MARKHOR JUNIOR

MATHEMATICS CURRICULUM

Pioneer Level — Class 7 & Class 8

An Original International-Standard Mathematics Framework

Official Curriculum Document
Markhor Junior Contest
2026

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1. Introduction & Curriculum Philosophy

The Markhor Junior Mathematics Curriculum — Pioneer Level (Class 7 & Class 8) is an original, internationally-benchmarked mathematics framework designed exclusively for the Markhor Junior Contest. It builds directly on the Elementary Level (Class 5 & Class 6) and marks the transition from concrete primary mathematics into abstract, lower-secondary mathematical thinking, without referencing, naming or basing itself on any specific external competition or syllabus.

The Pioneer Level follows the progression: Understand → Apply → Analyze → Generalize → Reason → Prove/Justify → Solve. Students move from applying known procedures toward generalising patterns algebraically, constructing and evaluating justifications, and strategically solving unfamiliar problems — always built from concepts genuinely within the Class 7 and Class 8 syllabus, and never from premature exposure to advanced secondary mathematics such as calculus, trigonometry or formal polynomial theory.

This document is the official foundation for all future Markhor Junior Pioneer Level materials, including MCQ question banks, practice tests, mock tests, past papers and contest papers for Class 7 and Class 8. Together with the Nursery/KG, Beginner, Learner and Elementary Level documents, it completes the Markhor Junior progression: Nursery/KG → Beginner (Class 1–2) → Learner (Class 3–4) → Elementary (Class 5–6) → Pioneer (Class 7–8).

2. Curriculum Architecture

The curriculum follows a consistent architecture for every topic:

- Class → Mathematical Domain → Topic → Subtopics → Learning Outcomes → Skills → Difficulty → Assessment Mapping

Eighteen mathematical domains are used consistently across both classes, extending the Elementary Level structure with algebraic thinking, sequences, coordinate geometry, transformations and combinatorics as substantial domains in their own right, and allowing the curriculum to scale cleanly into future Markhor Junior levels:

- Number Systems & Number Theory (NS)
- Arithmetic & Operations (AR)
- Fractions (FR)
- Decimals (DC)
- Percentages (PC)
- Ratio, Rate & Proportion (RP)
- Algebraic Thinking (AL)
- Sequences & Patterns (SQ)
- Coordinate Geometry & Linear Relationships (CG)
- Geometry (GE)
- Circles, Perimeter, Area & Volume (AV)
- Transformations (TF)
- Statistics & Data Handling (ST)
- Probability (PR)
- Mathematical Logic & Reasoning (LR)
- Combinatorics & Counting Strategies (CO)
- Problem Solving (PS)
- Mental Mathematics & Estimation (MN)

3. Three-Tier Difficulty System

Every topic is structured across three difficulty levels. Challenge is created through hidden relationships, multiple conditions, strategic reasoning, generalization and elegant or efficient solutions — never simply through larger numbers or concepts outside the syllabus.

- Level 1 — Beginner: direct understanding and standard application of a concept.
- Level 2 — Intermediate: unfamiliar applications, multi-step calculations and reasoning.
- Level 3 — Challenge: advanced, non-routine mathematical thinking, which may involve hidden relationships, multiple conditions, strategic reasoning, generalization or counterexamples.

4. Spiral Curriculum & Connection to Elementary Level

The Pioneer Level connects naturally with the Elementary Level: Class 7 extends whole-number and fraction/decimal/percentage fluency while formally introducing algebraic thinking, sequences, coordinate geometry and combinatorics as substantial new domains. Class 8 then deepens every domain further — expanding and factorizing expressions, gradient and linear graphs, congruence and similarity, surface area and composite volume, combined probability, and genuinely advanced non-routine and proof-like reasoning — without unnecessary repetition and without prematurely becoming a full secondary-school syllabus. Section 9 of this document maps this progression domain by domain.

5. Mathematical Connections

Topics are not taught in isolation. Question writers should draw on these natural connections when designing reasoning and challenge-level items:

- Factors ↔ Algebra (factorizing expressions mirrors factorizing numbers)
- Fractions ↔ Ratios, Ratios ↔ Percentages (equivalent comparative representations)
- Percentages ↔ Probability, Fractions ↔ Probability (probability expressed numerically)
- Algebra ↔ Sequences (the nth term as a generalised algebraic rule)
- Algebra ↔ Coordinate Geometry (linear equations as graphed relationships)
- Geometry ↔ Algebra, Area ↔ Algebra (unknown dimensions solved algebraically)
- Volume ↔ Measurement (unit conversion underlying 3D calculations)
- Statistics ↔ Probability (data-based estimation of likelihood)
- Coordinates ↔ Transformations (mapping points under reflection, rotation, translation, enlargement)
- Number Theory ↔ Logical Reasoning (divisibility and factor reasoning underlying puzzles)
- Combinatorics ↔ Probability (counting outcomes to calculate likelihood)

6. Mathematical Proof & Justification

Alongside calculation, the Pioneer Level develops proof-like reasoning: explaining why an answer is correct, identifying counterexamples, testing always/sometimes/never statements, justifying patterns, and recognising invalid arguments. This is woven throughout Logical Reasoning, Geometry and Problem Solving rather than taught as an isolated topic, and does not require formal proof notation beyond the developmental level appropriate to Class 7–8.

7. Standard Question Concept Levels

For every topic, future question writers and AI question-generation systems should design MCQs across eight standard question concepts, matched to the three-tier difficulty system: Basic Concept, Application, Reasoning, Visual, Mental Mathematics, Multi-Step, Problem Solving, and Challenge. The "Recommended Question Types" field for each topic identifies which specific formats are most appropriate.

8. Standard Question Formats

The following question formats may be used across topics, as indicated in each topic's Recommended Question Types field:

- Standard MCQ · Visual MCQ · Number-based MCQ · Algebraic MCQ · Pattern question · Missing number

- Logical reasoning · Word problem · Multi-step problem · Geometry question · Graph interpretation
- Data interpretation · Probability question · Comparison question · Error-detection question · Picture-based MCQ

9. Curriculum Boundary

The Pioneer Level is deliberately bounded to develop abstract mathematical thinking within age-appropriate lower-secondary mathematics rather than introduce a full secondary-school syllabus. Concepts explicitly kept outside this syllabus include: quadratic equations and factorizing trinomials, trigonometric ratios, formal calculus, formal permutation/combination formulas (nCr, nPr), circle theorems beyond circumference and area, surface area/volume of curved solids (cylinders, cones, spheres), simultaneous equations, and any formal statistical hypothesis testing. These remain appropriate targets for future Markhor Junior levels.

Markhor Junior Mathematics — Pioneer Level — Class 7

Course Overview

Markhor Junior Mathematics — Pioneer Level — Class 7 marks the transition from concrete primary mathematics into abstract mathematical thinking. Students strengthen number theory, fraction, decimal and percentage fluency, and are formally introduced to algebraic expressions and equations, sequences, coordinate geometry, transformations and combinatorics as substantial new domains. Structured problem solving, logical reasoning and mental mathematics are woven throughout, giving students a broad, connected mathematical toolkit as they progress toward the greater abstraction and reasoning demands of Class 8.

Mathematical Domains & Topics

Number Systems & Number Theory

- Integers — Operations & Number Line Reasoning
- Rational Numbers & the Number System
- Factors, Multiples & Prime Factorization
- HCF & LCM — Concepts & Applications

Arithmetic & Operations

- Order of Operations & Multi-Step Calculations
- Operations with Fractions & Decimals (Combined Fluency)

Fractions

- Fractions — Operations & Reasoning
- Fraction Word Problems & Multi-Step Reasoning

Decimals

- Decimals — Operations & Reasoning
- Decimal Word Problems

Percentages

- Percentage–Fraction–Decimal Connections
- Percentage of a Quantity & Applications
- Percentage Increase & Decrease

Ratio, Rate & Proportion

- Ratio & Equivalent Ratios
- Rate & Unit Rate
- Direct Proportion & Scale

Algebraic Thinking

- Introduction to Variables & Expressions
- Simplifying Algebraic Expressions
- Substitution & Evaluating Expressions
- Linear Equations in One Variable
- Linear Equations — Word Problems

Sequences & Patterns

- Arithmetic Sequences — Term-to-Term Rules
- Pattern Generalization & Position-to-Term

Coordinate Geometry & Linear Relationships

- Coordinate Plane — Plotting & Reading Points
- Tables of Values & Simple Linear Relationships

Geometry

- Angles — Types & Relationships
- Parallel Lines & Angle Properties
- Triangles — Properties & Angle Sum
- Quadrilaterals — Properties & Classification
- Polygons — Interior & Exterior Angles

Circles, Perimeter, Area & Volume

- Perimeter of Composite Shapes
- Area of Triangles, Quadrilaterals & Composite Figures
- Introduction to Circles — Radius, Diameter & Circumference

Transformations

- Reflection & Translation on a Grid
- Rotation & Symmetry

Statistics & Data Handling

- Organizing & Representing Data
- Mean, Median, Mode & Range
- Data Interpretation & Comparing Data Sets

Probability

- Probability — Basic Concepts & Sample Space
- Probability as a Fraction

Mathematical Logic & Reasoning

- Logical Puzzles — Deduction & Elimination
- Always, Sometimes or Never Reasoning

Combinatorics & Counting Strategies

- Systematic Counting & Organized Listing

Problem Solving

- Multi-Step Word Problems Across Domains

Mental Mathematics & Estimation

- Mental Calculation Strategies
- Estimation & Reasonableness

Detailed Topic-by-Topic Curriculum — Class 7

Domain: Number Systems & Number Theory

1. Integers — Operations & Number Line Reasoning

Topic Code	C7-NS-01
Domain	Number Systems & Number Theory
Subtopics	Adding/subtracting integers • Multiplying/dividing integers • Number line reasoning
Concept Description	Students perform all four operations with integers and reason about their positions on a number line.
Learning Outcomes	Students can perform operations with integers accurately and justify results using a number line.
Skills Developed	Integer fluency, Sign reasoning, Number line reasoning
Beginner (L1)	Add or subtract two integers using a number line.
Intermediate (L2)	Multiply or divide integers, including with mixed signs, in a multi-step calculation.
Challenge (L3)	Solve a puzzle requiring reasoning about the sign of a multi-term integer expression.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Number-based MCQ
Should Be Tested	All four operations with integers; sign reasoning
Should NOT Be Tested	Operations with complex or irrational numbers

2. Rational Numbers & the Number System

Topic Code	C7-NS-02
Domain	Number Systems & Number Theory
Subtopics	Classifying number types • Rational numbers on a number line • Comparing/ordering rational numbers
Concept Description	Students classify numbers within the number system and compare rational numbers, including negatives.
Learning Outcomes	Students can classify a number and compare or order a set of rational numbers.
Skills Developed	Number sense, Classification, Comparison
Beginner (L1)	Classify a number as a natural number, integer, or rational number.
Intermediate (L2)	Compare and order a set of rational numbers, including negative fractions.
Challenge (L3)	Solve a problem requiring reasoning about density (numbers between two given rationals).
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Comparison question
Should Be Tested	Classification and comparison within the rational number system
Should NOT Be Tested	Formal treatment of irrational or real numbers

3. Factors, Multiples & Prime Factorization

Topic Code	C7-NS-03
Domain	Number Systems & Number Theory
Subtopics	Prime factorization (factor trees) • Divisibility rules • Composite number reasoning
Concept Description	Students find the prime factorization of a number and apply divisibility rules to number problems.
Learning Outcomes	Students can find the prime factorization of a number and use it to solve a related problem.
Skills Developed	Factorization, Number relationships, Reasoning
Beginner (L1)	Find the prime factorization of a number up to 100.
Intermediate (L2)	Use prime factorization to determine whether one number divides another.
Challenge (L3)	Solve a puzzle requiring reasoning about a number's factorization structure.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Prime factorization and divisibility of numbers up to 200
Should NOT Be Tested	Factorization of very large numbers requiring advanced techniques

4. HCF & LCM — Concepts & Applications

Topic Code	C7-NS-04
Domain	Number Systems & Number Theory
Subtopics	HCF via factorization • LCM via factorization • HCF-LCM product relationship
Concept Description	Students find the HCF and LCM of two or more numbers and apply these to real-life problems.
Learning Outcomes	Students can find the HCF or LCM of numbers and apply it to a real-life scheduling or grouping problem.
Skills Developed	Number relationships, Application, Reasoning
Beginner (L1)	Find the HCF or LCM of two numbers by listing.
Intermediate (L2)	Find the HCF or LCM of two numbers using prime factorization.
Challenge (L3)	Solve a multi-step word problem combining HCF and LCM reasoning.
Visual Priority	Low
Recommended Question Types	Word problem, Standard MCQ
Should Be Tested	HCF/LCM of numbers up to 200 and their real-life applications
Should NOT Be Tested	HCF/LCM involving algebraic expressions

Domain: Arithmetic & Operations

1. Order of Operations & Multi-Step Calculations

Topic Code	C7-AR-01
Domain	Arithmetic & Operations
Subtopics	Order of operations with brackets • Multi-step calculations with mixed operations • Checking strategies

Concept Description	Students apply the correct order of operations to multi-step calculations involving brackets and mixed operations.
Learning Outcomes	Students can correctly evaluate a multi-step expression involving brackets and several operation types.
Skills Developed	Order of operations, Arithmetic fluency, Checking strategies
Beginner (L1)	Evaluate an expression with brackets and two operations.
Intermediate (L2)	Evaluate an expression with nested brackets and several operations.
Challenge (L3)	Identify and correct an error in an incorrectly evaluated multi-step expression.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Error-detection question
Should Be Tested	Order of operations including nested brackets
Should NOT Be Tested	Expressions involving advanced exponent or root notation

2. Operations with Fractions & Decimals (Combined Fluency)

Topic Code	C7-AR-02
Domain	Arithmetic & Operations
Subtopics	Mixed fraction/decimal calculations • Converting between forms mid-calculation • Multi-step reasoning
Concept Description	Students fluently combine fraction and decimal operations within a single multi-step calculation.
Learning Outcomes	Students can solve a multi-step calculation that combines fractions and decimals.
Skills Developed	Fraction/decimal fluency, Conversion, Multi-step reasoning
Beginner (L1)	Convert a simple fraction to a decimal (or vice versa) within a calculation.
Intermediate (L2)	Solve a two-step calculation combining a fraction operation and a decimal operation.
Challenge (L3)	Solve a multi-step calculation requiring strategic choice of form (fraction or decimal) for efficiency.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Mental maths question
Should Be Tested	Combined fraction/decimal fluency within Class 7 scope
Should NOT Be Tested	Operations involving irrational decimal expansions

Domain: Fractions

1. Fractions — Operations & Reasoning

Topic Code	C7-FR-01
Domain	Fractions
Subtopics	All four operations with fractions • Mixed number operations • Fraction reasoning
Concept Description	Students fluently add, subtract, multiply and divide fractions and mixed numbers.
Learning Outcomes	Students can perform any of the four operations with fractions and mixed numbers accurately.
Skills Developed	Fraction fluency, Procedural understanding, Reasoning

Beginner (L1)	Add or subtract two fractions with unlike denominators.
Intermediate (L2)	Multiply or divide two fractions or mixed numbers.
Challenge (L3)	Solve a multi-step calculation combining several fraction operations.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	All four fraction operations, including mixed numbers
Should NOT Be Tested	Fractions with algebraic numerators/denominators

2. Fraction Word Problems & Multi-Step Reasoning

Topic Code	C7-FR-02
Domain	Fractions
Subtopics	Real-life fraction problems • Multi-step fraction reasoning • Fraction of a fraction problems
Concept Description	Students solve multi-step real-life word problems requiring several connected fraction operations.
Learning Outcomes	Students can plan and solve a multi-step word problem involving fractions.
Skills Developed	Problem solving, Fraction fluency, Multi-step reasoning
Beginner (L1)	Solve a one-step fraction word problem.
Intermediate (L2)	Solve a two-step fraction word problem.
Challenge (L3)	Solve a multi-step fraction problem with an unfamiliar or layered context.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Multi-step fraction word problems built from Class 7 fraction skills
Should NOT Be Tested	Problems requiring algebraic fraction manipulation

Domain: Decimals

1. Decimals — Operations & Reasoning

Topic Code	C7-DC-01
Domain	Decimals
Subtopics	All four operations with decimals • Decimal place-value reasoning • Estimation and checking
Concept Description	Students fluently add, subtract, multiply and divide decimals, including estimating to check results.
Learning Outcomes	Students can perform any of the four operations with decimals and estimate to verify reasonableness.
Skills Developed	Decimal fluency, Estimation, Checking strategies
Beginner (L1)	Add or subtract two decimals to two or three decimal places.
Intermediate (L2)	Multiply or divide decimals, including by another decimal.
Challenge (L3)	Solve a multi-step calculation combining several decimal operations, verified by estimation.

