Cambridge Secondary 1
Mathematics Curriculum Framework
(with codes)

Cambridge
Checkpoint

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Contents

> **Note on codes**
>
> Each learning objective has a unique curriculum framework code, e.g.
> **7Ni1**. These codes appear in the Cambridge Teacher Guide, schemes
> of work and other published resources. Each sub-strand has a green
> reporting code, e.g. **Ni**. These codes appear in Checkpoint feedback
> reports. *Problem solving* is not assessed separately and so does not
> have a reporting code.

Introduction

Welcome to the Cambridge Secondary 1 Mathematics curriculum
framework.

This framework provides a comprehensive set of progressive learning
objectives for mathematics. The objectives detail what the learner
should know or what they should be able to do in each year of lower
secondary education. The learning objectives provide a structure for
teaching and learning and a reference against which learners' ability and
understanding can be checked.

The Cambridge Secondary 1 mathematics curriculum is presented in
six content areas: *Number*, *Algebra*, *Geometry*, *Measure*, *Handling data*
and *Problem solving*. The first five content areas are all underpinned
by *Problem solving,* which provides a structure for the application of
mathematical skills. Mental strategies are also a key part of the *Number*
content. Together, these two areas form a progressive step preparing
students for entry onto IGCSE level courses. This curriculum focuses
on principles, patterns, systems, functions and relationships so that
learners can apply their mathematical knowledge and develop a holistic
understanding of the subject. The Cambridge Secondary 1 Mathematics
curriculum framework continues the journey from the Cambridge
Primary Mathematics framework and provides a solid foundation upon
which the later stages of education can be built.

The Cambridge Curriculum is founded on the values of the University
of Cambridge and best practice in schools. The curriculum is dedicated
to developing learners who are confident, responsible, innovative and
engaged. Each curriculum framework for English, mathematics and
science is designed to engage learners in an active and creative learning
journey.

Stage 7

N Number

Ni Integers, powers and roots

- **7Ni1** Recognise negative numbers as positions on a number line, and order, add and subtract positive and negative integers in context.

- **7Ni2** Recognise multiples, factors, common factors, primes (all less than 100), making use of simple tests of divisibility; find the lowest common multiple in simple cases; use the 'sieve' for generating primes developed by Eratosthenes.

- **7Ni3** Recognise squares of whole numbers to at least 20×20 and the corresponding square roots; use the notation 7^2 and $\sqrt{49}$.

Np Place value, ordering and rounding

- **7Np1** Interpret decimal notation and place value; multiply and divide whole numbers and decimals by 10, 100 or 1000.

- **7Np2** Order decimals including measurements, changing these to the same units.

- **7Np3** Round whole numbers to the nearest 10, 100 or 1000 and decimals, including measurements, to the nearest whole number or one decimal place.

Nf Fractions, decimals, percentages, ratio and proportion

- **7Nf1** Recognise the equivalence of simple fractions, decimals and percentages.

- **7Nf2** Simplify fractions by cancelling common factors and identify equivalent fractions; change an improper fraction to a mixed number, and vice versa; convert terminating decimals to fractions, e.g. $0.23 = \frac{23}{100}$.

- **7Nf3** Compare two fractions by using diagrams, or by using a calculator to convert the fractions to decimals, e.g. $\frac{3}{5}$ and $\frac{13}{20}$.

- **7Nf4** Add and subtract two simple fractions, e.g. $\frac{1}{8} + \frac{9}{8}$, $\frac{11}{12} - \frac{5}{6}$; find fractions of quantities (whole number answers); multiply a fraction by an integer.

- **7Nf5** Understand percentage as the number of parts in every 100; use fractions and percentages to describe parts of shapes, quantities and measures.

- **7Nf6** Calculate simple percentages of quantities (whole number answers) and express a smaller quantity as a fraction or percentage of a larger one.

- **7Nf7** Use percentages to represent and compare different quantities.

- **7Nf8** Use ratio notation, simplify ratios and divide a quantity into two parts in a given ratio.

- **7Nf9** Recognise the relationship between ratio and proportion.

- **7Nf10** Use direct proportion in context; solve simple problems involving ratio and direct proportion.

Stage 7

N Number (continued)

Nc Calculation

Mental strategies

- **7Nc1** Consolidate the rapid recall of number facts, including positive integer complements to 100, multiplication facts to 10×10 and associated division facts.

