

# Mathematics

## Class IX (2026 – 27)

### Introduction:

The Mathematics curriculum for the Secondary stage has been redesigned in alignment with the National Education Policy 2020 and the National Curriculum Framework for School Education (NCF – SE) 2023, prioritizing deep conceptual understanding and logical reasoning. The revised syllabus places strong emphasis on developing core mathematical competencies, including problem-solving, visualisation, mathematical modelling, mathematical communication, computational thinking, and data analytics. The syllabus integrate Indian Knowledge System with contemporary mathematical knowledge, highlighting the rich contributions of Indian mathematicians to foster a sense of pride and historical context. A deliberate shift from rote learning to competency-based education ensures that students build deep conceptual understanding and logical reasoning rather than mere procedural fluency. Greater emphasis has been laid on the integration of real-life applications and experiential learning, encouraging students to connect mathematical concepts with everyday situations and cross-disciplinary contexts. Greater emphasis has been laid on competency based learning outcomes encouraging students to connect mathematical concepts with everyday situations and inter-disciplinary contexts. Continuous and holistic assessment through projects, activities, and investigations forms an integral part of the learning process, moving beyond summative examinations.

At the secondary stage, the curriculum focuses on developing essential global mathematical competencies, including mathematical representation through quantities and relations, mathematical modelling and algorithm building, and effective mathematical communication. The study of the number system, algebra, geometry, mensuration, statistics and probability is designed to build a strong foundation for higher education while enhancing functional life skills. The curriculum thus aims to build rich mathematical learning frameworks not only for higher academic pursuits but also for the practical demands of life in a rapidly changing, data-driven world.

**Objectives:** The broad objectives of teaching Mathematics at the secondary stage are to help the learners to:

- develop logical thinking, critical reasoning, and a structured approach to problem-solving;
- build the ability to recognise, analyse, and solve diverse problems with confidence and adaptability;
- communicate mathematical ideas effectively using appropriate language, symbols, and representations;
- appreciate the beauty, history, and real-life relevance of Mathematics as a discipline;
- connect mathematical concepts to fields such as Science, Technology, Engineering, and Economics;
- engage in both collaborative and independent mathematical exploration and learning;
- develop habits of precision, accuracy, and logical consistency in mathematical work;
- build confidence to explore, experiment, and grow in mathematical understanding without fear of failure.

## Curricular Goals (CGs) and Competencies (Cs) from the NCF-SE 2023

**CG-1: Understands numbers (natural, whole, integer, rational, irrational, and real), ways of representing numbers, relationships amongst numbers, and number sets.**

C-1.1 Develops understanding of numbers, including the set of real numbers and its properties.

**CG-2: Builds deductive and inductive logic to prove theorems related to numbers and their relationships (such as '2 is an irrational number', a recursion relation for *Virahanka* numbers, a formula for the sum of the first  $n$  square numbers).**

C-2.1 Understanding of powers (radical powers) and exponents.

**CG-3: Discovers and proves algebraic identities and models real-life situations in the form of equations to solve them.**

C-3.1 States and proves remainder theorem, factor theorem, and division algorithm.

C-3.2 Models and solves contextualised problems using equations (for example, simultaneous linear equations in two variables or single polynomial equations), and draws conclusions about a situation being modelled.

C-3.3 Learns Brahmagupta's quadratic formula (in both symbolic and poetic form) and its derivation, and uses it to solve some of the poetic puzzles of Bhaskara as well as modern-day problems.

**CG-4: Analyses characteristics and properties of two-dimensional geometric shapes, and develops mathematical arguments to explain geometric relationships.**

C-4.1 Describes relationships including congruence of two-dimensional geometric shapes (such as lines, angles, triangles) to make and test conjectures and solve problems.

C-4.2 Proves theorems using Euclid's axioms and postulates for triangles and quadrilaterals, and applies them to solve geometric problems.

C-4.3 Proves theorems about the geometry of a circle, including its chords, subtended angles, inscribed polygons, and area in terms of pi.

C-4.4 Understands the irrationality of pi, the best approximations to be discovered over human history, and the first exact formula (infinite series) for pi given by Madhava.