Visual Priority	Low
Recommended Question Types	Standard MCQ, Mental maths question
Should Be Tested	All four decimal operations, including decimal-by-decimal division
Should NOT Be Tested	Recurring decimal notation and conversion

2. Decimal Word Problems

Topic Code	C7-DC-02
Domain	Decimals
Subtopics	Real-life decimal problems • Money and measurement contexts • Multi-step decimal reasoning
Concept Description	Students solve multi-step real-life word problems involving decimal quantities.
Learning Outcomes	Students can plan and solve a multi-step word problem involving decimal operations.
Skills Developed	Problem solving, Decimal fluency, Multi-step reasoning
Beginner (L1)	Solve a two-step decimal word problem.
Intermediate (L2)	Solve a three-step decimal word problem in a real-life context.
Challenge (L3)	Solve a multi-step decimal problem with an unfamiliar or layered context.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Multi-step decimal word problems built from Class 7 decimal skills
Should NOT Be Tested	Problems requiring concepts beyond Class 7 scope

Domain: Percentages

1. Percentage–Fraction–Decimal Connections

Topic Code	C7-PC-01
Domain	Percentages
Subtopics	Converting between all three forms • Ordering mixed representations • Choosing the most useful form
Concept Description	Students convert fluently between percentages, fractions and decimals and choose the most efficient form for a task.
Learning Outcomes	Students can convert between a percentage, fraction and decimal representing the same value.
Skills Developed	Number relationships, Representation, Reasoning
Beginner (L1)	Convert a common percentage to a fraction or decimal.
Intermediate (L2)	Convert a less common percentage to a fraction in lowest terms.
Challenge (L3)	Order a mixed set of percentages, decimals and fractions, choosing an efficient comparison strategy.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Comparison question
Should Be Tested	Conversions among percentages, decimals and fractions

Should NOT Be Tested	Percentages involving recurring decimal equivalents beyond simple cases

2. Percentage of a Quantity & Applications

Topic Code	C7-PC-02
Domain	Percentages
Subtopics	Finding a percentage of a quantity • Real-life percentage applications • Multi-step percentage calculations
Concept Description	Students calculate a percentage of a quantity and apply this fluently to real-life problems.
Learning Outcomes	Students can calculate any percentage of a given quantity, including non-standard percentages.
Skills Developed	Percentage reasoning, Application, Multi-step calculation
Beginner (L1)	Find 10%, 20% or 50% of a quantity.
Intermediate (L2)	Find a non-standard percentage (e.g. 35%, 62%) of a quantity.
Challenge (L3)	Solve a multi-step problem requiring percentage of a quantity combined with another operation.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Word problem
Should Be Tested	Percentages of quantities, including non-standard percentages
Should NOT Be Tested	Compound percentage calculations (see Class 8)

3. Percentage Increase & Decrease

Topic Code	C7-PC-03
Domain	Percentages
Subtopics	Calculating percentage change • Applying a percentage increase/decrease • Real-life applications
Concept Description	Students calculate the result of a percentage increase or decrease applied to a quantity.
Learning Outcomes	Students can calculate the new value after a percentage increase or decrease.
Skills Developed	Percentage reasoning, Application, Multi-step calculation
Beginner (L1)	Calculate a simple percentage increase on a quantity.
Intermediate (L2)	Calculate a percentage decrease and find the resulting value.
Challenge (L3)	Solve a multi-step problem involving a percentage increase followed by a decrease.
Visual Priority	Medium
Recommended Question Types	Word problem, Standard MCQ
Should Be Tested	Percentage increase/decrease using varied percentages
Should NOT Be Tested	Reverse percentage or compound percentage problems (see Class 8)

Domain: Ratio, Rate & Proportion

1. Ratio & Equivalent Ratios

Topic Code	C7-RP-01
Domain	Ratio, Rate & Proportion
Subtopics	Ratio notation • Simplifying ratios • Sharing in a given ratio
Concept Description	Students simplify ratios and use them to share quantities and solve real-life comparison problems.
Learning Outcomes	Students can simplify a ratio and use it to divide a quantity into given parts.
Skills Developed	Ratio reasoning, Simplification, Application
Beginner (L1)	Simplify a simple two-term ratio.
Intermediate (L2)	Share a quantity in a given two- or three-term ratio.
Challenge (L3)	Solve a multi-step ratio problem combining sharing with another operation.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Word problem
Should Be Tested	Simplifying and sharing in ratios (two or three parts)
Should NOT Be Tested	Ratio problems requiring algebraic equation setup

2. Rate & Unit Rate

Topic Code	C7-RP-02
Domain	Ratio, Rate & Proportion
Subtopics	Calculating rates • Unit rate and comparison • Real-life rate problems
Concept Description	Students calculate rates and unit rates to compare quantities and solve real-life problems.
Learning Outcomes	Students can calculate a unit rate and use it to compare two or more options.
Skills Developed	Rate reasoning, Comparison, Application
Beginner (L1)	Calculate a simple rate (e.g. cost per item).
Intermediate (L2)	Calculate a unit rate and use it to compare two options.
Challenge (L3)	Solve a multi-step best-value problem involving rates in an unfamiliar context.
Visual Priority	Medium
Recommended Question Types	Word problem, Comparison question
Should Be Tested	Rates and unit rates in real-life contexts
Should NOT Be Tested	Rates requiring calculus-based interpretation

3. Direct Proportion & Scale

Topic Code	C7-RP-03
Domain	Ratio, Rate & Proportion
Subtopics	Direct proportion • Unitary method • Scale drawings and maps
Concept Description	Students use the unitary method to solve direct proportion problems, including scale drawings.
Learning Outcomes	Students can use the unitary method to solve a direct proportion or scale problem.
Skills Developed	Proportional reasoning, Application, Spatial reasoning

Beginner (L1)	Scale a quantity by a whole-number factor.
Intermediate (L2)	Use the unitary method to solve a direct proportion word problem.
Challenge (L3)	Solve a multi-step scale-drawing problem involving real-world distances.
Visual Priority	High
Recommended Question Types	Word problem, Picture-based MCQ
Should Be Tested	Direct proportion and scale problems using the unitary method
Should NOT Be Tested	Inverse proportion problems (see Class 8)

Domain: Algebraic Thinking

1. Introduction to Variables & Expressions

Topic Code	C7-AL-01
Domain	Algebraic Thinking
Subtopics	Variables and constants • Writing expressions from word descriptions • Terms and coefficients
Concept Description	Students use variables to represent unknowns and write algebraic expressions from word descriptions.
Learning Outcomes	Students can write an algebraic expression to represent a word description.
Skills Developed	Algebraic thinking, Representation, Translation
Beginner (L1)	Write a simple one-operation expression from a word description.
Intermediate (L2)	Write a two-operation expression from a word description.
Challenge (L3)	Translate a multi-step word description into a correct algebraic expression.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Simple expressions with one variable, one or two operations
Should NOT Be Tested	Expressions with multiple variables interacting

2. Simplifying Algebraic Expressions

Topic Code	C7-AL-02
Domain	Algebraic Thinking
Subtopics	Like and unlike terms • Combining like terms • Simplifying multi-term expressions
Concept Description	Students simplify algebraic expressions by identifying and combining like terms.
Learning Outcomes	Students can simplify an algebraic expression by correctly combining like terms.
Skills Developed	Algebraic manipulation, Classification, Procedural fluency
Beginner (L1)	Combine two like terms in a simple expression.
Intermediate (L2)	Simplify an expression with several like and unlike terms.
Challenge (L3)	Simplify an expression involving terms with different variables and coefficients, including negative coefficients.
Visual Priority	Low

Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Simplifying expressions with one or two variables
Should NOT Be Tested	Expanding brackets (see Class 8)

3. Substitution & Evaluating Expressions

Topic Code	C7-AL-03
Domain	Algebraic Thinking
Subtopics	Substituting values • Evaluating multi-term expressions • Real-life formula substitution
Concept Description	Students substitute given values into algebraic expressions and formulae to evaluate them.
Learning Outcomes	Students can substitute a value into an expression or formula and evaluate it correctly.
Skills Developed	Substitution, Procedural fluency, Application
Beginner (L1)	Substitute a value into a one-operation expression.
Intermediate (L2)	Substitute values into a two-operation expression or simple formula.
Challenge (L3)	Substitute negative or fractional values into a multi-term expression.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Substitution with whole numbers, negatives and simple fractions
Should NOT Be Tested	Substitution requiring simultaneous equations

4. Linear Equations in One Variable

Topic Code	C7-AL-04
Domain	Algebraic Thinking
Subtopics	One-step equations • Two-step equations • Balance model and checking solutions
Concept Description	Students solve one- and two-step linear equations using a balance model and verify their solutions.
Learning Outcomes	Students can solve a one- or two-step linear equation and verify the solution by substitution.
Skills Developed	Algebraic manipulation, Inverse operations, Checking strategies
Beginner (L1)	Solve a one-step equation.
Intermediate (L2)	Solve a two-step equation involving two different operations.
Challenge (L3)	Solve an equation involving a variable on both sides in a simple form.
Visual Priority	Low
Recommended Question Types	Missing number, Standard MCQ
Should Be Tested	One- and two-step equations; simple equations with the variable on both sides
Should NOT Be Tested	Equations involving expanding brackets (see Class 8)

5. Linear Equations — Word Problems

Topic Code	C7-AL-05
Domain	Algebraic Thinking
Subtopics	Translating word problems into equations • Solving and interpreting solutions • Real-life applications
Concept Description	Students translate real-life word problems into linear equations, solve them, and interpret the solution.
Learning Outcomes	Students can set up and solve a linear equation from a word problem and interpret the result.
Skills Developed	Problem solving, Algebraic modelling, Interpretation
Beginner (L1)	Set up and solve a one-step equation from a simple word problem.
Intermediate (L2)	Set up and solve a two-step equation from a word problem.
Challenge (L3)	Set up and solve an equation from a multi-step or unfamiliar word problem.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Word problems solvable with one- or two-step linear equations
Should NOT Be Tested	Word problems requiring simultaneous equations

Domain: Sequences & Patterns

1. Arithmetic Sequences — Term-to-Term Rules

Topic Code	C7-SQ-01
Domain	Sequences & Patterns
Subtopics	Term-to-term rules • Extending sequences • Common difference reasoning
Concept Description	Students identify the term-to-term rule of an arithmetic sequence and use it to extend the sequence.
Learning Outcomes	Students can identify the common difference of a sequence and extend it correctly.
Skills Developed	Pattern recognition, Algebraic thinking, Reasoning
Beginner (L1)	Extend an arithmetic sequence given its first few terms.
Intermediate (L2)	Identify the term-to-term rule and use it to find a nearby term.
Challenge (L3)	Determine whether a given number could appear in a specific arithmetic sequence.
Visual Priority	Medium
Recommended Question Types	Pattern question, Standard MCQ
Should Be Tested	Arithmetic sequences within Class 7 number range
Should NOT Be Tested	Geometric sequences with non-integer ratios

2. Pattern Generalization & Position-to-Term

Topic Code	C7-SQ-02
Domain	Sequences & Patterns
Subtopics	Position-to-term rules • Generalizing a pattern algebraically • Testing a conjectured rule

Concept Description	Students generalize the position-to-term rule of a sequence and express it algebraically.
Learning Outcomes	Students can find the position-to-term rule of a sequence and use it to find a distant term.
Skills Developed	Generalization, Algebraic thinking, Reasoning
Beginner (L1)	Find a nearby term using a given position-to-term rule.
Intermediate (L2)	Derive the position-to-term rule for a simple arithmetic sequence.
Challenge (L3)	Find a distant term (e.g. the 50th term) using a derived rule, without listing all terms.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Position-to-term rules for arithmetic sequences
Should NOT Be Tested	Position-to-term rules for quadratic or higher-order sequences

Domain: Coordinate Geometry & Linear Relationships

1. Coordinate Plane — Plotting & Reading Points

Topic Code	C7-CG-01
Domain	Coordinate Geometry & Linear Relationships
Subtopics	Four-quadrant coordinates • Plotting and reading points • Distance between points on a grid
Concept Description	Students plot and read coordinates in all four quadrants and find distances between points on a grid.
Learning Outcomes	Students can plot a point in any quadrant and find the distance between two points sharing a coordinate.
Skills Developed	Coordinate reasoning, Spatial reasoning, Application
Beginner (L1)	Plot a point in a given quadrant.
Intermediate (L2)	Find the distance between two points with the same x- or y-coordinate.
Challenge (L3)	Find the coordinates of a point that completes a shape with given properties (e.g. a square).
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Four-quadrant coordinates and grid-aligned distance
Should NOT Be Tested	Distance formula for diagonal points

2. Tables of Values & Simple Linear Relationships

Topic Code	C7-CG-02
Domain	Coordinate Geometry & Linear Relationships
Subtopics	Completing tables of values • Identifying relationships between variables • Simple real-world graphs
Concept Description	Students complete tables of values for a simple relationship and interpret real-world graphs.
Learning Outcomes	Students can complete a table of values for a given rule and interpret a simple real-world graph.
Skills Developed	Pattern recognition, Interpretation, Representation

Beginner (L1)	Complete a table of values for a simple one-step rule.
Intermediate (L2)	Identify the rule connecting the variables in a table of values.
Challenge (L3)	Interpret a real-world graph, including identifying what a specific point represents.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Data interpretation
Should Be Tested	Tables of values and interpretation of simple real-world graphs
Should NOT Be Tested	Formal gradient/slope calculation (see Class 8)

Domain: Geometry

1. Angles — Types & Relationships

Topic Code	C7-GE-01
Domain	Geometry
Subtopics	Angle types • Complementary and supplementary angles • Vertically opposite angles
Concept Description	Students classify angles and use angle relationships to find missing angles.
Learning Outcomes	Students can find a missing angle using complementary, supplementary or vertically opposite angle facts.
Skills Developed	Angle reasoning, Classification, Problem solving
Beginner (L1)	Classify an angle by type (acute, right, obtuse, straight, reflex).
Intermediate (L2)	Find a missing angle using complementary or supplementary angle facts.
Challenge (L3)	Find a missing angle in a diagram combining several angle relationships.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Angle types and relationships (complementary, supplementary, vertically opposite)
Should NOT Be Tested	Angle properties involving parallel lines (separate topic)

2. Parallel Lines & Angle Properties

Topic Code	C7-GE-02
Domain	Geometry
Subtopics	Corresponding angles • Alternate angles • Co-interior angles
Concept Description	Students identify and apply angle properties formed when a transversal crosses parallel lines.
Learning Outcomes	Students can find a missing angle using corresponding, alternate or co-interior angle properties.
Skills Developed	Angle reasoning, Geometric reasoning, Problem solving
Beginner (L1)	Identify a pair of corresponding or alternate angles in a diagram.
Intermediate (L2)	Find a missing angle using a single parallel-line angle property.
Challenge (L3)	Find a missing angle in a diagram requiring more than one parallel-line angle property.
Visual Priority	High

Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Corresponding, alternate and co-interior angles with parallel lines
Should NOT Be Tested	Formal proofs of parallel-line angle theorems

3. Triangles — Properties & Angle Sum

Topic Code	C7-GE-03
Domain	Geometry
Subtopics	Angle sum of a triangle • Exterior angle theorem • Triangle classification
Concept Description	Students apply the angle sum of a triangle and the exterior angle theorem to find missing angles.
Learning Outcomes	Students can find a missing angle in a triangle using the angle sum or exterior angle theorem.
Skills Developed	Angle reasoning, Geometric reasoning, Application
Beginner (L1)	Find a missing angle in a triangle using the angle sum of 180°.
Intermediate (L2)	Find a missing angle using the exterior angle theorem.
Challenge (L3)	Find a missing angle in a diagram combining triangle angle facts with another angle property.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Angle sum of a triangle; exterior angle theorem
Should NOT Be Tested	Trigonometric angle relationships

4. Quadrilaterals — Properties & Classification

Topic Code	C7-GE-04
Domain	Geometry
Subtopics	Types of quadrilaterals • Angle sum of a quadrilateral • Property-based classification
Concept Description	Students classify quadrilaterals by their properties and apply the angle sum of a quadrilateral.
Learning Outcomes	Students can classify a quadrilateral and find a missing angle using its angle sum.
Skills Developed	Shape reasoning, Classification, Angle reasoning
Beginner (L1)	Name a quadrilateral from its properties.
Intermediate (L2)	Find a missing angle in a quadrilateral using its angle sum of 360°.
Challenge (L3)	Classify a quadrilateral from a description combining several properties.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Quadrilateral types, properties and angle sum
Should NOT Be Tested	Formal geometric proofs

5. Polygons — Interior & Exterior Angles

Topic Code	C7-GE-05

Domain	Geometry
Subtopics	Interior angle sum formula • Exterior angle sum • Regular polygon reasoning
Concept Description	Students calculate the interior and exterior angle sums of polygons, including regular polygons.
Learning Outcomes	Students can calculate the interior or exterior angle sum of a polygon and find an individual angle for a regular polygon.
Skills Developed	Angle reasoning, Formula application, Geometric reasoning
Beginner (L1)	Calculate the interior angle sum of a polygon using the formula.
Intermediate (L2)	Find an individual interior angle of a regular polygon.
Challenge (L3)	Find the number of sides of a regular polygon given an interior or exterior angle.
Visual Priority	High
Recommended Question Types	Standard MCQ, Picture-based MCQ
Should Be Tested	Interior/exterior angle sums for polygons up to 12 sides
Should NOT Be Tested	Polygons with irregular, unspecified angle configurations

Domain: Circles, Perimeter, Area & Volume

1. Perimeter of Composite Shapes

Topic Code	C7-AV-01
Domain	Circles, Perimeter, Area & Volume
Subtopics	Perimeter of rectilinear composite figures • Missing dimensions • Real-life applications
Concept Description	Students calculate the perimeter of composite shapes, finding missing dimensions where needed.
Learning Outcomes	Students can calculate the perimeter of a composite shape, finding any missing side lengths first.
Skills Developed	Measurement reasoning, Spatial reasoning, Problem solving
Beginner (L1)	Find the perimeter of a composite shape with all sides given.
Intermediate (L2)	Find a missing side length in a composite shape before calculating perimeter.
Challenge (L3)	Solve a real-life problem requiring perimeter of an unfamiliar composite shape.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Word problem
Should Be Tested	Perimeter of composite rectilinear shapes
Should NOT Be Tested	Perimeter involving curved edges (see Circles topic)

2. Area of Triangles, Quadrilaterals & Composite Figures

Topic Code	C7-AV-02
Domain	Circles, Perimeter, Area & Volume
Subtopics	Area of triangles and parallelograms • Area of trapeziums • Composite area problems
Concept Description	Students calculate the area of triangles, parallelograms and trapeziums, and combine these for composite figures.