- **7Nc2** Use known facts and place value to multiply and divide two-digit numbers by a single-digit number, e.g. 45×6, $96 \div 6$.

- **7Nc3** Know and apply tests of divisibility by 2, 3, 5, 6, 8, 9, 10 and 100.

- **7Nc4** Use known facts and place value to multiply simple decimals by one-digit numbers, e.g. 0.8×6.

- **7Nc5** Calculate simple fractions and percentages of quantities, e.g. one quarter of 64, 20% of 50 kg.

- **7Nc6** Use the laws of arithmetic and inverse operations to simplify calculations with whole numbers and decimals.

- **7Nc7** Use the order of operations, including brackets, to work out simple calculations.

Addition and subtraction

- **7Nc8** Add and subtract integers and decimals, including numbers with different numbers of decimal places.

Multiplication and division

- **7Nc9** Multiply and divide decimals with one and/or two places by single-digit numbers, e.g. 13.7×8, $4.35 \div 5$.

- **7Nc10** Know that in any division where the dividend is not a multiple of the divisor there will be a remainder, e.g. $157 \div 25 = 6$ remainder 7. The remainder can be expressed as a fraction of the divisor, e.g. $157 \div 25 = 6\frac{7}{25}$.

- **7Nc11** Know when to round up or down after division when the context requires a whole-number answer.

A Algebra

Ae Expressions, equations and formulae

- **7Ae1** Use letters to represent unknown numbers or variables; know the meanings of the words *term*, *expression* and *equation*.

- **7Ae2** Know that algebraic operations follow the same order as arithmetic operations.

- **7Ae3** Construct simple algebraic expressions by using letters to represent numbers.

- **7Ae4** Simplify linear expressions, e.g. collect like terms; multiply a constant over a bracket.

- **7Ae5** Derive and use simple formulae, e.g. to change hours to minutes.

- **7Ae6** Substitute positive integers into simple linear expressions/formulae.

- **7Ae7** Construct and solve simple linear equations with integer coefficients (unknown on one side only), e.g. $2x = 8$, $3x + 5 = 14$, $9 - 2x = 7$.

A Algebra (continued)

As Sequences, functions and graphs

- **7As1** Generate terms of an integer sequence and find a term given its position in the sequence; find simple term-to-term rules.

- **7As2** Generate sequences from spatial patterns and describe the general term in simple cases.

- **7As3** Represent simple functions using words, symbols and mappings.

- **7As4** Generate coordinate pairs that satisfy a linear equation, where y is given explicitly in terms of x; plot the corresponding graphs; recognise straight-line graphs parallel to the x- or y-axis.

G Geometry

Gs Shapes and geometric reasoning

- **7Gs1** Identify, describe, visualise and draw 2D shapes in different orientations.

- **7Gs2** Use the notation and labelling conventions for points, lines, angles and shapes.

- **7Gs3** Name and identify side, angle and symmetry properties of special quadrilaterals and triangles, and regular polygons with 5, 6 and 8 sides.

- **7Gs4** Estimate the size of acute, obtuse and reflex angles to the nearest 10°.

- **7Gs5** Start to recognise the angular connections between parallel lines, perpendicular lines and transversals.

- **7Gs6** Calculate the sum of angles at a point, on a straight line and in a triangle, and prove that vertically opposite angles are equal; derive and use the property that the angle sum of a quadrilateral is 360°.

- **7Gs7** Solve simple geometrical problems by using side and angle properties to identify equal lengths or calculate unknown angles, and explain reasoning.

- **7Gs8** Recognise and describe common solids and some of their properties, e.g. the number of faces, edges and vertices.

- **7Gs9** Recognise line and rotation symmetry in 2D shapes and patterns; draw lines of symmetry and complete patterns with two lines of symmetry; identify the order of rotation symmetry.

- **7Gs10** Use a ruler, set square and protractor to:

  - measure and draw straight lines to the nearest millimetre

  - measure and draw acute, obtuse and reflex angles to the nearest degree

  - draw parallel and perpendicular lines

  - construct a triangle given two sides and the included angle (SAS) or two angles and the included side (ASA)

  - construct squares and rectangles

  - construct regular polygons, given a side and the internal angle

Stage 7

G Geometry (continued)

Gp Position and movement

- **7Gp1** Read and plot coordinates of points determined by geometric information in all four quadrants.

- **7Gp2** Transform 2D points and shapes by:

  – reflection in a given line

  – rotation about a given point

  – translation

  Know that shapes remain congruent after these transformations.