C-4.5 Specifies locations and describes spatial relationships using coordinate geometry, for example, plotting a pair of linear equations and graphically finding the solution, or finding the area of triangle with given coordinates as vertices.

C-4.6 Understands the definitions of the basic trigonometric functions, their history and motivation (including the introduction of the sin and cos functions by Aryabhata using chords), and their utility across the sciences.

**CG-5: Derives and uses formulae to calculate areas of plane figures, surface area, and volumes of solid objects.**

C-5.1 Visualises, represents, and calculates the area of a triangle using Heron's formula and its generalisation to cyclic quadrilaterals given by Brahmagupta's formula.

C-5.2 Visualises and uses mathematical thinking to discover formulae to calculate surface areas and volumes of solid objects (cubes, cuboids, spheres, hemispheres, right circular cylinders or cones, and their combinations).

**CG-6: Analyses and interprets data using statistical concepts (such as measures of central tendency, standard deviations) and probability.**

C-6.1 Applies measures of central tendencies, such as mean, median, and mode.

C-6.2 Applies concepts from probability to solve problems on the likelihood of everyday events.

**CG-7: Begins to perceive and appreciate the axiomatic and deductive structure of Mathematics.**

C-7.1 Proves mathematical statements and carries out geometric constructions using stated assumptions, axioms, postulates, definitions, and mathematics vocabulary.

C-7.2 Visualises and appreciates geometric proofs for algebraic identities and other 'proofs without words'.

C-7.3 Proves theorems using Euclid's axioms and postulates for angles, triangles, quadrilaterals, circles, area-related theorems for triangles, and parallelograms.

C-7.4 Constructs different geometrical shapes like bisectors of line segments, angles and their bisectors, triangles, and other polygons, satisfying given constraints.

**CG-8: Builds skills, such as visualisation, optimisation, representation, and mathematical modelling along with their application in daily life.**

C-8.1 Models daily-life phenomena and uses representations, such as graphs, tables, and equations to draw conclusions.

C-8.2 Uses two-dimensional representations of three-dimensional objects to visualise and solve problems, such as those involving surface area and volume.

C-8.3 Employs optimisation strategies to maximise desired quantities (such as area, volume, or other output) under given constraints.

**CG-9: Develops computational thinking, i.e., deals with complex problems and is able to break them down into a series of simple problems that can then be solved by suitable procedures/algorithms.**

C-9.1 Decomposes a problem into sub-problems.

C-9.2 Describes and analyses a sequence of instructions being followed.

C-9.3 Analyses similarities and differences among problems to make one solution or procedure work for multiple problems.

C-9.4 Engages in algorithmic problem-solving to design such solutions.

**CG-10: Knows and appreciates important contributions of mathematicians from India and around the world.**

C-10.1 Recognises the important contributions made by mathematicians (Indian and others) in the field of Mathematics (such as the evolution of numbers, geometry, and algebra).

C-10.2 Recognises modern contributions to Mathematics made in both India and abroad, and understands the next frontiers and next major open questions in the field of Mathematics.

**CG-11: Explores connections of Mathematics with other subjects.**

C-11.1 Applies mathematical knowledge and tools to analyse problems or situations in multiple subjects across Science, Social Science, Visual Arts, Music, Vocational Education, and Sports.

## COURSE STRUCTURE CLASS – IX

<b>Units</b>	<b>Unit Name</b>	<b>Chapter Name</b>	<b>Marks</b>
I	Number System	<ul style="list-style-type: none"><li>• Number System</li></ul>	07
II	Algebra	<ul style="list-style-type: none"><li>• Introduction to Polynomials</li><li>• Sequences and Progressions</li><li>• Exploring Algebraic Identities</li><li>• Linear Equations in Two Variables</li></ul>	20
III	Coordinate Geometry	<ul style="list-style-type: none"><li>• Coordinate Geometry</li></ul>	04
IV	Geometry	<ul style="list-style-type: none"><li>• Introduction to Euclid's Geometry: Axioms and Postulates</li><li>• Lines and Angles</li><li>• Triangles – Congruence Theorems</li><li>• 4-gons (Quadrilaterals)</li><li>• Circles</li></ul>	25
V	Mensuration	<ul style="list-style-type: none"><li>• Area and Perimeter</li><li>• Surface Area and Volume</li></ul>	14
VI	Statistics and Probability	<ul style="list-style-type: none"><li>• Statistics</li><li>• Introduction to Probability</li></ul>	10
	<b>Total</b>		<b>80</b>