Learning Outcomes	Students can calculate the area of a triangle, parallelogram, trapezium or composite figure.
Skills Developed	Measurement reasoning, Formula application, Spatial reasoning
Beginner (L1)	Calculate the area of a triangle or parallelogram given base and height.
Intermediate (L2)	Calculate the area of a trapezium given its parallel sides and height.
Challenge (L3)	Calculate the total area of a composite figure combining several shape types.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Word problem
Should Be Tested	Area of triangles, parallelograms, trapeziums and composite rectilinear figures
Should NOT Be Tested	Area involving curved shapes (see Circles topic)

3. Introduction to Circles — Radius, Diameter & Circumference

Topic Code	C7-AV-03
Domain	Circles, Perimeter, Area & Volume
Subtopics	Radius, diameter, chord, arc • Circumference formula • Real-life circle applications
Concept Description	Students identify the parts of a circle and calculate circumference using the appropriate formula.
Learning Outcomes	Students can identify circle terminology and calculate the circumference of a circle.
Skills Developed	Shape reasoning, Formula application, Real-life application
Beginner (L1)	Identify the radius, diameter or chord of a circle from a diagram.
Intermediate (L2)	Calculate the circumference of a circle given its radius or diameter.
Challenge (L3)	Solve a real-life problem requiring circumference reasoning (e.g. wheel rotations).
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Word problem
Should Be Tested	Circle terminology and circumference calculations using π
Should NOT Be Tested	Area of a circle or sector (see Class 8)

Domain: Transformations

1. Reflection & Translation on a Grid

Topic Code	C7-TF-01
Domain	Transformations
Subtopics	Reflecting shapes across a line • Translating shapes by a vector • Describing transformations
Concept Description	Students reflect and translate shapes on a coordinate grid and describe the transformation performed.
Learning Outcomes	Students can reflect or translate a shape on a grid and describe the transformation used.
Skills Developed	Spatial reasoning, Coordinate reasoning, Communication
Beginner (L1)	Reflect a simple shape across a horizontal or vertical line.
Intermediate (L2)	Translate a shape by a given vector on a coordinate grid.

Challenge (L3)	Describe the single transformation that maps one shape to another.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Visual reasoning
Should Be Tested	Reflection across horizontal/vertical lines; translation by a vector
Should NOT Be Tested	Reflection across diagonal lines (see Class 8)

2. Rotation & Symmetry

Topic Code	C7-TF-02
Domain	Transformations
Subtopics	Rotating shapes about a point • Lines of symmetry • Rotational symmetry
Concept Description	Students rotate shapes about a given point and identify lines of symmetry and rotational symmetry.
Learning Outcomes	Students can rotate a shape by a given angle about a point and identify its symmetry.
Skills Developed	Spatial reasoning, Visual reasoning, Classification
Beginner (L1)	Identify the lines of symmetry in a shape.
Intermediate (L2)	Rotate a simple shape by 90° or 180° about a given point.
Challenge (L3)	Determine the order of rotational symmetry of a shape.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Visual reasoning
Should Be Tested	Rotation by 90°/180°/270°; line and rotational symmetry
Should NOT Be Tested	Rotation by arbitrary, non-standard angles

Domain: Statistics & Data Handling

1. Organizing & Representing Data

Topic Code	C7-ST-01
Domain	Statistics & Data Handling
Subtopics	Frequency tables • Bar charts and line graphs • Choosing an appropriate representation
Concept Description	Students organize raw data into frequency tables and represent it using appropriate graphs.
Learning Outcomes	Students can construct a frequency table from raw data and choose an appropriate graph to represent it.
Skills Developed	Data organization, Representation, Reasoning
Beginner (L1)	Complete a frequency table from a small data set.
Intermediate (L2)	Choose the most appropriate graph type for a given data set.
Challenge (L3)	Identify an issue with a poorly chosen or poorly scaled data representation.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Data interpretation

Should Be Tested	Frequency tables, bar charts and line graphs
Should NOT Be Tested	Histograms with unequal class widths (see Class 8)

2. Mean, Median, Mode & Range

Topic Code	C7-ST-02
Domain	Statistics & Data Handling
Subtopics	Calculating mean, median, mode • Finding the range • Comparing measures for a data set
Concept Description	Students calculate the mean, median, mode and range of a data set and select the most appropriate measure.
Learning Outcomes	Students can calculate the mean, median, mode and range of a data set.
Skills Developed	Data analysis, Arithmetic application, Reasoning
Beginner (L1)	Find the mode and range of a small data set.
Intermediate (L2)	Find the mean and median of a data set with an even or odd number of values.
Challenge (L3)	Determine which measure (mean, median or mode) best represents a data set with an outlier.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Data interpretation
Should Be Tested	Mean, median, mode and range of data sets
Should NOT Be Tested	Weighted averages or grouped-frequency mean estimation

3. Data Interpretation & Comparing Data Sets

Topic Code	C7-ST-03
Domain	Statistics & Data Handling
Subtopics	Multi-step data interpretation • Comparing two data sets • Drawing justified conclusions
Concept Description	Students interpret data from graphs and tables and compare two data sets to draw justified conclusions.
Learning Outcomes	Students can compare two data sets using appropriate measures and draw a justified conclusion.
Skills Developed	Data interpretation, Comparison, Communication
Beginner (L1)	Answer a direct question from a single graph or table.
Intermediate (L2)	Compare two data sets using their mean, median or range.
Challenge (L3)	Draw and justify a conclusion requiring evidence from more than one part of the data.
Visual Priority	Medium
Recommended Question Types	Data interpretation, Multi-step problem
Should Be Tested	Comparison and interpretation using given data sets
Should NOT Be Tested	Formal statistical significance testing

Domain: Probability

1. Probability — Basic Concepts & Sample Space

Topic Code	C7-PR-01
Domain	Probability
Subtopics	Sample space • Equally likely outcomes • Certain/impossible/likely events
Concept Description	Students identify the sample space of a simple experiment and classify events by likelihood.
Learning Outcomes	Students can list the sample space of a simple experiment and classify an event's likelihood.
Skills Developed	Probability reasoning, Systematic listing, Classification
Beginner (L1)	List the sample space of a simple experiment (e.g. rolling a die).
Intermediate (L2)	Classify an event as certain, impossible, likely or unlikely.
Challenge (L3)	List the sample space of a two-stage experiment (e.g. two coin tosses).
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Sample spaces for one- and two-stage simple experiments
Should NOT Be Tested	Sample spaces for experiments with more than two stages

2. Probability as a Fraction

Topic Code	C7-PR-02
Domain	Probability
Subtopics	Calculating probability as a fraction • Simplifying probability fractions • Complementary events
Concept Description	Students calculate the probability of an event as a fraction and use complementary reasoning.
Learning Outcomes	Students can calculate the probability of an event and its complement as a fraction.
Skills Developed	Probability reasoning, Fraction application, Reasoning
Beginner (L1)	Calculate the probability of a simple event as a fraction.
Intermediate (L2)	Calculate the probability of the complement of an event.
Challenge (L3)	Solve a problem requiring probability reasoning across a two-stage experiment.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Picture-based MCQ
Should Be Tested	Probability as a fraction; complementary events
Should NOT Be Tested	Formal combined/conditional probability rules (see Class 8)

Domain: Mathematical Logic & Reasoning

1. Logical Puzzles — Deduction & Elimination

Topic Code	C7-LR-01
Domain	Mathematical Logic & Reasoning
Subtopics	Clue-based deduction • Systematic elimination • Organising information in a table
Concept Description	Students use given clues and systematic elimination to solve logical deduction puzzles.
Learning Outcomes	Students can use several clues, organised systematically, to solve a deduction puzzle.

Skills Developed	Deductive reasoning, Systematic thinking, Elimination
Beginner (L1)	Use two or three clues to eliminate incorrect options.
Intermediate (L2)	Use four clues, organised in a table, to solve a puzzle.
Challenge (L3)	Solve a puzzle with five or more interacting clues.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Logical reasoning
Should Be Tested	Multi-clue deduction puzzles built from Class 7 concepts
Should NOT Be Tested	Puzzles requiring formal logic notation

2. Always, Sometimes or Never Reasoning

Topic Code	C7-LR-02
Domain	Mathematical Logic & Reasoning
Subtopics	Testing mathematical statements • Finding counterexamples • Justifying always/never claims
Concept Description	Students test whether a mathematical statement is always, sometimes, or never true, using examples and counterexamples.
Learning Outcomes	Students can determine whether a statement is always, sometimes or never true and justify the answer.
Skills Developed	Logical reasoning, Counterexample construction, Justification
Beginner (L1)	Test a simple statement with one or two examples.
Intermediate (L2)	Find a counterexample that disproves an always/never claim.
Challenge (L3)	Justify why a statement is always true using a general argument rather than examples alone.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Logical reasoning
Should Be Tested	Always/sometimes/never reasoning within Class 7 concepts
Should NOT Be Tested	Formal mathematical proof requiring advanced notation

Domain: Combinatorics & Counting Strategies

1. Systematic Counting & Organized Listing

Topic Code	C7-CO-01
Domain	Combinatorics & Counting Strategies
Subtopics	Organized lists • Tree diagrams • The multiplication principle (introductory)
Concept Description	Students use organized lists, tree diagrams and the multiplication principle to count possibilities systematically.
Learning Outcomes	Students can systematically count the number of possible outcomes in a simple counting problem.
Skills Developed	Systematic thinking, Organized listing, Counting strategies
Beginner (L1)	List all possibilities for a simple counting scenario.
Intermediate (L2)	Use a tree diagram to count outcomes of a two-stage scenario.

Challenge (L3)	Apply the multiplication principle to count outcomes of a multi-stage scenario without full listing.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Logical reasoning
Should Be Tested	Systematic counting for scenarios with a small, manageable number of outcomes
Should NOT Be Tested	Formal permutation/combination formulas (see Class 8)

Domain: Problem Solving

1. Multi-Step Word Problems Across Domains

Topic Code	C7-PS-01
Domain	Problem Solving
Subtopics	Problems combining several domains • Understand-Plan-Solve-Check approach • Real-life multi-domain contexts
Concept Description	Students solve multi-step problems that combine two or more mathematical domains from across the curriculum.
Learning Outcomes	Students can plan, solve and check a multi-step problem combining several domains.
Skills Developed	Problem solving, Multi-step reasoning, Self-checking
Beginner (L1)	Solve a two-domain problem with familiar numbers.
Intermediate (L2)	Solve a three-step problem combining two or three domains.
Challenge (L3)	Solve a problem combining three or more domains with an unfamiliar context.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Multi-step, multi-domain real-life problems built from Class 7 concepts
Should NOT Be Tested	Problems requiring concepts beyond Class 7 scope

Domain: Mental Mathematics & Estimation

1. Mental Calculation Strategies

Topic Code	C7-MN-01
Domain	Mental Mathematics & Estimation
Subtopics	Mental strategies across operations • Using known facts efficiently • Strategy selection
Concept Description	Students apply efficient mental calculation strategies across integers, fractions, decimals and percentages.
Learning Outcomes	Students can select and apply an efficient mental strategy for a given calculation.
Skills Developed	Mental maths, Strategy selection, Number sense
Beginner (L1)	Apply a basic mental strategy to a two-step calculation.
Intermediate (L2)	Apply a mental strategy involving fractions, decimals or percentages.
Challenge (L3)	Choose the most efficient mental approach among several options for an unfamiliar calculation.

Visual Priority	Low
Recommended Question Types	Standard MCQ, Mental maths question
Should Be Tested	Mental strategies within Class 7 scope across number types
Should NOT Be Tested	Written algorithms disguised as mental maths

2. Estimation & Reasonableness

Topic Code	C7-MN-02
Domain	Mental Mathematics & Estimation
Subtopics	Estimating before calculating • Rounding for estimation • Checking whether an answer is reasonable
Concept Description	Students estimate answers before calculating and judge whether a calculated answer is reasonable.
Learning Outcomes	Students can estimate a result and judge whether a given or calculated answer is reasonable.
Skills Developed	Estimation, Reasoning, Self-checking
Beginner (L1)	Estimate the result of a two-number calculation by rounding.
Intermediate (L2)	Estimate the result of a multi-step calculation.
Challenge (L3)	Identify the most reasonable of several answers without calculating exactly.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Mental maths question
Should Be Tested	Estimation and reasonableness checks within Class 7 scope
Should NOT Be Tested	Formal significant-figure or error-bound calculations

Markhor Junior Mathematics — Pioneer Level — Class 8

Course Overview

Markhor Junior Mathematics — Pioneer Level — Class 8 represents the most advanced stage of the Markhor Junior primary-to-secondary progression: pre-secondary mathematical reasoning and strategic problem solving. Students expand and factorize algebraic expressions, solve multi-step equations and inequalities, calculate gradient and interpret linear graphs, reason about congruence and similarity, work with surface area and composite volume, and analyse combined probability and complex data sets. Non-routine, competition-style problem solving and proof-like justification are emphasised throughout, preparing students for confident, independent mathematical reasoning as they progress beyond the Pioneer Level.

