

Syllabus Scope & Purpose: The Group E syllabus bridges upper primary and lower secondary mathematical thinking. Contestants are expected to choose appropriate problem-solving strategies, calculate accurately with mixed numbers and units, and apply mathematical reasoning to non-routine puzzles.

1 Numbers and Operations

- ▶ Apply the order of operations with brackets, $\times$, $\div$, $+$ and $-$ (BODMAS/PEMDAS).
- ▶ Work with whole numbers, decimals and fractions in single and multi-step calculations.
- ▶ Compare fractions and decide if a fraction is proper or improper without full computation.

2 Number Theory and Digits

- ▶ Divisibility rules, multiples and factors; lowest common multiple (LCM, including counting in tens and dozens).
- ▶ Prime numbers, prime factorization, and factor trees.
- ▶ Determining the units digit of a product.
- ▶ Place value and digit puzzles, including letter-for-digit cryptarithms.

3 Fractions, Ratio, Proportion and Percentages

- ▶ Find a fraction of a quantity, and determine the whole from a known part.
- ▶ Share an amount in a given ratio, including multi-part ratios.
- ▶ Direct proportion with whole numbers and decimals.
- ▶ Percentages of quantities and successive percentage changes.
- ▶ Concentration and mixture problems.

4 Word Problems and Algebraic Reasoning

- ▶ Solve multi-step problems with unknown quantities using the bar model or units' method.
- ▶ Age problems across past, present, and future timeframes.
- ▶ Averages: calculating the change in mean when values are added, removed, or increased.
- ▶ Money, unit pricing, and best-value comparison problems.
- ▶ Working backwards through a sequence of mathematical operations.

5 Rates: Motion and Work

- ▶ Speed, distance, and time, including meeting point and catch-up scenarios.
- ▶ Joint work and cooperative rate problems.
- ▶ Workers and time scenarios (painters and fences, hummingbirds and flowers).

6 Measurement and Time

- ▶ Convert units of length, area, volume (m^3 to cm^3), mass (kg and g) and liquid capacity.
- ▶ Time and calendar calculations: hours across days, fractions of a day, and elapsed time.

7 Geometry and Spatial Reasoning

- ▶ Angles in parallel lines cut by a transversal, angle bisectors, and adjacent angle theorems.
- ▶ Properties of quadrilaterals (parallelograms with equal diagonals) and circles (radius, diameter, chord).
- ▶ Area of rectangles and triangles, including shaded and composite regions.
- ▶ Cutting figures on a grid into identical congruent parts.
- ▶ 3-D spatial visualisation: solid cubes built from unit cubes; opposite faces of standard dice.

8 Counting, Sets and Patterns

- ▶ Counting arrangements and selections (e.g. captain and deputy from 11; routes between cities).
- ▶ Venn diagrams with two sets, including finding elements in "neither" category.
- ▶ Number sequences: discovering the inductive rule and continuing sequences (e.g. 2, 6, 12, 20, 30, ...).

9 Logical Reasoning

- ▶ Solve “who is who” association puzzles using systematic elimination tables.
- ▶ Truth-teller and liar deductive statements.
- ▶ Arrangement puzzles with spatial position clues (next to, between, opposite).
- ▶ Careful parsing of precision statements (“all except”, “at least”, “exactly one”).

PROBLEM-SOLVING STRATEGIES & MATHEMATICAL HABITS

Contestants are expected to choose a strategy, not just apply a formula. These eight appear repeatedly across the papers: Working Backwards, Systematic Listing, Pigeonhole Principle, Invariant Parity Arguments, Finding a Pattern, Drawing a Diagram / Bar Model, Making a Simpler Case, and Elimination.