# Directorate of Education, GNCT of Delhi

## Annual Syllabus (Part-I)

### Class-IX (2026-27)

### Subject: Mathematics

Book	Chapter No. and Name	Key Concepts	Relevant CGs	Competencies
Part-I	<b>Chapter – 1 Orienting Yourself: The Use of Coordinates</b>	<ul style="list-style-type: none"><li>• Brief history of coordinate geometry</li><li>• The 2-D Cartesian coordinate system</li><li>• Distance between two points in the 2-D plane</li><li>• Midpoint of the line segment between two points in the 2-D plane</li></ul>	CG-4, C-4.5, CG-9	The student will be able to: <ul style="list-style-type: none"><li>• Specify locations and the position of one point relative to another point using coordinates.</li><li>• Represent a floor plan on a grid using coordinates.</li><li>• Compute the distance between two points using coordinates.</li><li>• Determine whether three points lie in a straight line using coordinates.</li><li>• Compute the position of the midpoint of a line segment using coordinates.</li><li>• Check whether a triangle is right angled using coordinates.</li><li>• Apply computational thinking to model situations on the coordinate plane and verify geometric properties through systematic reasoning.</li></ul>
Part-I	<b>Chapter – 2 Introduction to Linear Polynomials</b>	<ul style="list-style-type: none"><li>• Algebraic expressions</li><li>• Definition of a polynomial</li><li>• Degree of a polynomial</li><li>• Introduction to linear polynomials and applications</li><li>• Exploring linear patterns</li><li>• Modelling linear growth and linear decay</li><li>• Linear relationships</li><li>• Visualising linear relationships</li><li>• Slope and y-intercept of a line <math>y = ax + b</math></li></ul>	CG-3, C-3.2, CG-9	The student will be able to: <ul style="list-style-type: none"><li>• Understand the meaning of an algebraic expression.</li><li>• Define a polynomial.</li><li>• Identify the degree, terms and coefficients of terms in a polynomial.</li><li>• Model linear growth and decay using linear polynomials.</li><li>• Explain and identify patterns in linear relationships.</li><li>• Identify the slope and y-intercept of a linear equation in two variables.</li><li>• Graph a linear equation in two variables.</li><li>• Use computational thinking to identify patterns, construct linear expressions, and systematically represent and analyse linear relationships using equations and graphs.</li></ul>

<b>Part-I</b>	<b>Chapter – 3 The World of Numbers</b>	<ul style="list-style-type: none"> <li>• Introduction to rational numbers</li> <li>• Representation of rational numbers on the number line</li> <li>• Density of rational numbers and its proof</li> <li>• Finding rational numbers between any two rational numbers</li> <li>• Decimal representation of rational numbers</li> <li>• Introduction to irrational numbers</li> <li>• Proof of irrationality of <math>\sqrt{2}</math> and <math>\sqrt{3}</math></li> <li>• The square root spiral</li> </ul>	CG-1, C-1.1, CG-9	<p>The student will be able to:</p> <ul style="list-style-type: none"> <li>• Understand the concept of a rational number.</li> <li>• Represent rational numbers on the number line.</li> <li>• Understand the properties of rational numbers.</li> <li>• Explain the concept of density of rational numbers.</li> <li>• Compute decimal representation of rational numbers.</li> <li>• Understand the concept of irrational numbers.</li> <li>• Prove the irrationality.</li> <li>• Construct the square root spiral.</li> <li>• Apply computational thinking to represent rational and irrational numbers through algorithms and visual models, generate decimal expansions systematically, and reason about numbers using step-by-step logical procedures.</li> </ul>
<b>Part-I</b>	<b>Chapter – 4 Exploring Algebraic Identities</b>	<ul style="list-style-type: none"> <li>• Revisiting algebraic identities</li> <li>• Visualising identities using geometrical models</li> <li>• Factorisation of algebraic expressions using identities</li> <li>• More identities and their applications</li> <li>• Visualising factorisation of quadratic expressions through algebra tiles and without using algebra tiles</li> <li>• Finding new identities</li> <li>• Simplifying rational expressions</li> </ul>	CG-7, C-7.2, CG-9	<p>The student will be able to:</p> <ul style="list-style-type: none"> <li>• Visualise algebraic identities using geometric models.</li> <li>• Determine the factors of algebraic expressions using identities.</li> <li>• Interpret factors of quadratic expressions through geometric models.</li> <li>• Find simplified versions of rational expressions.</li> <li>• Use computational thinking strategies, such as decomposition and step by step procedures to visualise algebraic identities, factor expressions, and simplify rational expressions.</li> </ul>