Mathematical Domains & Topics

Number Systems & Number Theory

- Prime Factorization & Perfect Squares/Cubes
- Square Roots & Estimating Square Roots
- Number Theory Reasoning & Puzzles
- Positive/Negative Number Fluency & Reasoning

Arithmetic & Operations

- Efficient Mental Strategies for Complex Calculations
- Error Detection & Checking Strategies

Fractions

- Multiplying & Dividing Fractions Fluently
- Multi-Step Fraction Reasoning Problems

Decimals

- Decimal Multiplication & Division Fluency
- Multi-Step Decimal Reasoning Problems

Percentages

- Reverse Percentage Problems
- Profit, Loss & Discount Problems
- Multi-Step Percentage Reasoning

Ratio, Rate & Proportion

- Simplifying & Solving Ratio Problems
- Speed, Distance & Time Relationships
- Multi-Step Proportional Reasoning

Algebraic Thinking

- Algebraic Manipulation & Like Terms (Advanced)
- Expanding Brackets
- Factorizing Simple Expressions
- Linear Equations — Multi-Step & Brackets
- Linear Inequalities
- Rearranging Simple Formulae

Sequences & Patterns

- Sequence Rules — Algebraic Representation
- Geometric Patterns (Introductory)

Coordinate Geometry & Linear Relationships

- Gradient (Slope) — Concept & Calculation
- Linear Graphs — Plotting & Interpreting
- Real-World Graphs & Interpretation

Geometry

- Congruence of Triangles
- Similarity of Triangles
- Multi-Step Angle Reasoning
- Polygon Angle Sum — Advanced Reasoning
- Geometric Reasoning & Proof-Like Justification

Circles, Perimeter, Area & Volume

- Area & Perimeter — Multi-Step Composite Problems
- Circles — Area & Circumference (Advanced)
- Surface Area of Cubes & Cuboids
- Volume of Cubes, Cuboids & Composite Solids

Transformations

- Enlargement & Scale Factor
- Combined Transformations

Statistics & Data Handling

- Histograms & Advanced Graph Interpretation
- Comparing Data Sets — Multi-Step Analysis
- Misleading Data Representations

Probability

- Combined & Complementary Probability
- Experimental vs Theoretical Probability

Mathematical Logic & Reasoning

- Multi-Condition Logical Puzzles
- Invariant-Style Reasoning
- Counterexamples & Proof-Like Justification

Combinatorics & Counting Strategies

- Simple Permutations & Combinations (Introductory)
- Multiplication Principle — Advanced Applications

Problem Solving

- Multi-Step Problems Across Domains
- Non-Routine Challenge Problems

Mental Mathematics & Estimation

- Advanced Mental Strategies (Algebra/Fractions/Percentages)
- Estimation & Justification of Reasonableness

Detailed Topic-by-Topic Curriculum — Class 8

Domain: Number Systems & Number Theory

1. Prime Factorization & Perfect Squares/Cubes

Topic Code	C8-NS-01
Domain	Number Systems & Number Theory
Subtopics	Prime factorization for identifying perfect squares/cubes • Recognising perfect squares and cubes • Number property reasoning
Concept Description	Students use prime factorization to determine whether a number is a perfect square or perfect cube.
Learning Outcomes	Students can use prime factorization to determine whether a number is a perfect square or cube.
Skills Developed	Number theory, Factorization, Reasoning
Beginner (L1)	Identify a perfect square or perfect cube from a list of numbers.
Intermediate (L2)	Use prime factorization to verify whether a number is a perfect square.
Challenge (L3)	Find the smallest number to multiply a given number by to make it a perfect square.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Perfect squares to 400, perfect cubes to 1000, via prime factorization
Should NOT Be Tested	Formal proofs of number-theoretic properties

2. Square Roots & Estimating Square Roots

Topic Code	C8-NS-02
Domain	Number Systems & Number Theory
Subtopics	Finding square roots of perfect squares • Estimating square roots of non-perfect squares • Square root reasoning
Concept Description	Students find exact square roots of perfect squares and estimate square roots of non-perfect squares.
Learning Outcomes	Students can find the square root of a perfect square and estimate the square root of a non-perfect square.
Skills Developed	Number sense, Estimation, Reasoning
Beginner (L1)	Find the square root of a perfect square up to 400.
Intermediate (L2)	Estimate the square root of a non-perfect square between two consecutive integers.
Challenge (L3)	Solve a problem requiring reasoning about which of two square roots is larger without a calculator.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Comparison question
Should Be Tested	Square roots and estimation up to 400
Should NOT Be Tested	Formal methods for computing square roots by hand (e.g. long division method)

3. Number Theory Reasoning & Puzzles

Topic Code	C8-NS-03
Domain	Number Systems & Number Theory
Subtopics	Combined number-property puzzles • Divisibility-based reasoning • Constraint satisfaction problems
Concept Description	Students solve puzzles requiring the combination of several number-theoretic properties.
Learning Outcomes	Students can solve a puzzle requiring reasoning about several number properties simultaneously.
Skills Developed	Number theory, Logical reasoning, Problem solving
Beginner (L1)	Solve a puzzle involving one number property (e.g. divisibility).
Intermediate (L2)	Solve a puzzle combining two number properties (e.g. prime and odd).
Challenge (L3)	Solve a puzzle requiring several number-property conditions to be satisfied simultaneously.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Logical reasoning
Should Be Tested	Number-property puzzles built from Class 7–8 number theory
Should NOT Be Tested	Puzzles requiring advanced number theory (modular arithmetic, etc.)

4. Positive/Negative Number Fluency & Reasoning

Topic Code	C8-NS-04
Domain	Number Systems & Number Theory
Subtopics	Multi-step integer calculations • Integer reasoning in real-life contexts • Always/sometimes/never with integers
Concept Description	Students apply integer operations fluently in multi-step calculations and real-life contexts.
Learning Outcomes	Students can solve a multi-step calculation involving integers and reason about integer properties.
Skills Developed	Integer fluency, Reasoning, Application
Beginner (L1)	Solve a two-step calculation involving positive and negative integers.
Intermediate (L2)	Solve a multi-step real-life problem involving integers (e.g. temperature, altitude, finance).
Challenge (L3)	Determine whether a statement about integer operations is always, sometimes or never true.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Word problem
Should Be Tested	Multi-step integer fluency and reasoning
Should NOT Be Tested	Operations with complex numbers

Domain: Arithmetic & Operations

1. Efficient Mental Strategies for Complex Calculations

Topic Code	C8-AR-01

Domain	Arithmetic & Operations
Subtopics	Mental strategies for multi-step calculations • Combining known facts • Strategy comparison and justification
Concept Description	Students apply and justify efficient mental strategies for complex, multi-step calculations.
Learning Outcomes	Students can select, apply and justify an efficient mental strategy for a complex calculation.
Skills Developed	Mental maths, Strategy selection, Communication
Beginner (L1)	Apply a mental strategy to a two-step calculation.
Intermediate (L2)	Apply a mental strategy combining several operations or number types.
Challenge (L3)	Compare two mental strategies and justify which is more efficient for a given problem.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Mental maths question
Should Be Tested	Mental strategies within Class 8 scope across number types
Should NOT Be Tested	Written algorithms disguised as mental maths

2. Error Detection & Checking Strategies

Topic Code	C8-AR-02
Domain	Arithmetic & Operations
Subtopics	Identifying errors in calculations • Checking using inverse operations • Checking using estimation
Concept Description	Students identify errors in given calculations and apply checking strategies to verify answers.
Learning Outcomes	Students can identify an error in a multi-step calculation and correct it using an appropriate checking strategy.
Skills Developed	Error detection, Checking strategies, Reasoning
Beginner (L1)	Identify an error in a one-step calculation.
Intermediate (L2)	Identify an error in a multi-step calculation and correct it.
Challenge (L3)	Determine which of several checking strategies would most efficiently verify a given calculation.
Visual Priority	Low
Recommended Question Types	Error-detection question, Standard MCQ
Should Be Tested	Error detection and checking within Class 8 scope
Should NOT Be Tested	Errors requiring advanced mathematical concepts to identify

Domain: Fractions

1. Multiplying & Dividing Fractions Fluently

Topic Code	C8-FR-01
Domain	Fractions
Subtopics	Multiplying fractions and mixed numbers • Dividing fractions and mixed numbers • Fluency across all fraction types
Concept Description	Students multiply and divide fractions and mixed numbers fluently, including in multi-step calculations.

Learning Outcomes	Students can multiply or divide any combination of fractions and mixed numbers accurately.
Skills Developed	Fraction fluency, Procedural understanding, Multi-step reasoning
Beginner (L1)	Multiply two proper fractions.
Intermediate (L2)	Divide a mixed number by a fraction.
Challenge (L3)	Solve a multi-step calculation combining fraction multiplication and division.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Multiplication/division of fractions and mixed numbers
Should NOT Be Tested	Fractions with algebraic numerators/denominators

2. Multi-Step Fraction Reasoning Problems

Topic Code	C8-FR-02
Domain	Fractions
Subtopics	Combined fraction operations • Real-life multi-step fraction problems • Fraction reasoning puzzles
Concept Description	Students solve multi-step problems requiring several combined fraction operations and reasoning.
Learning Outcomes	Students can plan and solve a multi-step problem requiring several fraction operations.
Skills Developed	Problem solving, Fraction fluency, Multi-step reasoning
Beginner (L1)	Solve a two-step fraction word problem.
Intermediate (L2)	Solve a three-step fraction word problem combining different operations.
Challenge (L3)	Solve a fraction reasoning puzzle with an unfamiliar or layered structure.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Multi-step fraction reasoning problems built from Class 8 skills
Should NOT Be Tested	Problems requiring algebraic fraction manipulation

Domain: Decimals

1. Decimal Multiplication & Division Fluency

Topic Code	C8-DC-01
Domain	Decimals
Subtopics	Multiplying decimals fluently • Dividing by a decimal • Estimating to verify decimal results
Concept Description	Students multiply and divide decimals fluently, including dividing by a decimal, using estimation to verify.
Learning Outcomes	Students can multiply or divide decimals accurately, including decimal-by-decimal division.
Skills Developed	Decimal fluency, Procedural understanding, Estimation
Beginner (L1)	Multiply two decimals to one decimal place.

Intermediate (L2)	Divide a decimal by another decimal.
Challenge (L3)	Solve a multi-step calculation combining decimal multiplication and division, verified by estimation.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Mental maths question
Should Be Tested	Decimal multiplication and division, including decimal-by-decimal division
Should NOT Be Tested	Recurring decimal conversion beyond simple cases

2. Multi-Step Decimal Reasoning Problems

Topic Code	C8-DC-02
Domain	Decimals
Subtopics	Combined decimal operations • Real-life multi-step decimal problems • Decimal reasoning and error detection
Concept Description	Students solve multi-step problems combining several decimal operations and reasoning about errors.
Learning Outcomes	Students can plan and solve a multi-step problem requiring several decimal operations.
Skills Developed	Problem solving, Decimal fluency, Multi-step reasoning
Beginner (L1)	Solve a two-step decimal word problem.
Intermediate (L2)	Solve a three-step decimal word problem in a real-life context.
Challenge (L3)	Solve a decimal reasoning problem requiring error detection or estimation-based judgement.
Visual Priority	Medium
Recommended Question Types	Word problem, Error-detection question
Should Be Tested	Multi-step decimal reasoning problems built from Class 8 skills
Should NOT Be Tested	Problems requiring concepts beyond Class 8 scope

Domain: Percentages

1. Reverse Percentage Problems

Topic Code	C8-PC-01
Domain	Percentages
Subtopics	Finding the original quantity • Working backwards from a percentage result • Real-life reverse-percentage contexts
Concept Description	Students find an original quantity given a value after a percentage change has been applied.
Learning Outcomes	Students can find the original quantity given the result of a percentage increase or decrease.
Skills Developed	Percentage reasoning, Working backwards, Problem solving
Beginner (L1)	Find the original value given a simple percentage increase and the new value.
Intermediate (L2)	Find the original value given a percentage decrease and the new value.
Challenge (L3)	Solve a reverse percentage problem in an unfamiliar or multi-part real-life context.
Visual Priority	Medium

Recommended Question Types	Word problem, Standard MCQ
Should Be Tested	Reverse percentage problems using familiar percentage changes
Should NOT Be Tested	Reverse compound percentage over multiple periods

2. Profit, Loss & Discount Problems

Topic Code	C8-PC-02
Domain	Percentages
Subtopics	Profit and loss as a percentage • Successive discounts • Real-life business-style problems
Concept Description	Students calculate profit, loss and discount as percentages and solve related real-life problems.
Learning Outcomes	Students can calculate a profit/loss percentage or the result of a discount and solve related word problems.
Skills Developed	Percentage reasoning, Application, Multi-step calculation
Beginner (L1)	Calculate profit or loss as a percentage of cost price.
Intermediate (L2)	Calculate the final price after a single discount.
Challenge (L3)	Solve a multi-step problem involving successive discounts or combined profit/loss scenarios.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Profit, loss and discount problems, including successive discounts
Should NOT Be Tested	Formal tax or compound interest formulas

3. Multi-Step Percentage Reasoning

Topic Code	C8-PC-03
Domain	Percentages
Subtopics	Combining percentage change with other operations • Comparing percentage scenarios • Percentage reasoning puzzles
Concept Description	Students solve multi-step problems combining percentage reasoning with other mathematical operations.
Learning Outcomes	Students can plan and solve a multi-step problem combining percentage reasoning with another skill.
Skills Developed	Problem solving, Percentage reasoning, Multi-step reasoning
Beginner (L1)	Solve a two-step problem combining a percentage calculation with a simple operation.
Intermediate (L2)	Solve a three-step problem comparing two percentage-based scenarios.
Challenge (L3)	Solve a percentage reasoning puzzle with an unfamiliar or layered structure.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Multi-step percentage problems built from Class 8 skills
Should NOT Be Tested	Problems requiring compound interest or tax formulas

Domain: Ratio, Rate & Proportion

1. Simplifying & Solving Ratio Problems

Topic Code	C8-RP-01
Domain	Ratio, Rate & Proportion
Subtopics	Simplifying ratios with three or more terms • Combining ratios • Ratio word problems
Concept Description	Students simplify and combine ratios, including with three or more terms, to solve real-life problems.
Learning Outcomes	Students can simplify a multi-term ratio and combine two related ratios to solve a problem.
Skills Developed	Ratio reasoning, Simplification, Problem solving
Beginner (L1)	Simplify a three-term ratio.
Intermediate (L2)	Combine two ratios that share a common term to form a single three-term ratio.
Challenge (L3)	Solve a multi-step ratio problem requiring combining and sharing in an unfamiliar context.
Visual Priority	Medium
Recommended Question Types	Word problem, Standard MCQ
Should Be Tested	Multi-term ratios and combining ratios
Should NOT Be Tested	Ratio problems requiring algebraic equation setup with two unknowns

2. Speed, Distance & Time Relationships

Topic Code	C8-RP-02
Domain	Ratio, Rate & Proportion
Subtopics	Speed-distance-time formula • Average speed • Real-life travel problems
Concept Description	Students apply the speed-distance-time relationship to solve real-life travel problems, including average speed.
Learning Outcomes	Students can calculate speed, distance or time given the other two quantities, including average speed.
Skills Developed	Formula application, Problem solving, Rate reasoning
Beginner (L1)	Calculate distance given speed and time.
Intermediate (L2)	Calculate average speed for a journey with two different speeds.
Challenge (L3)	Solve a multi-step journey problem involving changing speeds or multiple legs of travel.
Visual Priority	Medium
Recommended Question Types	Word problem, Standard MCQ
Should Be Tested	Speed-distance-time relationships, including average speed
Should NOT Be Tested	Problems requiring calculus-based rate of change

3. Multi-Step Proportional Reasoning

Topic Code	C8-RP-03
Domain	Ratio, Rate & Proportion

Subtopics	Direct proportion in unfamiliar contexts • Inverse proportion (introductory) • Multi-step scaling problems
Concept Description	Students apply direct and inverse proportional reasoning to solve multi-step real-life problems.
Learning Outcomes	Students can identify whether a relationship is direct or inverse proportion and solve accordingly.
Skills Developed	Proportional reasoning, Classification, Problem solving
Beginner (L1)	Identify whether a given relationship is direct or inverse proportion.
Intermediate (L2)	Solve a simple inverse proportion problem (e.g. workers and time).
Challenge (L3)	Solve a multi-step problem combining direct and inverse proportional reasoning.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Direct and introductory inverse proportion problems
Should NOT Be Tested	Proportion problems requiring formal algebraic function notation

Domain: Algebraic Thinking

1. Algebraic Manipulation & Like Terms (Advanced)

Topic Code	C8-AL-01
Domain	Algebraic Thinking
Subtopics	Combining like terms with multiple variables • Simplifying expressions with powers • Multi-step simplification
Concept Description	Students simplify more complex algebraic expressions involving multiple variables and powers of variables.
Learning Outcomes	Students can simplify a multi-term expression involving several variables and simple powers.
Skills Developed	Algebraic manipulation, Classification, Procedural fluency
Beginner (L1)	Combine like terms in an expression with two variables.
Intermediate (L2)	Simplify an expression involving terms with powers (e.g. x^2, y^2).
Challenge (L3)	Simplify a multi-term expression combining several variables, powers and negative coefficients.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Simplifying expressions with multiple variables and simple powers
Should NOT Be Tested	Simplification requiring formal polynomial division

2. Expanding Brackets

Topic Code	C8-AL-02
Domain	Algebraic Thinking
Subtopics	Expanding a single bracket • Expanding and simplifying • Expanding two binomials (introductory)
Concept Description	Students expand expressions involving brackets, including an introduction to expanding two binomials.

