposite to equal angles of a triangle are equal.
Property of Equilateral Triangle	Each angle of an equilateral triangle is 60°.

quadrilaterals, parallelogram, diagonal, congruent, transversal, alternate angles, theorem, converse, intersecting, interior angles, linear pair, isosceles triangle, bisects, exterior angle, rhombus, perpendicular, rectangle, vertically opposite, parallelogram bisect, angle sum property, intercepts, mid-point theorem, trapezium, congruence, angle bisector, opposite sides, opposite angles, transversals, line segment, symmetry, corresponding parts, triangle properties, reasoning, justification, CPCT (corresponding parts of congruent triangles), ASA rule, SSS rule.

9th, Maths (8)

Quadrilaterals

Formula / Theorem	Expression
A diagonal of a parallelogram divides it into two congruent triangles	$\Delta ABC \cong \Delta CDA$
In a parallelogram, opposite sides are equal	$AB = CD$ and $AD = BC$
In a parallelogram, opposite angles are equal	$\angle A = \angle C$ and $\angle B = \angle D$
Diagonals of a parallelogram bisect each other	$AO = OC$ and $BO = OD$
If in a quadrilateral, each pair of opposite sides is equal, then it is a parallelogram	If $AB = CD$ and $AD = BC \Rightarrow ABCD$ is a parallelogram
If in a quadrilateral, each pair of opposite angles is equal, then it is a parallelogram	If $\angle A = \angle C$ and $\angle B = \angle D \Rightarrow ABCD$ is a parallelogram
If diagonals of a quadrilateral bisect each other, then it is a parallelogram	$AO = OC$ and $BO = OD \Rightarrow ABCD$ is a parallelogram
Each angle of a rectangle is a right angle	$\angle A = \angle B = \angle C = \angle D = 90°$
Diagonals of a rhombus are perpendicular bisectors of each other	Diagonals intersect at 90°
Mid-point theorem	$EF \parallel BC$ and $EF = 1/2\ BC$
Converse of mid-point theorem	If $EF \parallel BC$ and E is midpoint of AB $\Rightarrow$ F is midpoint of AC
Diagonals of a rectangle are equal and bisect each other	$AC = BD$ and $AO = OC$, $BO = OD$
Diagonals of a square bisect each other at right angles and are equal	$AC = BD$, $AO = OC$, $BO = OD$, $\angle AOB = 90°$

Subtended, congruent, corresponding, bisects, perpendicular, chord, converse, coincide, equidistant, intersecting, semicircle, reflex angle, diameter, segment, concyclic, cyclic quadrilateral, peculiar, diagonals, trapezium, parallelogram, internal angle bisectors, superimpose, illustrate, complementary, verify, assumed, hypothesis, infer, neglecting, extension, external, radii, interior, opposite, symmetrical, sum property, isosceles, triangle, right angle, equal chords, tracing paper, construct, property, definition, geometry, theorem, proof, justify, centres, length, circle, plane, angle, line segment, common, points, activity, observation, measurement, exercise, solution.

9th, Maths (9) Circles

Theorem/Property	Description	Formula/Expression
Theorem 9.1	Equal chords of a circle subtend equal angles at the centre	If AB = CD, then $\angle AOB = \angle COD$
Theorem 9.2	Chords subtending equal angles at the centre are equal	If $\angle AOB = \angle COD$, then AB = CD
Theorem 9.3	Perpendicular from centre to chord bisects the chord	If $OM \perp AB$, then AM = MB
Theorem 9.4	Line from centre bisecting a chord is perpendicular to the chord	If OM bisects AB, then $OM \perp AB$
Theorem 9.5	Equal chords are equidistant from the centre	If AB = CD, then OM = ON
Theorem 9.6	Chords equidistant from the centre are equal	If OM = ON, then AB = CD
Arc-Chord Relation	Equal chords make congruent arcs and vice versa	AB = CD $\Leftrightarrow$ arc AB $\cong$ arc CD
Angle Subtended by Arc	Angle at centre is double angle at any point on the circle	$\angle POQ = 2\angle PAQ$
Theorem 9.8	Angles in the same segment are equal	$\angle PAQ = \angle PCQ$
Angle in Semicircle	Angle in a semicircle is a right angle	If PQ is diameter, then $\angle PRQ = 90°$
Theorem 9.9	Equal angles on same side of segment implies cyclic	If $\angle ACB = \angle ADB$, then A, B, C, D lie on a circle
Theorem 9.10	Sum of opposite angles of cyclic quadrilateral is 180°	$\angle A + \angle C = 180°$, $\angle B + \angle D = 180°$
Theorem 9.11	Quadrilateral with opposite angles summing to 180° is cyclic	If $\angle A + \angle C = 180°$, then ABCD is cyclic