<b>Part-I</b>	<b>Chapter – 5 I’m Up and Down, and Round and Round</b>	<ul style="list-style-type: none"> <li>• Practical applications and uses of circles</li> <li>• Definitions related to a circle — centre, diameter, and radius</li> <li>• Chords and the angles they subtend</li> <li>• Midpoints and perpendicular bisectors of chords</li> <li>• Distance of chords from the centre</li> <li>• Subtended angles by an arc</li> <li>• Cyclicity of points</li> </ul>	CG-4, C-7.3, CG-9	<p>The student will be able to:</p> <ul style="list-style-type: none"> <li>• State the definition of a circle.</li> <li>• Explain the meanings of the terms ‘chord’, ‘diameter’, ‘radius’, ‘arc’, ‘segment’, and ‘sector’.</li> <li>• Explain why there exists a unique circle through three non-collinear points.</li> <li>• Construct the circum-circle and circum-centre of a triangle.</li> <li>• Describe the location of the circum-centre for acute, obtuse, and right-angled triangles.</li> <li>• Explain what ‘angle subtended by an arc at the centre’ means.</li> <li>• Explain why ‘equal chords subtend equal angles at the centre’.</li> <li>• Explain why ‘chords that subtend equal angles at the centre are equal’.</li> <li>• Explain why ‘the line from the centre of a circle to the midpoint of a chord is perpendicular to the chord’.</li> <li>• Explain why ‘a perpendicular from the centre to a chord bisects the chord’.</li> <li>• State the relationship between length of a chord and its distance from the centre of the circle.</li> <li>• Explain why ‘equal chords are equidistant from the centre (and conversely)’.</li> <li>• Explain why ‘among unequal chords, the longer chord is closer to the centre’.</li> <li>• Explain why ‘the diameter is the longest chord’.</li> <li>• Explain why ‘the angle subtended by an arc at the centre is double the angle subtended by the arc at any point on the remaining part of the circle’.</li> <li>• Explain why ‘angles in the same segment of a circle are equal’.</li> <li>• Explain why ‘the angle in a semi circle is a right angle’.</li> <li>• Determine when four given points are concyclic.</li> <li>• Explain why ‘a quadrilateral with supplementary opposite angles is cyclic, and conversely’.</li> <li>• Explain how circular wheels have influenced transport, farming, building, and technology.</li> <li>• Identify cultural motifs involving circles, for example, the Dharmachakra, Ashoka Chakra, Sudarshan Chakra.</li> <li>• Use computational thinking to breakdown circle-related problems, apply geometric rules step-by-step, and verify properties of figures, such as chords, angles, and cyclic quadrilaterals through systematic reasoning.</li> </ul>
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<b>Part-I</b>	<b>Chapter – 6</b> <b>Measuring Space:</b> <b>Perimeter and Area</b>	<ul style="list-style-type: none"> <li>• Perimeter of shapes</li> <li>• Perimeter of a circle: Introduction to Pi and its irrationality</li> <li>• Length of an arc</li> <li>• Area of shapes: rectangles, parallelograms, and triangles</li> <li>• Heron’s formula</li> <li>• Squaring a rectangle :Proof from Baudhayana’s Sulbasutras</li> <li>• Area of a circle: derivation</li> <li>• Area of the sector of a circle</li> <li>• Brahmagupta’s formula for area of acyclic 4-gon</li> <li>• Heron’s formula as a special case of Brahmagupta’s formula</li> </ul>	CG-5, C-5.1, CG-9	The student will be able to: <ul style="list-style-type: none"> <li>• Define perimeter as the length around the boundary of any shape.</li> <li>• Explain that the circumference to diameter ratio is constant for all circles.</li> <li>• List historical approximations to <math>\pi</math> (from Archimedes, Aryabhata, and ZuChongzhi).</li> <li>• Compute the circumference of a circle and the length of an arc.</li> <li>• Apply ideas of circle perimeter and arc length to real-world contexts.</li> <li>• Explain why a median of a triangle divides it into two triangles of equal area.