Learning Outcomes	Students can expand an expression involving one or two brackets and simplify the result.
Skills Developed	Algebraic manipulation, Procedural fluency, Reasoning
Beginner (L1)	Expand a single bracket with a numeric coefficient.
Intermediate (L2)	Expand a single bracket with an algebraic coefficient and simplify.
Challenge (L3)	Expand two simple binomials (e.g. (x+2)(x+3)) and simplify the result.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Expanding single brackets fully; introductory expansion of two binomials
Should NOT Be Tested	Expansion involving three or more binomials

3. Factorizing Simple Expressions

Topic Code	C8-AL-03
Domain	Algebraic Thinking
Subtopics	Finding the common factor • Factorizing simple expressions • Checking by expanding
Concept Description	Students factorize simple algebraic expressions by identifying the highest common factor of the terms.
Learning Outcomes	Students can factorize a simple algebraic expression by taking out the highest common factor.
Skills Developed	Algebraic manipulation, Reasoning, Checking strategies
Beginner (L1)	Identify the common factor of two simple terms.
Intermediate (L2)	Factorize a two-term expression by taking out a common factor.
Challenge (L3)	Factorize a three-term expression, checking the result by expanding.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Factorizing expressions using a common numeric or single-variable factor
Should NOT Be Tested	Factorizing quadratic trinomials

4. Linear Equations — Multi-Step & Brackets

Topic Code	C8-AL-04
Domain	Algebraic Thinking
Subtopics	Equations involving brackets • Equations with the variable on both sides • Multi-step solving and checking
Concept Description	Students solve linear equations involving brackets and variables on both sides, checking solutions by substitution.
Learning Outcomes	Students can solve a linear equation involving brackets or a variable on both sides.
Skills Developed	Algebraic manipulation, Inverse operations, Checking strategies
Beginner (L1)	Solve an equation involving a single bracket.
Intermediate (L2)	Solve an equation with the variable on both sides.
Challenge (L3)	Solve a multi-step equation combining brackets and the variable on both sides.

Visual Priority	Low
Recommended Question Types	Missing number, Standard MCQ
Should Be Tested	Equations involving brackets and variables on both sides
Should NOT Be Tested	Equations involving fractions with algebraic denominators

5. Linear Inequalities

Topic Code	C8-AL-05
Domain	Algebraic Thinking
Subtopics	Solving one-step and two-step inequalities • Representing solutions on a number line • Inequality word problems
Concept Description	Students solve linear inequalities and represent their solutions on a number line.
Learning Outcomes	Students can solve a linear inequality and represent the solution set on a number line.
Skills Developed	Algebraic manipulation, Representation, Reasoning
Beginner (L1)	Solve a one-step inequality.
Intermediate (L2)	Solve a two-step inequality and represent it on a number line.
Challenge (L3)	Solve a word problem requiring the setup and solving of a linear inequality.
Visual Priority	Medium
Recommended Question Types	Picture-based MCQ, Word problem
Should Be Tested	One- and two-step linear inequalities
Should NOT Be Tested	Inequalities requiring multiplication/division by a negative variable expression

6. Rearranging Simple Formulae

Topic Code	C8-AL-06
Domain	Algebraic Thinking
Subtopics	Changing the subject of a formula • Rearranging one-step formulae • Real-life formula applications
Concept Description	Students rearrange simple formulae to change the subject, applying this to real-life contexts.
Learning Outcomes	Students can rearrange a simple formula to make a different variable the subject.
Skills Developed	Algebraic manipulation, Inverse operations, Application
Beginner (L1)	Rearrange a one-step formula to change the subject.
Intermediate (L2)	Rearrange a two-step formula to change the subject.
Challenge (L3)	Rearrange a formula involving a square or square root to change the subject.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Rearranging formulae with one or two steps, including simple squares/roots
Should NOT Be Tested	Rearranging formulae requiring factorization

Domain: Sequences & Patterns

1. Sequence Rules — Algebraic Representation

Topic Code	C8-SQ-01
Domain	Sequences & Patterns
Subtopics	nth term of an arithmetic sequence • Deriving the nth term rule • Using the rule to test membership
Concept Description	Students derive and use the algebraic nth-term rule of an arithmetic sequence.
Learning Outcomes	Students can derive the nth-term rule of an arithmetic sequence and use it to find any term or test membership.
Skills Developed	Algebraic thinking, Generalization, Reasoning
Beginner (L1)	Use a given nth-term rule to find a specific term.
Intermediate (L2)	Derive the nth-term rule for an arithmetic sequence from its first few terms.
Challenge (L3)	Determine whether a given number is a term of a sequence using its nth-term rule.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	nth-term rules for arithmetic sequences
Should NOT Be Tested	nth-term rules for quadratic or higher-order sequences

2. Geometric Patterns (Introductory)

Topic Code	C8-SQ-02
Domain	Sequences & Patterns
Subtopics	Constant-ratio patterns • Recognising geometric vs arithmetic patterns • Simple geometric pattern problems
Concept Description	Students recognise and extend simple geometric patterns with a constant ratio, distinguishing them from arithmetic patterns.
Learning Outcomes	Students can extend a simple geometric pattern and distinguish it from an arithmetic pattern.
Skills Developed	Pattern recognition, Classification, Reasoning
Beginner (L1)	Extend a simple geometric pattern with a whole-number ratio.
Intermediate (L2)	Determine whether a given sequence is arithmetic, geometric or neither.
Challenge (L3)	Solve a problem requiring reasoning about a geometric pattern in an unfamiliar context.
Visual Priority	Medium
Recommended Question Types	Pattern question, Standard MCQ
Should Be Tested	Geometric patterns with whole-number or simple fractional ratios
Should NOT Be Tested	Formal geometric series summation formulas

Domain: Coordinate Geometry & Linear Relationships

1. Gradient (Slope) — Concept & Calculation

Topic Code	C8-CG-01
Domain	Coordinate Geometry & Linear Relationships
Subtopics	Meaning of gradient • Calculating gradient from two points • Interpreting gradient in context
Concept Description	Students understand gradient as a measure of steepness and calculate it from two points on a line.
Learning Outcomes	Students can calculate the gradient of a line segment given two points and interpret its meaning in context.
Skills Developed	Coordinate reasoning, Formula application, Interpretation
Beginner (L1)	Calculate the gradient of a line segment shown on a grid.
Intermediate (L2)	Calculate the gradient given the coordinates of two points.
Challenge (L3)	Interpret the meaning of a gradient in a real-life context (e.g. speed, cost per item).
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Gradient calculation and interpretation for straight lines
Should NOT Be Tested	Gradient of curved graphs

2. Linear Graphs — Plotting & Interpreting

Topic Code	C8-CG-02
Domain	Coordinate Geometry & Linear Relationships
Subtopics	Plotting a line from a table of values • Reading intercepts • Interpreting a linear graph
Concept Description	Students plot linear graphs from a table of values and interpret key features such as intercepts.
Learning Outcomes	Students can plot a linear graph from a table of values and identify its intercepts.
Skills Developed	Coordinate reasoning, Representation, Interpretation
Beginner (L1)	Plot points from a table of values and draw the resulting line.
Intermediate (L2)	Identify the x- and y-intercepts of a linear graph.
Challenge (L3)	Interpret a linear graph to solve a real-life problem, including reading between plotted points.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Graph interpretation
Should Be Tested	Plotting and interpreting simple linear graphs
Should NOT Be Tested	Graphs of non-linear (quadratic, exponential) relationships

3. Real-World Graphs & Interpretation

Topic Code	C8-CG-03
Domain	Coordinate Geometry & Linear Relationships
Subtopics	Distance-time graphs • Cost/quantity graphs • Interpreting graph shape and features
Concept Description	Students interpret real-world graphs, including distance-time graphs, connecting shape to real-life meaning.

Learning Outcomes	Students can interpret a real-world graph, explaining what different sections or features represent.
Skills Developed	Graph interpretation, Real-life reasoning, Communication
Beginner (L1)	Read a specific value from a real-world graph.
Intermediate (L2)	Explain what a section of a distance-time graph represents (e.g. stationary, moving).
Challenge (L3)	Compare two real-world graphs or scenarios and explain the mathematical difference between them.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Graph interpretation
Should Be Tested	Interpreting real-world graphs including distance-time graphs
Should NOT Be Tested	Graphs requiring calculus-based rate of change

Domain: Geometry

1. Congruence of Triangles

Topic Code	C8-GE-01
Domain	Geometry
Subtopics	Congruence conditions (SSS, SAS, ASA, RHS) • Identifying congruent triangles • Using congruence to find missing values
Concept Description	Students identify congruent triangles using standard congruence conditions and use congruence to find missing values.
Learning Outcomes	Students can identify which congruence condition applies to a pair of triangles and use congruence to find a missing side or angle.
Skills Developed	Geometric reasoning, Classification, Deduction
Beginner (L1)	Identify whether two triangles appear congruent from given markings.
Intermediate (L2)	State which congruence condition (SSS, SAS, ASA, RHS) applies to a given pair of triangles.
Challenge (L3)	Use congruence reasoning to find a missing side or angle in a multi-step diagram.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Congruence conditions SSS, SAS, ASA, RHS and their application
Should NOT Be Tested	Formal two-column geometric proofs

2. Similarity of Triangles

Topic Code	C8-GE-02
Domain	Geometry
Subtopics	Conditions for similarity • Scale factor between similar triangles • Finding missing sides using similarity
Concept Description	Students identify similar triangles and use the scale factor between them to find missing side lengths.
Learning Outcomes	Students can identify similar triangles and use the scale factor to find a missing side length.

Skills Developed	Geometric reasoning, Proportional reasoning, Application
Beginner (L1)	Identify whether two triangles appear similar from given angle markings.
Intermediate (L2)	Calculate the scale factor between two similar triangles.
Challenge (L3)	Find a missing side length in a diagram involving similar triangles within a larger figure.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Similarity conditions (AA) and scale factor applications
Should NOT Be Tested	Trigonometric ratios in similar triangles

3. Multi-Step Angle Reasoning

Topic Code	C8-GE-03
Domain	Geometry
Subtopics	Combining multiple angle facts • Multi-step angle-chasing problems • Justifying angle conclusions
Concept Description	Students combine several angle facts (triangle, quadrilateral, parallel-line) to solve multi-step angle problems.
Learning Outcomes	Students can find a missing angle in a complex diagram by combining several angle facts in sequence.
Skills Developed	Geometric reasoning, Multi-step problem solving, Justification
Beginner (L1)	Find a missing angle using two combined angle facts.
Intermediate (L2)	Find a missing angle using three combined angle facts in a multi-step diagram.
Challenge (L3)	Find a missing angle in an unfamiliar diagram requiring four or more reasoning steps, and justify the method.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Multi-step angle reasoning combining known Class 7–8 angle facts
Should NOT Be Tested	Angle reasoning requiring trigonometry

4. Polygon Angle Sum — Advanced Reasoning

Topic Code	C8-GE-04
Domain	Geometry
Subtopics	Interior/exterior angle sum in multi-step problems • Combining polygon facts with algebra • Irregular polygon reasoning
Concept Description	Students apply polygon angle-sum facts in multi-step problems, including combining them with simple algebra.
Learning Outcomes	Students can solve a multi-step problem combining polygon angle-sum facts with algebraic reasoning.
Skills Developed	Geometric reasoning, Algebraic thinking, Multi-step problem solving
Beginner (L1)	Find the interior angle sum of an irregular polygon.

Intermediate (L2)	Find a missing angle in an irregular polygon given the others.
Challenge (L3)	Solve for an unknown number of sides given an algebraic expression for an interior or exterior angle.
Visual Priority	High
Recommended Question Types	Standard MCQ, Missing number
Should Be Tested	Polygon angle-sum reasoning combined with simple algebra
Should NOT Be Tested	Polygon reasoning requiring formal trigonometric identities

5. Geometric Reasoning & Proof-Like Justification

Topic Code	C8-GE-05
Domain	Geometry
Subtopics	Justifying geometric conclusions • Explaining why a result must be true • Comparing valid reasoning approaches
Concept Description	Students justify geometric conclusions using known properties, developing proof-like reasoning without formal notation.
Learning Outcomes	Students can justify a geometric conclusion by clearly stating the properties used.
Skills Developed	Geometric reasoning, Justification, Communication
Beginner (L1)	State the property that justifies a simple geometric fact.
Intermediate (L2)	Explain, using known properties, why a geometric conclusion must be true.
Challenge (L3)	Compare two different valid justifications for the same geometric conclusion and identify a flawed one.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Logical reasoning
Should Be Tested	Informal justification using known Class 7–8 geometry facts
Should NOT Be Tested	Formal two-column or axiomatic proofs

Domain: Circles, Perimeter, Area & Volume

1. Area & Perimeter — Multi-Step Composite Problems

Topic Code	C8-AV-01
Domain	Circles, Perimeter, Area & Volume
Subtopics	Composite figures with missing dimensions • Combining perimeter and area reasoning • Real-life multi-step problems
Concept Description	Students solve multi-step problems requiring both perimeter and area of composite figures, including missing dimensions.
Learning Outcomes	Students can solve a multi-step problem requiring both the perimeter and area of a composite figure.
Skills Developed	Measurement reasoning, Multi-step problem solving, Spatial reasoning
Beginner (L1)	Calculate the area of a composite figure with all dimensions given.
Intermediate (L2)	Find a missing dimension in a composite figure using given area or perimeter information.

Challenge (L3)	Solve a real-life problem requiring both perimeter and area of an unfamiliar composite figure.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Word problem
Should Be Tested	Multi-step perimeter/area problems for composite rectilinear and triangular figures
Should NOT Be Tested	Figures involving curved edges (see Circles topic)

2. Circles — Area & Circumference (Advanced)

Topic Code	C8-AV-02
Domain	Circles, Perimeter, Area & Volume
Subtopics	Area of a circle • Composite shapes involving circles • Sector and arc reasoning (introductory)
Concept Description	Students calculate the area of a circle and solve composite problems combining circles with other shapes.
Learning Outcomes	Students can calculate the area of a circle and solve a composite problem involving a circle and another shape.
Skills Developed	Formula application, Spatial reasoning, Multi-step problem solving
Beginner (L1)	Calculate the area of a circle given its radius or diameter.
Intermediate (L2)	Calculate the area of a composite shape combining a circle (or semicircle) with a rectilinear shape.
Challenge (L3)	Solve a multi-step problem involving the area or circumference of a sector or arc.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Word problem
Should Be Tested	Area of circles; introductory sector/arc reasoning
Should NOT Be Tested	Formal sector-angle formulas beyond simple fractions (e.g. quarter, half)

3. Surface Area of Cubes & Cuboids

Topic Code	C8-AV-03
Domain	Circles, Perimeter, Area & Volume
Subtopics	Nets of cubes/cuboids • Calculating surface area from dimensions • Real-life surface area problems
Concept Description	Students calculate the surface area of cubes and cuboids using nets and direct formula application.
Learning Outcomes	Students can calculate the surface area of a cube or cuboid, including from a net.
Skills Developed	Spatial reasoning, Formula application, Multi-step calculation
Beginner (L1)	Identify the faces of a cuboid from its net and find their areas.
Intermediate (L2)	Calculate the total surface area of a cuboid given its three dimensions.
Challenge (L3)	Solve a real-life problem requiring surface area (e.g. painting, wrapping, packaging).
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Word problem

Should Be Tested	Surface area of cubes and cuboids via net-based and formula-based methods
Should NOT Be Tested	Surface area of cylinders or other curved solids

4. Volume of Cubes, Cuboids & Composite Solids

Topic Code	C8-AV-04
Domain	Circles, Perimeter, Area & Volume
Subtopics	Volume formula application • Composite solid volume • Missing dimension problems
Concept Description	Students calculate the volume of cubes, cuboids and simple composite solids, including finding missing dimensions.
Learning Outcomes	Students can calculate the volume of a composite solid and find a missing dimension given the volume.
Skills Developed	Formula application, Spatial reasoning, Problem solving
Beginner (L1)	Calculate the volume of a cuboid given its three dimensions.
Intermediate (L2)	Calculate the volume of a composite solid made of two cuboids.
Challenge (L3)	Find a missing dimension of a composite solid given its total volume.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Word problem
Should Be Tested	Volume of cubes, cuboids and composite rectilinear solids
Should NOT Be Tested	Volume of cylinders, prisms with non-rectangular cross-sections, or spheres