Heron, scalene, perimeter, semi-perimeter, hypotenuse, equilateral, isosceles, mensuration, specialised, quadrilaterals, trapezoids, polygon, cylinder, cone, sphere, geometrical, triangular, base, applied mathematics,

encyclopedic, verify, triangular park, fencing, barbed wire, perimeter, planted, hired, advertisements, earnings, slide, message, painted, yield, ratio, plot, substituted, derived, approximate, expression, simplified.

Heron’s Formula

Formula Name	Formula	Where
Heron's Formula	Area = $\sqrt{[s(s - a)(s - b)(s - c)]}$	s = (a + b + c) / 2, a, b, c are sides of the triangle
Semi-perimeter	s = (a + b + c) / 2	a, b, c are the sides of the triangle
Area of Triangle with Base and Height	Area = (1/2) × base × height	Applicable when height is known
Perimeter of Triangle	Perimeter = a + b + c	a, b, c are the sides of the triangle
Cost of Fencing	Cost = Rate per metre × (Perimeter – Gate length)	Used in real-life application examples

Surface Areas and Volumes

congruent, prism, pyramids, perpendicular, slant, circumference, approximately, diameter, stitching, wastage, tomb, hemisphere, circumference, diameter, encloses, capacity, ratio, revolved, diameter, canvas, displaced, graduated, density, volume, metallic, trough, measuring, spherical, shot-putt, capacity, truncated, assumed, overlapping, hemisphere,

surface area, curved, summary, hemispherical, motorcyclist, whitewashing, circumference, tent, enclosed, corn cob, triangular, sand, conical, capacity, experiment, solid, practical, activity, derive, formulation, applicable, respectively, calculated, obtained, spherical, metallic, displaced, density, measurement.

Surface Areas and Volumes

Topic	Formula Type	Formula
Cone	Curved Surface Area	πrl
Cone	Total Surface Area	$\pi rl + \pi r^2 = \pi r(l + r)$
Cone	Volume	$(1/3)\pi r^2 h$
Cone	Slant Height	$l = \sqrt{(r^2 + h^2)}$
Sphere	Surface Area	$4\pi r^2$
Sphere	Volume	$(4/3)\pi r^3$
Hemisphere	Curved Surface Area	$2\pi r^2$
Hemisphere	Total Surface Area	$3\pi r^2$
Hemisphere	Volume	$(2/3)\pi r^3$

graphical representation, comparisons, individual items, bar graphs, histograms, frequency polygons, pictorial representation, uniform width, equal spacing, variable, vertical axis, expenditures, entertainment, miscellaneous, frequency distribution, continuous class intervals, class interval, suitable scale, maximum frequency, rectangular bars, solid figure, grouped frequency distribution, proportional, varying widths, misleading picture, modified lengths, proportionate, class-size, frequency polygon, adjacent rectangles, mid-points, congruent triangles, imaginary class-interval, class-mark, class preceding, class succeeding, cost of living index, plotting, class-marks, large data, survey, organisation, reproductive, neuropsychiatric, cardiovascular, respiratory, backward districts, scheduled caste, histogram, cricket match, surname, frequency table, intervals, random survey, telephone directory.

Topic	Formula
Class-mark	(Upper limit + Lower limit) / 2
Adjusted Height for Histogram with Varying Widths	Height = (Frequency / Class width) × Smallest class width