</li> <li>• Use Heron’s formula to compute the area of a triangle from its sides.</li> <li>• Explain the classical problem of ‘squaring’ a given shape.</li> <li>• Explain how ancient civilisations approximated the area of a circle.</li> <li>• Compute the area of a circle using the formula.</li> <li>• Explain and use the formula for area of a sector of a circle.</li> <li>• Solve problems on areas of sectors and segments of circles.</li> <li>• State Brahmagupta’s formula for the area of a cyclic quadrilateral in terms of its sides.</li> <li>• Explain why Heron’s formula is a ‘special case’ of Brahmagupta’s formula.</li> <li>• Explain the notion of ‘special case’ and ‘generalisation’ in mathematics.</li> <li>• Use computational thinking to breakdown shapes; apply step-by-step methods to calculate perimeter and area, recognise patterns across formulae, and understand generalisation and special cases in geometry.</li> </ul>
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<b>Part-I</b>	<b>Chapter – 7</b> <b>The Mathematics of Maybe: Introduction to Probability</b>	<ul style="list-style-type: none"> <li>• Concept of probability and randomness</li> <li>• The probability scale</li> <li>• Empirical probability: analysing statistical data and performing experiments</li> <li>• Theoretical probability: sample space and events</li> <li>• Representing probability through tree diagrams and tables</li> </ul>	CG-6, C-6.2, CG-9	The student will be able to: <ul style="list-style-type: none"> <li>• Understand the concept of randomness.</li> <li>• Describe the likelihood of an event using the probability scale.</li> <li>• Estimate the empirical probability of the occurrence of an event by analysing statistical data.</li> <li>• Define theoretical probability of an event.</li> <li>• Apply the definition of theoretical probability to compute the probability of an event.</li> <li>• Compute probability of events with the help of tree diagrams and tables.</li> <li>• Use computational thinking strategies, such as pattern recognition and simulation, to model random experiments and estimate probabilities.</li> </ul>
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<b>Part-I</b>	<b>Chapter – 8</b> <b>Predicting</b> <b>What Comes</b> <b>Next:</b> <b>Exploring</b> <b>Sequences</b> <b>and</b> <b>Progressions</b>	<ul style="list-style-type: none"> <li>• Introduction to sequences</li> <li>• Explicit or general rule of a sequence</li> <li>• Recursive rule of a sequence</li> <li>• Arithmetic Progressions</li> <li>• (AP): nth term, visualising an AP, and practical contexts leading to APs</li> <li>• Sum of the first n natural numbers</li> <li>• Geometric Progressions (GP): nth term, visualising a GP, and practical contexts leading to GPs</li> <li>• Applications of GP in fractals</li> <li>• Tower of Hanoi puzzle</li> </ul>	CG-11, C-8.1, CG-9	The student will be able to: <ul style="list-style-type: none"> <li>• Understand the concept of a sequence of numbers.</li> <li>• Identify the pattern in a sequence and predict the next few terms.</li> <li>• Determine the recursive and explicit rules for different sequences.</li> <li>• Obtain the terms of sequence given its recursive and explicit rule.</li> <li>• Identify Arithmetic Progressions (AP).</li> <li>• Determine the nth term of an AP.</li> <li>• Visualise an AP graphically.</li> <li>• Identify Geometric Progressions (GP).</li> <li>• Determine the nth term of a GP.</li> <li>• Visualise a GP graphically.</li> <li>• Analyse attributes of fractals using GP.</li> <li>• Solve the Tower of Hanoi puzzle.</li> <li>• Use computational thinking to identify patterns, write step-by-step rules, and model patterns in sequences and progressions.</li> </ul>
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- The above content must be completed for Mid Term Examination by **5th September, 2026**.
- Mental Maths & Maths Lab Activities
- Revision of syllabus for Mid Term Examination.

## MID TERM EXAMINATION