Domain: Transformations

1. Enlargement & Scale Factor

Topic Code	C8-TF-01
Domain	Transformations
Subtopics	Enlarging a shape by a scale factor • Centre of enlargement • Effect of scale factor on area
Concept Description	Students enlarge shapes by a given scale factor about a centre of enlargement and reason about the effect on area.
Learning Outcomes	Students can enlarge a shape by a given scale factor and describe the effect on its area.
Skills Developed	Spatial reasoning, Proportional reasoning, Coordinate reasoning
Beginner (L1)	Enlarge a simple shape by a whole-number scale factor.
Intermediate (L2)	Enlarge a shape about a given centre of enlargement on a coordinate grid.
Challenge (L3)	Determine the effect of a given scale factor on the area of a shape.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Enlargement by positive whole-number and simple fractional scale factors
Should NOT Be Tested	Enlargement by negative scale factors

2. Combined Transformations

Topic Code	C8-TF-02
Domain	Transformations
Subtopics	Applying two transformations in sequence • Describing a combined transformation • Invariant points and properties
Concept Description	Students apply two transformations in sequence and describe the combined effect, including invariant properties.
Learning Outcomes	Students can apply two transformations in sequence and describe the single combined transformation, where possible.
Skills Developed	Spatial reasoning, Coordinate reasoning, Communication
Beginner (L1)	Apply two given transformations to a shape in sequence.
Intermediate (L2)	Describe the combined effect of two transformations applied in sequence.
Challenge (L3)	Determine whether a point or property remains invariant under a combined transformation.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Visual reasoning
Should Be Tested	Combining any two of reflection, rotation, translation and enlargement
Should NOT Be Tested	Combined transformations requiring matrix representation

Domain: Statistics & Data Handling

1. Histograms & Advanced Graph Interpretation

Topic Code	C8-ST-01
Domain	Statistics & Data Handling
Subtopics	Reading histograms with equal class widths • Comparing histograms to bar charts • Interpreting distribution shape
Concept Description	Students read and interpret histograms with equal class widths and describe the shape of a distribution.
Learning Outcomes	Students can read a value from a histogram and describe the shape of the distribution it shows.
Skills Developed	Data interpretation, Representation, Communication
Beginner (L1)	Read the frequency of a single class interval from a histogram.
Intermediate (L2)	Compare two class intervals on a histogram to answer a question.
Challenge (L3)	Describe the overall shape of a distribution shown on a histogram and explain what it suggests about the data.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Data interpretation
Should Be Tested	Histograms with equal class widths
Should NOT Be Tested	Histograms with unequal class widths (frequency density)

2. Comparing Data Sets — Multi-Step Analysis

Topic Code	C8-ST-02
Domain	Statistics & Data Handling
Subtopics	Comparing using multiple measures • Multi-step comparative reasoning • Justified conclusions with evidence
Concept Description	Students compare two or more data sets using multiple statistical measures and justify their conclusions with evidence.
Learning Outcomes	Students can compare data sets using several measures together and justify a conclusion with specific evidence.
Skills Developed	Data analysis, Comparison, Communication
Beginner (L1)	Compare two data sets using one measure (e.g. mean).
Intermediate (L2)	Compare two data sets using two measures together (e.g. mean and range).
Challenge (L3)	Justify a multi-step conclusion about several data sets using combined evidence from more than one measure.
Visual Priority	Medium
Recommended Question Types	Data interpretation, Multi-step problem
Should Be Tested	Multi-step comparison using mean, median, mode and range together
Should NOT Be Tested	Formal statistical hypothesis testing

3. Misleading Data Representations

Topic Code	C8-ST-03
Domain	Statistics & Data Handling
Subtopics	Identifying misleading scales/axes • Spotting manipulated graphs • Explaining why a representation misleads
Concept Description	Students identify features of a data representation that could mislead a reader and explain why.
Learning Outcomes	Students can identify a misleading feature in a graph or table and explain why it distorts the impression given.
Skills Developed	Critical thinking, Data interpretation, Communication
Beginner (L1)	Identify an obviously misleading feature (e.g. a broken y-axis).
Intermediate (L2)	Explain how a specific graph feature could mislead a reader about the data.
Challenge (L3)	Compare a misleading and an honest representation of the same data and explain the difference in impression they create.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Identifying and explaining common misleading graph techniques
Should NOT Be Tested	Formal statistical bias or sampling theory

Domain: Probability

1. Combined & Complementary Probability

Topic Code	C8-PR-01

Domain	Probability
Subtopics	Probability of combined events • Complementary probability • Simple two-stage probability problems
Concept Description	Students calculate probabilities of combined events, using complementary reasoning and simple two-stage analysis.
Learning Outcomes	Students can calculate the probability of a combined event, including using the complement where useful.
Skills Developed	Probability reasoning, Logical reasoning, Application
Beginner (L1)	Calculate the probability of a simple combined event using a sample-space list.
Intermediate (L2)	Use the complement to calculate the probability of 'at least one' type event.
Challenge (L3)	Solve a multi-step probability problem involving a two-stage experiment with dependent reasoning.
Visual Priority	High
Recommended Question Types	Picture-based MCQ, Standard MCQ
Should Be Tested	Combined and complementary probability for simple two-stage experiments
Should NOT Be Tested	Formal conditional probability notation

2. Experimental vs Theoretical Probability

Topic Code	C8-PR-02
Domain	Probability
Subtopics	Comparing experimental results to theoretical probability • Relative frequency • Reasoning about sample size
Concept Description	Students compare experimental (relative frequency) results with theoretical probability and reason about sample size.
Learning Outcomes	Students can calculate a relative frequency from experimental data and compare it to the theoretical probability.
Skills Developed	Probability reasoning, Data interpretation, Reasoning
Beginner (L1)	Calculate the relative frequency of an event from given trial results.
Intermediate (L2)	Compare a relative frequency to the theoretical probability and describe the difference.
Challenge (L3)	Reason about how increasing the number of trials would be expected to affect the relative frequency.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Data interpretation
Should Be Tested	Relative frequency and its relationship to theoretical probability
Should NOT Be Tested	Formal statistical significance or confidence interval concepts

Domain: Mathematical Logic & Reasoning

1. Multi-Condition Logical Puzzles

Topic Code	C8-LR-01

Domain	Mathematical Logic & Reasoning
Subtopics	Puzzles with several interacting conditions • Systematic organisation of information • Efficient elimination strategies
Concept Description	Students solve puzzles requiring the simultaneous, systematic use of several logical conditions.
Learning Outcomes	Students can solve a puzzle by systematically organising and applying several interacting conditions.
Skills Developed	Logical reasoning, Systematic thinking, Strategy
Beginner (L1)	Solve a puzzle using three conditions.
Intermediate (L2)	Solve a puzzle using four or five conditions, organised in a table.
Challenge (L3)	Solve a puzzle using six or more interacting conditions, requiring an efficient solving strategy.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Logical reasoning
Should Be Tested	Multi-condition puzzles built from Class 8 concepts
Should NOT Be Tested	Puzzles requiring formal logic notation

2. Invariant-Style Reasoning

Topic Code	C8-LR-02
Domain	Mathematical Logic & Reasoning
Subtopics	Identifying what stays the same under change • Reasoning about quantities that must be preserved • Simple invariant puzzles
Concept Description	Students reason about mathematical quantities or properties that remain unchanged (invariant) under a process.
Learning Outcomes	Students can identify a quantity or property that remains invariant under a described mathematical process.
Skills Developed	Logical reasoning, Abstract thinking, Justification
Beginner (L1)	Identify a simple invariant property in a described repeated process.
Intermediate (L2)	Use an invariant to determine whether a final state is possible.
Challenge (L3)	Justify, using invariant reasoning, why a certain outcome can never occur in a described process.
Visual Priority	Medium
Recommended Question Types	Logical reasoning, Standard MCQ
Should Be Tested	Simple invariant reasoning built from Class 8 concepts
Should NOT Be Tested	Invariant reasoning requiring formal group theory or modular arithmetic proofs

3. Counterexamples & Proof-Like Justification

Topic Code	C8-LR-03
Domain	Mathematical Logic & Reasoning
Subtopics	Constructing counterexamples • Distinguishing valid from invalid justifications • Building a simple general argument

Concept Description	Students construct counterexamples to disprove false claims and distinguish valid from invalid mathematical justifications.
Learning Outcomes	Students can construct a counterexample to a false mathematical claim and evaluate the validity of a given justification.
Skills Developed	Logical reasoning, Justification, Critical thinking
Beginner (L1)	Test a mathematical claim using one or two examples.
Intermediate (L2)	Construct a counterexample that disproves a given claim.
Challenge (L3)	Evaluate whether a given justification for a mathematical claim is valid, and explain any flaw.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Logical reasoning
Should Be Tested	Counterexample construction and evaluation of simple justifications
Should NOT Be Tested	Formal mathematical proof requiring advanced notation

Domain: Combinatorics & Counting Strategies

1. Simple Permutations & Combinations (Introductory)

Topic Code	C8-CO-01
Domain	Combinatorics & Counting Strategies
Subtopics	Arrangements where order matters • Selections where order doesn't matter • Distinguishing the two situations
Concept Description	Students distinguish between situations where order matters (arrangements) and where it does not (selections), and count each systematically.
Learning Outcomes	Students can determine whether a counting problem involves order and count the possibilities systematically.
Skills Developed	Combinatorial reasoning, Classification, Systematic counting
Beginner (L1)	Count the number of ways to arrange a small number of distinct items in a row.
Intermediate (L2)	Count the number of ways to select a small group of items where order does not matter.
Challenge (L3)	Solve a counting problem requiring the student to first determine whether order matters, then count accordingly.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Logical reasoning
Should Be Tested	Simple arrangements and selections with small numbers of items
Should NOT Be Tested	Formal factorial notation or combination formulas (nCr)

2. Multiplication Principle — Advanced Applications

Topic Code	C8-CO-02
Domain	Combinatorics & Counting Strategies
Subtopics	Multi-stage counting problems • Counting with restrictions • Combining counting with probability

Concept Description	Students apply the multiplication principle to multi-stage counting problems, including those with restrictions.
Learning Outcomes	Students can apply the multiplication principle to a multi-stage counting problem, including one with a restriction.
Skills Developed	Combinatorial reasoning, Systematic thinking, Problem solving
Beginner (L1)	Apply the multiplication principle to a simple two-stage counting problem.
Intermediate (L2)	Apply the multiplication principle to a three-stage counting problem.
Challenge (L3)	Solve a counting problem with a restriction (e.g. certain items cannot be adjacent or repeated).
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Logical reasoning
Should Be Tested	Multi-stage counting with the multiplication principle, including simple restrictions
Should NOT Be Tested	Counting problems requiring inclusion-exclusion principle

Domain: Problem Solving

1. Multi-Step Problems Across Domains

Topic Code	C8-PS-01
Domain	Problem Solving
Subtopics	Problems combining several domains • Understand-Plan-Represent-Solve-Check-Justify approach • Real-life multi-domain contexts
Concept Description	Students solve multi-step problems that combine three or more mathematical domains from across the curriculum.
Learning Outcomes	Students can plan, solve, check and justify a multi-step problem combining several domains.
Skills Developed	Problem solving, Multi-step reasoning, Justification
Beginner (L1)	Solve a two-domain problem with familiar numbers.
Intermediate (L2)	Solve a problem combining three domains (e.g. algebra, geometry and percentages).
Challenge (L3)	Solve a problem combining four or more domains with an unfamiliar context.
Visual Priority	Medium
Recommended Question Types	Word problem, Multi-step problem
Should Be Tested	Multi-step, multi-domain real-life problems built from Class 8 concepts
Should NOT Be Tested	Problems requiring concepts beyond Class 8 scope

2. Non-Routine Challenge Problems

Topic Code	C8-PS-02
Domain	Problem Solving
Subtopics	Unfamiliar problem types • Hidden relationships • Competition-style strategic reasoning
Concept Description	Students apply strategic, flexible thinking to genuinely unfamiliar, competition-style problems.
Learning Outcomes	Students can approach an unfamiliar problem strategically, trying and comparing more than one approach if needed.

Skills Developed	Non-routine problem solving, Strategic thinking, Perseverance
Beginner (L1)	Solve a non-routine problem with a guided first step.
Intermediate (L2)	Solve a non-routine problem combining two or three known concepts.
Challenge (L3)	Solve a genuinely unfamiliar, multi-condition competition-style problem requiring an elegant or efficient solution.
Visual Priority	Medium
Recommended Question Types	Standard MCQ, Logical reasoning, Word problem
Should Be Tested	Non-routine problems built from Class 8 concepts only
Should NOT Be Tested	Problems requiring concepts beyond Class 8 scope

Domain: Mental Mathematics & Estimation

1. Advanced Mental Strategies (Algebra/Fractions/Percentages)

Topic Code	C8-MN-01
Domain	Mental Mathematics & Estimation
Subtopics	Mental algebraic substitution • Mental fraction/percentage estimation • Strategy comparison across topics
Concept Description	Students apply mental strategies across algebra, fractions and percentages, comparing approaches for efficiency.
Learning Outcomes	Students can mentally estimate or solve a calculation involving algebra, fractions or percentages.
Skills Developed	Mental maths, Number relationships, Strategy selection
Beginner (L1)	Mentally substitute a simple value into an expression.
Intermediate (L2)	Mentally estimate the result of a percentage or fraction calculation.
Challenge (L3)	Choose the most efficient mental approach among algebraic, fraction or percentage methods for the same problem.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Mental maths question
Should Be Tested	Mental strategies across algebra, fractions and percentages within Class 8 scope
Should NOT Be Tested	Written algorithms disguised as mental maths

2. Estimation & Justification of Reasonableness

Topic Code	C8-MN-02
Domain	Mental Mathematics & Estimation
Subtopics	Estimating multi-step results • Justifying why an estimate is reasonable • Checking complex calculations
Concept Description	Students estimate and justify the reasonableness of answers to complex, multi-step calculations.
Learning Outcomes	Students can estimate the result of a complex calculation and justify why their estimate is reasonable.
Skills Developed	Estimation, Reasoning, Communication

Beginner (L1)	Estimate the result of a two-step calculation by rounding.
Intermediate (L2)	Estimate the result of a multi-step calculation involving different operations or number types.
Challenge (L3)	Justify, using estimation, which of several given answers is most likely correct, explaining the reasoning.
Visual Priority	Low
Recommended Question Types	Standard MCQ, Mental maths question
Should Be Tested	Estimation and justified reasonableness checks within Class 8 scope
Should NOT Be Tested	Formal significant-figure or error-bound calculations

10. Class 7 → Class 8 Progression Map

This spiral progression map shows, for every domain, how Class 7 foundations develop into Class 8 fluency and reasoning, and what a Challenge-level extension looks like.

Domain	Class 7 Foundation	Class 8 Development	Challenge Extension
Number Systems & Number Theory	Integers, rational numbers, factorization, HCF/LCM.	Perfect squares/cubes, square roots, deeper number-theory puzzles.	Multi-property number puzzles combining factorization, squares and integer reasoning.
Arithmetic & Operations	Order of operations; combined fraction/decimal fluency.	Efficient mental strategies for complex calculations; error detection and checking.	Justifying the most efficient strategy or checking method for an unfamiliar calculation.
Fractions	All four fraction operations; multi-step word problems.	Fluent multiplication/division of fractions and mixed numbers; multi-step reasoning problems.	Multi-step fraction reasoning puzzles with an unfamiliar structure.
Decimals	All four decimal operations; word problems.	Decimal-by-decimal multiplication/division fluency; multi-step reasoning and error detection.	Multi-step decimal problems requiring estimation-based error checking.
Percentages	Percentage-fraction-decimal links; percentage of a quantity; percentage increase/decrease.	Reverse percentage; profit/loss/discount; multi-step percentage reasoning.	Multi-step problems combining reverse percentage with profit/loss scenarios.
Ratio, Rate & Proportion	Ratio and equivalent ratios; unit rate; direct proportion and scale.	Multi-term ratios; speed-distance-time; direct and introductory inverse proportion.	Multi-step proportional reasoning combining direct and inverse relationships.
Algebraic Thinking	Variables, expressions, substitution, simplifying, one/two-step linear equations.	Expanding brackets, factorizing, multi-step equations, inequalities, rearranging formulae.	Multi-step algebraic manipulation combining expansion, factorization and equation solving.
Sequences & Patterns	Term-to-term rules; position-to-term generalization.	Algebraic nth-term rules; introductory geometric patterns.	Determining term membership or comparing arithmetic and geometric pattern behaviour.
Coordinate Geometry & Linear Relationships	Four-quadrant coordinates; tables of values; simple relationships.	Gradient calculation; plotting/interpreting linear graphs; real-world graphs.	Interpreting gradient and intercepts together in an unfamiliar real-world context.
Geometry	Angle relationships, parallel lines, triangle/quadrilateral/polygon angle facts.	Congruence, similarity, multi-step angle reasoning, advanced polygon reasoning, proof-like justification.	Multi-step diagrams combining congruence/similarity with several angle facts.

Domain	Class 7 Foundation	Class 8 Development	Challenge Extension
Circles, Perimeter, Area & Volume	Perimeter/area of composite rectilinear figures; circle terminology and circumference.	Multi-step composite area/perimeter; circle area and sector reasoning; surface area and composite volume.	Multi-step problems combining circles with rectilinear composite figures and missing dimensions.
Transformations	Reflection and translation on a grid; rotation and symmetry.	Enlargement and scale factor; combined transformations and invariant points.	Describing a single combined transformation and reasoning about its invariant properties.
Statistics & Data Handling	Organizing/representing data; mean/median/mode/range; data interpretation.	Histograms; multi-step comparison of data sets; identifying misleading representations.	Justified multi-step conclusions combining several statistical measures and evidence.
Probability	Sample space; probability as a fraction; complementary events.	Combined/complementary probability; experimental vs theoretical probability.	Multi-step two-stage probability problems requiring dependent reasoning.
Mathematical Logic & Reasoning	Deduction and elimination puzzles; always/sometimes/never reasoning.	Multi-condition puzzles; invariant-style reasoning; counterexamples and proof-like justification.	Puzzles with six or more interacting conditions requiring an efficient solving strategy.
Combinatorics & Counting Strategies	Systematic counting; organized lists; introductory multiplication principle.	Simple permutations/combinations; advanced multiplication principle with restrictions.	Counting problems with restrictions requiring careful case-by-case reasoning.
Problem Solving	Multi-step problems combining two to three domains.	Multi-step problems across three or more domains; genuinely non-routine challenges.	Unfamiliar, multi-domain competition-style problems with more than one valid approach.
Mental Mathematics & Estimation	Mental strategies and estimation across number types.	Advanced mental strategies across algebra, fractions and percentages; justified estimation.	Comparing and justifying the efficiency of different mental strategies for the same problem.

11. MCQ Assessment Blueprint

The following domain-weighting tables give future question writers a recommended percentage distribution for building a balanced Markhor Junior Pioneer Level question bank. Algebraic Thinking carries the strongest single weighting in both classes, reflecting its centrality to Pioneer Level mathematical maturity, and grows further from Class 7 to Class 8 as manipulation fluency and equation complexity increase. Geometry remains consistently well-represented across both classes. Mental Mathematics & Estimation is intentionally woven throughout other domains as a skill rather than heavily weighted as a standalone category.

Class 7 — Domain Distribution

Mathematical Domain	% of Question Bank
Number Systems & Number Theory	8%
Arithmetic & Operations	5%
Fractions	8%
Decimals	6%
Percentages	6%
Ratio, Rate & Proportion	7%

Mathematical Domain	% of Question Bank
Algebraic Thinking	13%
Sequences & Patterns	4%
Coordinate Geometry & Linear Relationships	4%
Geometry	11%
Circles, Perimeter, Area & Volume	8%
Transformations	4%
Statistics & Data Handling	6%
Probability	3%
Mathematical Logic & Reasoning	4%
Combinatorics & Counting Strategies	2%
Problem Solving	4%
Mental Mathematics & Estimation	1%
Total	**104%**

Class 8 — Domain Distribution

Mathematical Domain	% of Question Bank
Number Systems & Number Theory	6%
Arithmetic & Operations	4%
Fractions	6%
Decimals	5%
Percentages	7%
Ratio, Rate & Proportion	7%
Algebraic Thinking	15%
Sequences & Patterns	4%
Coordinate Geometry & Linear Relationships	6%
Geometry	11%
Circles, Perimeter, Area & Volume	8%
Transformations	4%
Statistics & Data Handling	5%
Probability	4%
Mathematical Logic & Reasoning	4%
Combinatorics & Counting Strategies	3%
Problem Solving	4%
Mental Mathematics & Estimation	1%
Total	**104%**

12. Difficulty Distribution

Reflecting the Pioneer Level's increasing mathematical maturity and competition orientation, both classes carry a larger share of Intermediate and Challenge items than the Elementary Level, with Class 8 shifting further toward Challenge as students approach pre-secondary reasoning.

Class 7

Difficulty Level	% of Question Bank
Level 1 — Beginner	25%
Level 2 — Intermediate	40%
Level 3 — Challenge	35%

Class 8

Difficulty Level	% of Question Bank
Level 1 — Beginner	20%
Level 2 — Intermediate	38%
Level 3 — Challenge	42%

13. Future Question Bank Tagging System

Every Markhor Junior Pioneer Level MCQ should be tagged using the following standardised code, consistent with the Beginner, Learner and Elementary Level systems and scalable to future classes:

CLASS – DOMAIN – DIFFICULTY – TYPE – SEQUENCE

Example: C8-AL-C-ALQ-032 → Class 8, Algebraic Thinking, Challenge, Algebraic MCQ, item 32.

Class Codes

Code	Meaning
C7	Pioneer Level — Class 7
C8	Pioneer Level — Class 8

Domain Codes

Code	Meaning
NS	Number Systems & Number Theory
AR	Arithmetic & Operations
FR	Fractions
DC	Decimals
PC	Percentages
RP	Ratio, Rate & Proportion
AL	Algebraic Thinking
SQ	Sequences & Patterns
CG	Coordinate Geometry & Linear Relationships
GE	Geometry
AV	Circles, Perimeter, Area & Volume
TF	Transformations
ST	Statistics & Data Handling
PR	Probability
LR	Mathematical Logic & Reasoning
CO	Combinatorics & Counting Strategies
PS	Problem Solving
MN	Mental Mathematics & Estimation

Difficulty Codes

Code	Meaning
B	Beginner (Level 1)
I	Intermediate (Level 2)
C	Challenge (Level 3)

Question Type Codes

Code	Meaning
MCQ	Standard multiple-choice question
VMCQ	Visual multiple-choice question
PMCQ	Picture-based multiple-choice question
ALQ	Algebraic MCQ
PAT	Pattern question
MSN	Missing value question
LGR	Logical reasoning question
WRD	Word / real-life problem
MSP	Multi-step problem
GEO	Geometry question
GRI	Graph interpretation question
DIN	Data interpretation question
PRB	Probability question
CMP	Comparison question
ERR	Error-detection question

14. Assessment Alignment

This curriculum is structured to directly support every future Markhor Junior assessment product at the Pioneer Level:

- Practice Test — reinforces individual topics and targeted skill practice, drawing mainly from Beginner and Intermediate level items.
- Mock Test — provides mixed-topic, timed examination preparation across all eighteen domains, following the recommended MCQ Assessment Blueprint distribution.
- Past Paper — offers contest-style revision and benchmarking, balancing all three difficulty levels as previously used in official Markhor Junior papers.
- Contest Paper — delivers a balanced evaluation of mathematical knowledge, reasoning, mental mathematics and non-routine problem solving, weighted according to the official domain and difficulty distributions in Sections 11 and 12.

15. Master Syllabus Table

A single reference table for teachers, curriculum managers, question writers and AI question-generation systems. Full topic detail (subtopics, concept description, skills, should/should-not boundaries) is provided in the Detailed Topic-by-Topic Curriculum sections above; this table gives a compact, scannable overview.

Class 7

Code	Domain	Topic	Beginner	Intermediate	Challenge	Visual
C7-NS-01	NS	Integers — Operations & Number Line Reasoning	Add or subtract two integers using a number line.	Multiply or divide integers, including with mixed signs, in a multi-step calculation.	Solve a puzzle requiring reasoning about the sign of a multi-term integer expression.	Medium
C7-NS-02	NS	Rational Numbers & the Number System	Classify a number as a natural number, integer, or rational number.	Compare and order a set of rational numbers, including negative fractions.	Solve a problem requiring reasoning about density (numbers between two given rationals).	Medium
C7-NS-03	NS	Factors, Multiples & Prime Factorization	Find the prime factorization of a number up to 100.	Use prime factorization to determine whether one number divides another.	Solve a puzzle requiring reasoning about a number's factorization structure.	Low
C7-NS-04	NS	HCF & LCM — Concepts & Applications	Find the HCF or LCM of two numbers by listing.	Find the HCF or LCM of two numbers using prime factorization.	Solve a multi-step word problem combining HCF and LCM reasoning.	Low
C7-AR-05	AR	Order of Operations & Multi-Step Calculations	Evaluate an expression with brackets and two operations.	Evaluate an expression with nested brackets and several operations.	Identify and correct an error in an incorrectly evaluated multi-step expression.	Low
C7-AR-06	AR	Operations with Fractions & Decimals (Combined Fluency)	Convert a simple fraction to a decimal (or vice versa) within a calculation.	Solve a two-step calculation combining a fraction operation and a decimal operation.	Solve a multi-step calculation requiring strategic choice of form (fraction or decimal) for efficiency.	Low
C7-FR-07	FR	Fractions — Operations & Reasoning	Add or subtract two fractions with unlike denominators.	Multiply or divide two fractions or mixed numbers.	Solve a multi-step calculation combining several fraction operations.	Medium
C7-FR-08	FR	Fraction Word Problems & Multi-Step Reasoning	Solve a one-step fraction word problem.	Solve a two-step fraction word problem.	Solve a multi-step fraction problem with an unfamiliar or layered context.	Medium
C7-DC-09	DC	Decimals — Operations & Reasoning	Add or subtract two decimals to two or three decimal places.	Multiply or divide decimals, including by another decimal.	Solve a multi-step calculation combining several decimal operations, verified by estimation.	Low
C7-DC-10	DC	Decimal Word Problems	Solve a two-step decimal word problem.	Solve a three-step decimal word problem in a real-life context.	Solve a multi-step decimal problem with an unfamiliar or layered context.	Medium
C7-PC-11	PC	Percentage–Fraction–Decimal Connections	Convert a common percentage to a fraction or decimal.	Convert a less common percentage to a fraction in lowest terms.	Order a mixed set of percentages, decimals and fractions, choosing an efficient comparison strategy.	Medium
C7-PC-12	PC	Percentage of a Quantity & Applications	Find 10%, 20% or 50% of a quantity.	Find a non-standard percentage (e.g. 35%, 62%) of a quantity.	Solve a multi-step problem requiring percentage of a quantity combined with another operation.	Low
C7-PC-13	PC	Percentage Increase & Decrease	Calculate a simple percentage increase on a quantity.	Calculate a percentage decrease and find the resulting value.	Solve a multi-step problem involving a percentage increase followed by a decrease.	Medium
C7-RP-14	RP	Ratio & Equivalent Ratios	Simplify a simple two-term ratio.	Share a quantity in a given two- or three-term ratio.	Solve a multi-step ratio problem combining sharing with another operation.	Medium

Code	Domain	Topic	Beginner	Intermediate	Challenge	Visual
C7-RP-15	RP	Rate & Unit Rate	Calculate a simple rate (e.g. cost per item).	Calculate a unit rate and use it to compare two options.	Solve a multi-step best-value problem involving rates in an unfamiliar context.	Medium
C7-RP-16	RP	Direct Proportion & Scale	Scale a quantity by a whole-number factor.	Use the unitary method to solve a direct proportion word problem.	Solve a multi-step scale-drawing problem involving real-world distances.	High
C7-AL-17	AL	Introduction to Variables & Expressions	Write a simple one-operation expression from a word description.	Write a two-operation expression from a word description.	Translate a multi-step word description into a correct algebraic expression.	Low
C7-AL-18	AL	Simplifying Algebraic Expressions	Combine two like terms in a simple expression.	Simplify an expression with several like and unlike terms.	Simplify an expression involving terms with different variables and coefficients, including negative coefficients.	Low
C7-AL-19	AL	Substitution & Evaluating Expressions	Substitute a value into a one-operation expression.	Substitute values into a two-operation expression or simple formula.	Substitute negative or fractional values into a multi-term expression.	Low
C7-AL-20	AL	Linear Equations in One Variable	Solve a one-step equation.	Solve a two-step equation involving two different operations.	Solve an equation involving a variable on both sides in a simple form.	Low
C7-AL-21	AL	Linear Equations — Word Problems	Set up and solve a one-step equation from a simple word problem.	Set up and solve a two-step equation from a word problem.	Set up and solve an equation from a multi-step or unfamiliar word problem.	Medium
C7-SQ-22	SQ	Arithmetic Sequences — Term-to-Term Rules	Extend an arithmetic sequence given its first few terms.	Identify the term-to-term rule and use it to find a nearby term.	Determine whether a given number could appear in a specific arithmetic sequence.	Medium
C7-SQ-23	SQ	Pattern Generalization & Position-to-Term	Find a nearby term using a given position-to-term rule.	Derive the position-to-term rule for a simple arithmetic sequence.	Find a distant term (e.g. the 50th term) using a derived rule, without listing all terms.	Medium
C7-CG-24	CG	Coordinate Plane — Plotting & Reading Points	Plot a point in a given quadrant.	Find the distance between two points with the same x- or y-coordinate.	Find the coordinates of a point that completes a shape with given properties (e.g. a square).	High
C7-CG-25	CG	Tables of Values & Simple Linear Relationships	Complete a table of values for a simple one-step rule.	Identify the rule connecting the variables in a table of values.	Interpret a real-world graph, including identifying what a specific point represents.	High
C7-GE-26	GE	Angles — Types & Relationships	Classify an angle by type (acute, right, obtuse, straight, reflex).	Find a missing angle using complementary or supplementary angle facts.	Find a missing angle in a diagram combining several angle relationships.	High
C7-GE-27	GE	Parallel Lines & Angle Properties	Identify a pair of corresponding or alternate angles in a diagram.	Find a missing angle using a single parallel-line angle property.	Find a missing angle in a diagram requiring more than one parallel-line angle property.	High
C7-GE-28	GE	Triangles — Properties & Angle Sum	Find a missing angle in a triangle using the angle sum of 180°.	Find a missing angle using the exterior angle theorem.	Find a missing angle in a diagram combining triangle angle facts with another angle property.	High
C7-GE-29	GE	Quadrilaterals — Properties & Classification	Name a quadrilateral from its properties.	Find a missing angle in a quadrilateral using its angle sum of 360°.	Classify a quadrilateral from a description combining several properties.	High
C7-GE-30	GE	Polygons — Interior & Exterior Angles	Calculate the interior angle sum of a polygon using the formula.	Find an individual interior angle of a regular polygon.	Find the number of sides of a regular polygon given an interior or exterior angle.	High
C7-AV-31	AV	Perimeter of Composite Shapes	Find the perimeter of a composite shape with all sides given.	Find a missing side length in a composite shape before calculating perimeter.	Solve a real-life problem requiring perimeter of an unfamiliar composite shape.	High

Code	Domain	Topic	Beginner	Intermediate	Challenge	Visual
C7-AV-32	AV	Area of Triangles, Quadrilaterals & Composite Figures	Calculate the area of a triangle or parallelogram given base and height.	Calculate the area of a trapezium given its parallel sides and height.	Calculate the total area of a composite figure combining several shape types.	High
C7-AV-33	AV	Introduction to Circles — Radius, Diameter & Circumference	Identify the radius, diameter or chord of a circle from a diagram.	Calculate the circumference of a circle given its radius or diameter.	Solve a real-life problem requiring circumference reasoning (e.g. wheel rotations).	High
C7-TF-34	TF	Reflection & Translation on a Grid	Reflect a simple shape across a horizontal or vertical line.	Translate a shape by a given vector on a coordinate grid.	Describe the single transformation that maps one shape to another.	High
C7-TF-35	TF	Rotation & Symmetry	Identify the lines of symmetry in a shape.	Rotate a simple shape by 90° or 180° about a given point.	Determine the order of rotational symmetry of a shape.	High
C7-ST-36	ST	Organizing & Representing Data	Complete a frequency table from a small data set.	Choose the most appropriate graph type for a given data set.	Identify an issue with a poorly chosen or poorly scaled data representation.	High
C7-ST-37	ST	Mean, Median, Mode & Range	Find the mode and range of a small data set.	Find the mean and median of a data set with an even or odd number of values.	Determine which measure (mean, median or mode) best represents a data set with an outlier.	Medium
C7-ST-38	ST	Data Interpretation & Comparing Data Sets	Answer a direct question from a single graph or table.	Compare two data sets using their mean, median or range.	Draw and justify a conclusion requiring evidence from more than one part of the data.	Medium
C7-PR-39	PR	Probability — Basic Concepts & Sample Space	List the sample space of a simple experiment (e.g. rolling a die).	Classify an event as certain, impossible, likely or unlikely.	List the sample space of a two-stage experiment (e.g. two coin tosses).	High
C7-PR-40	PR	Probability as a Fraction	Calculate the probability of a simple event as a fraction.	Calculate the probability of the complement of an event.	Solve a problem requiring probability reasoning across a two-stage experiment.	Medium
C7-LR-41	LR	Logical Puzzles — Deduction & Elimination	Use two or three clues to eliminate incorrect options.	Use four clues, organised in a table, to solve a puzzle.	Solve a puzzle with five or more interacting clues.	Medium
C7-LR-42	LR	Always, Sometimes or Never Reasoning	Test a simple statement with one or two examples.	Find a counterexample that disproves an always/never claim.	Justify why a statement is always true using a general argument rather than examples alone.	Low
C7-CO-43	CO	Systematic Counting & Organized Listing	List all possibilities for a simple counting scenario.	Use a tree diagram to count outcomes of a two-stage scenario.	Apply the multiplication principle to count outcomes of a multi-stage scenario without full listing.	High
C7-PS-44	PS	Multi-Step Word Problems Across Domains	Solve a two-domain problem with familiar numbers.	Solve a three-step problem combining two or three domains.	Solve a problem combining three or more domains with an unfamiliar context.	Medium
C7-MN-45	MN	Mental Calculation Strategies	Apply a basic mental strategy to a two-step calculation.	Apply a mental strategy involving fractions, decimals or percentages.	Choose the most efficient mental approach among several options for an unfamiliar calculation.	Low
C7-MN-46	MN	Estimation & Reasonableness	Estimate the result of a two-number calculation by rounding.	Estimate the result of a multi-step calculation.	Identify the most reasonable of several answers without calculating exactly.	Low

Class 8

Code	Domain	Topic	Beginner	Intermediate	Challenge	Visual
C8-NS-01	NS	Prime Factorization & Perfect Squares/Cubes	Identify a perfect square or perfect cube from a list of numbers.	Use prime factorization to verify whether a number is a perfect square.	Find the smallest number to multiply a given number by to make it a perfect square.	Low
C8-NS-02	NS	Square Roots & Estimating Square Roots	Find the square root of a perfect square up to 400.	Estimate the square root of a non-perfect square between two consecutive integers.	Solve a problem requiring reasoning about which of two square roots is larger without a calculator.	Low
C8-NS-03	NS	Number Theory Reasoning & Puzzles	Solve a puzzle involving one number property (e.g. divisibility).	Solve a puzzle combining two number properties (e.g. prime and odd).	Solve a puzzle requiring several number-property conditions to be satisfied simultaneously.	Low
C8-NS-04	NS	Positive/Negative Number Fluency & Reasoning	Solve a two-step calculation involving positive and negative integers.	Solve a multi-step real-life problem involving integers (e.g. temperature, altitude, finance).	Determine whether a statement about integer operations is always, sometimes or never true.	Medium
C8-AR-05	AR	Efficient Mental Strategies for Complex Calculations	Apply a mental strategy to a two-step calculation.	Apply a mental strategy combining several operations or number types.	Compare two mental strategies and justify which is more efficient for a given problem.	Low
C8-AR-06	AR	Error Detection & Checking Strategies	Identify an error in a one-step calculation.	Identify an error in a multi-step calculation and correct it.	Determine which of several checking strategies would most efficiently verify a given calculation.	Low
C8-FR-07	FR	Multiplying & Dividing Fractions Fluently	Multiply two proper fractions.	Divide a mixed number by a fraction.	Solve a multi-step calculation combining fraction multiplication and division.	Medium
C8-FR-08	FR	Multi-Step Fraction Reasoning Problems	Solve a two-step fraction word problem.	Solve a three-step fraction word problem combining different operations.	Solve a fraction reasoning puzzle with an unfamiliar or layered structure.	Medium
C8-DC-09	DC	Decimal Multiplication & Division Fluency	Multiply two decimals to one decimal place.	Divide a decimal by another decimal.	Solve a multi-step calculation combining decimal multiplication and division, verified by estimation.	Low
C8-DC-10	DC	Multi-Step Decimal Reasoning Problems	Solve a two-step decimal word problem.	Solve a three-step decimal word problem in a real-life context.	Solve a decimal reasoning problem requiring error detection or estimation-based judgement.	Medium
C8-PC-11	PC	Reverse Percentage Problems	Find the original value given a simple percentage increase and the new value.	Find the original value given a percentage decrease and the new value.	Solve a reverse percentage problem in an unfamiliar or multi-part real-life context.	Medium
C8-PC-12	PC	Profit, Loss & Discount Problems	Calculate profit or loss as a percentage of cost price.	Calculate the final price after a single discount.	Solve a multi-step problem involving successive discounts or combined profit/loss scenarios.	Medium
C8-PC-13	PC	Multi-Step Percentage Reasoning	Solve a two-step problem combining a percentage calculation with a simple operation.	Solve a three-step problem comparing two percentage-based scenarios.	Solve a percentage reasoning puzzle with an unfamiliar or layered structure.	Medium
C8-RP-14	RP	Simplifying & Solving Ratio Problems	Simplify a three-term ratio.	Combine two ratios that share a common term to form a single three-term ratio.	Solve a multi-step ratio problem requiring combining and sharing in an unfamiliar context.	Medium
C8-RP-15	RP	Speed, Distance & Time Relationships	Calculate distance given speed and time.	Calculate average speed for a journey with two different speeds.	Solve a multi-step journey problem involving changing speeds or multiple legs of travel.	Medium
C8-RP-16	RP	Multi-Step Proportional Reasoning	Identify whether a given relationship is direct or inverse proportion.	Solve a simple inverse proportion problem (e.g. workers and time).	Solve a multi-step problem combining direct	Medium

Code	Domain	Topic	Beginner	Intermediate	Challenge	Visual
					and inverse proportional reasoning.	
C8-AL-17	AL	Algebraic Manipulation & Like Terms (Advanced)	Combine like terms in an expression with two variables.	Simplify an expression involving terms with powers (e.g. x^2, y^2).	Simplify a multi-term expression combining several variables, powers and negative coefficients.	Low
C8-AL-18	AL	Expanding Brackets	Expand a single bracket with a numeric coefficient.	Expand a single bracket with an algebraic coefficient and simplify.	Expand two simple binomials (e.g. (x+2)(x+3)) and simplify the result.	Low
C8-AL-19	AL	Factorizing Simple Expressions	Identify the common factor of two simple terms.	Factorize a two-term expression by taking out a common factor.	Factorize a three-term expression, checking the result by expanding.	Low
C8-AL-20	AL	Linear Equations — Multi-Step & Brackets	Solve an equation involving a single bracket.	Solve an equation with the variable on both sides.	Solve a multi-step equation combining brackets and the variable on both sides.	Low
C8-AL-21	AL	Linear Inequalities	Solve a one-step inequality.	Solve a two-step inequality and represent it on a number line.	Solve a word problem requiring the setup and solving of a linear inequality.	Medium
C8-AL-22	AL	Rearranging Simple Formulae	Rearrange a one-step formula to change the subject.	Rearrange a two-step formula to change the subject.	Rearrange a formula involving a square or square root to change the subject.	Low
C8-SQ-23	SQ	Sequence Rules — Algebraic Representation	Use a given nth-term rule to find a specific term.	Derive the nth-term rule for an arithmetic sequence from its first few terms.	Determine whether a given number is a term of a sequence using its nth-term rule.	Low
C8-SQ-24	SQ	Geometric Patterns (Introductory)	Extend a simple geometric pattern with a whole-number ratio.	Determine whether a given sequence is arithmetic, geometric or neither.	Solve a problem requiring reasoning about a geometric pattern in an unfamiliar context.	Medium
C8-CG-25	CG	Gradient (Slope) — Concept & Calculation	Calculate the gradient of a line segment shown on a grid.	Calculate the gradient given the coordinates of two points.	Interpret the meaning of a gradient in a real-life context (e.g. speed, cost per item).	High
C8-CG-26	CG	Linear Graphs — Plotting & Interpreting	Plot points from a table of values and draw the resulting line.	Identify the x- and y-intercepts of a linear graph.	Interpret a linear graph to solve a real-life problem, including reading between plotted points.	High
C8-CG-27	CG	Real-World Graphs & Interpretation	Read a specific value from a real-world graph.	Explain what a section of a distance-time graph represents (e.g. stationary, moving).	Compare two real-world graphs or scenarios and explain the mathematical difference between them.	High
C8-GE-28	GE	Congruence of Triangles	Identify whether two triangles appear congruent from given markings.	State which congruence condition (SSS, SAS, ASA, RHS) applies to a given pair of triangles.	Use congruence reasoning to find a missing side or angle in a multi-step diagram.	High
C8-GE-29	GE	Similarity of Triangles	Identify whether two triangles appear similar from given angle markings.	Calculate the scale factor between two similar triangles.	Find a missing side length in a diagram involving similar triangles within a larger figure.	High
C8-GE-30	GE	Multi-Step Angle Reasoning	Find a missing angle using two combined angle facts.	Find a missing angle using three combined angle facts in a multi-step diagram.	Find a missing angle in an unfamiliar diagram requiring four or more reasoning steps, and justify the method.	High
C8-GE-31	GE	Polygon Angle Sum — Advanced Reasoning	Find the interior angle sum of an irregular polygon.	Find a missing angle in an irregular polygon given the others.	Solve for an unknown number of sides given an algebraic expression for an interior or exterior angle.	High
C8-GE-32	GE	Geometric Reasoning & Proof-Like Justification	State the property that justifies a simple geometric fact.	Explain, using known properties, why a geometric conclusion must be true.	Compare two different valid justifications for the same geometric conclusion and identify a flawed one.	Medium

Code	Domain	Topic	Beginner	Intermediate	Challenge	Visual
C8-AV-33	AV	Area & Perimeter — Multi-Step Composite Problems	Calculate the area of a composite figure with all dimensions given.	Find a missing dimension in a composite figure using given area or perimeter information.	Solve a real-life problem requiring both perimeter and area of an unfamiliar composite figure.	High
C8-AV-34	AV	Circles — Area & Circumference (Advanced)	Calculate the area of a circle given its radius or diameter.	Calculate the area of a composite shape combining a circle (or semicircle) with a rectilinear shape.	Solve a multi-step problem involving the area or circumference of a sector or arc.	High
C8-AV-35	AV	Surface Area of Cubes & Cuboids	Identify the faces of a cuboid from its net and find their areas.	Calculate the total surface area of a cuboid given its three dimensions.	Solve a real-life problem requiring surface area (e.g. painting, wrapping, packaging).	High
C8-AV-36	AV	Volume of Cubes, Cuboids & Composite Solids	Calculate the volume of a cuboid given its three dimensions.	Calculate the volume of a composite solid made of two cuboids.	Find a missing dimension of a composite solid given its total volume.	High
C8-TF-37	TF	Enlargement & Scale Factor	Enlarge a simple shape by a whole-number scale factor.	Enlarge a shape about a given centre of enlargement on a coordinate grid.	Determine the effect of a given scale factor on the area of a shape.	High
C8-TF-38	TF	Combined Transformations	Apply two given transformations to a shape in sequence.	Describe the combined effect of two transformations applied in sequence.	Determine whether a point or property remains invariant under a combined transformation.	High
C8-ST-39	ST	Histograms & Advanced Graph Interpretation	Read the frequency of a single class interval from a histogram.	Compare two class intervals on a histogram to answer a question.	Describe the overall shape of a distribution shown on a histogram and explain what it suggests about the data.	High
C8-ST-40	ST	Comparing Data Sets — Multi-Step Analysis	Compare two data sets using one measure (e.g. mean).	Compare two data sets using two measures together (e.g. mean and range).	Justify a multi-step conclusion about several data sets using combined evidence from more than one measure.	Medium
C8-ST-41	ST	Misleading Data Representations	Identify an obviously misleading feature (e.g. a broken y-axis).	Explain how a specific graph feature could mislead a reader about the data.	Compare a misleading and an honest representation of the same data and explain the difference in impression they create.	High
C8-PR-42	PR	Combined & Complementary Probability	Calculate the probability of a simple combined event using a sample-space list.	Use the complement to calculate the probability of 'at least one' type event.	Solve a multi-step probability problem involving a two-stage experiment with dependent reasoning.	High
C8-PR-43	PR	Experimental vs Theoretical Probability	Calculate the relative frequency of an event from given trial results.	Compare a relative frequency to the theoretical probability and describe the difference.	Reason about how increasing the number of trials would be expected to affect the relative frequency.	Medium
C8-LR-44	LR	Multi-Condition Logical Puzzles	Solve a puzzle using three conditions.	Solve a puzzle using four or five conditions, organised in a table.	Solve a puzzle using six or more interacting conditions, requiring an efficient solving strategy.	Medium
C8-LR-45	LR	Invariant-Style Reasoning	Identify a simple invariant property in a described repeated process.	Use an invariant to determine whether a final state is possible.	Justify, using invariant reasoning, why a certain outcome can never occur in a described process.	Medium
C8-LR-46	LR	Counterexamples & Proof-Like Justification	Test a mathematical claim using one or two examples.	Construct a counterexample that disproves a given claim.	Evaluate whether a given justification for a mathematical claim is valid, and explain any flaw.	Low
C8-CO-47	CO	Simple Permutations & Combinations (Introductory)	Count the number of ways to arrange a small number of distinct items in a row.	Count the number of ways to select a small group of items where order does not matter.	Solve a counting problem requiring the student to first determine whether order matters, then count accordingly.	Medium

Code	Domain	Topic	Beginner	Intermediate	Challenge	Visual
C8-CO-48	CO	Multiplication Principle — Advanced Applications	Apply the multiplication principle to a simple two-stage counting problem.	Apply the multiplication principle to a three-stage counting problem.	Solve a counting problem with a restriction (e.g. certain items cannot be adjacent or repeated).	Medium
C8-PS-49	PS	Multi-Step Problems Across Domains	Solve a two-domain problem with familiar numbers.	Solve a problem combining three domains (e.g. algebra, geometry and percentages).	Solve a problem combining four or more domains with an unfamiliar context.	Medium
C8-PS-50	PS	Non-Routine Challenge Problems	Solve a non-routine problem with a guided first step.	Solve a non-routine problem combining two or three known concepts.	Solve a genuinely unfamiliar, multi-condition competition-style problem requiring an elegant or efficient solution.	Medium
C8-MN-51	MN	Advanced Mental Strategies (Algebra/Fractions/Percentages)	Mentally substitute a simple value into an expression.	Mentally estimate the result of a percentage or fraction calculation.	Choose the most efficient mental approach among algebraic, fraction or percentage methods for the same problem.	Low
C8-MN-52	MN	Estimation & Justification of Reasonableness	Estimate the result of a two-step calculation by rounding.	Estimate the result of a multi-step calculation involving different operations or number types.	Justify, using estimation, which of several given answers is most likely correct, explaining the reasoning.	Low

16. Final Quality Control Summary

This curriculum has been reviewed against the following standards:

- Class 7 is appropriately more advanced than Elementary Level Class 5–6, with algebraic thinking, sequences, coordinate geometry, transformations and combinatorics introduced as substantial new domains.
- Class 8 is clearly more advanced than Class 7, with no unnecessary repetition.
- The Pioneer Level connects naturally with the Elementary Level through a consistent spiral progression.
- Arithmetic fluency and abstract mathematical reasoning are balanced throughout; algebra receives appropriate emphasis without becoming a full secondary syllabus.
- Number theory is well represented, with fractions, decimals, percentages and ratios properly connected to each other and to algebra and probability.
- Geometry and coordinate geometry are sufficiently represented; statistics, probability and combinatorial thinking are all included and connected.
- Proof-like reasoning is introduced gradually through counterexamples, justification and always/sometimes/never reasoning, without requiring formal proof notation.
- Problem solving, mental mathematics and estimation are integrated across domains, not treated as isolated add-ons.
- Challenge-level items are built from hidden relationships, multiple conditions, strategic reasoning and generalization, not merely larger numbers or advanced concepts outside the syllabus.
- Every topic can generate high-quality MCQs across the eight standard question concepts and has clearly defined testing boundaries.
- Learning outcomes are measurable and question-bank ready.
- The curriculum supports future Practice Tests, Mock Tests, Past Papers and Contest Papers, and is scalable to future Markhor Junior levels.
- The syllabus is 100% original and exclusively branded as the Markhor Junior Mathematics Curriculum; no external competition is mentioned anywhere in this document.
- No copyrighted material has been copied or closely reproduced from any external source.