G Measure

Gl Length, mass and capacity

7Gl1 • **7Ml1** Choose suitable units of measurement to estimate, measure, calculate and solve problems in everyday contexts.

7Gl2 • **7Ml2** Know abbreviations for and relationships between metric units; convert between:

– kilometres (km), metres (m), centimetres (cm), millimetres (mm)

– tonnes (t), kilograms (kg) and grams (g)

– litres (l) and millilitres (ml)

7Gl3 • **7Ml3** Read the scales on a range of analogue and digital measuring instruments.

Gt Time and rates of change

7Gt1 • **7Mt1** Draw and interpret graphs in real life contexts involving more than one stage, e.g. travel graphs.

7Gt2 • **7Mt2** Know the relationships between units of time; understand and use the 12-hour and 24-hour clock systems; interpret timetables; calculate time intervals.

Ga Area, perimeter and volume

7Ga1 • **7Ma1** Know the abbreviations for and relationships between square metres (m^2), square centimetres (cm^2), square millimetres (mm^2).

7Ga2 • **7Ma2** Derive and use formulae for the area and perimeter of a rectangle; calculate the perimeter and area of compound shapes made from rectangles.

7Ga3 • **7Ma3** Derive and use the formula for the volume of a cuboid; calculate volumes of cuboids.

7Ga4 • **7Ma4** Calculate the surface area of cubes and cuboids from their nets.

Stage 7

D Handling data

Dc Planning and collecting data

- **7Dc1** Decide which data would be relevant to an enquiry and collect and organise the data.

- **7Dc2** Design and use a data collection sheet or questionnaire for a simple survey.

- **7Dc3** Construct and use frequency tables to gather discrete data, grouped where appropriate in equal class intervals.

Dp Processing and presenting data

- **7Dp1** Find the mode (or modal class for grouped data), median and range.

- **7Dp2** Calculate the mean, including from a simple frequency table.

- **7Dp3** Draw and interpret:
  - bar-line graphs and bar charts
  - frequency diagrams for grouped discrete data
  - simple pie charts
  - pictograms

Di Interpreting and discussing results

- **7Di1** Draw conclusions based on the shape of graphs and simple statistics.

- **7Di2** Compare two simple distributions using the range and the mode, median or mean.

Db Probability

- **7Db1** Use the language of probability to describe and interpret results involving likelihood and chance.

- **7Db2** Understand and use the probability scale from 0 to 1.

- **7Db3** Find probabilities based on equally likely outcomes in simple contexts.

- **7Db4** Identify all the possible mutually exclusive outcomes of a single event.

- **7Db5** Use experimental data to estimate probabilities.

- **7Db6** Compare experimental and theoretical probabilities in simple contexts.

Stage 7

Problem solving

Using techniques and skills in solving mathematical problems

- **7Pt1** Use the laws of arithmetic and inverse operations to simplify calculations with whole numbers and decimals.

- **7Pt2** Manipulate numbers, algebraic expressions and equations, and apply routine algorithms.

- **7Pt3** Understand everyday systems of measurement and use them to estimate, measure and calculate.

- **7Pt4** Recognise and use spatial relationships in two and three dimensions.

- **7Pt5** Draw accurate mathematical diagrams, graphs and constructions.

- **7Pt6** Check results of calculations by using inverse operations.

- **7Pt7** Estimate, approximate and check their working.

- **7Pt8** Solve word problems involving whole numbers, percentages, decimals, money or measures: choose operations and mental or written methods appropriate to the numbers and context, including problems with more than one step.

Using understanding and strategies in solving problems

- **7Ps1** Identify and represent information or unknown numbers in problems, making correct use of numbers, symbols, words, diagrams, tables and graphs.

- **7Ps2** Recognise mathematical properties, patterns and relationships, generalising in simple cases.

- **7Ps3** Work logically and draw simple conclusions.

- **7Ps4** Relate results or findings to the original context and check that they are reasonable.

- **7Ps5** Record and explain methods, results and conclusions.

- **7Ps6** Discuss and communicate findings effectively, orally and in writing.

Stage 8

N Number

Ni Integers, powers and roots

- **8Ni1** Add, subtract, multiply and divide integers.

- **8Ni2** Identify and use multiples, factors, common factors, highest common factors, lowest common multiples and primes; write a number in terms of its prime factors, e.g. $500 = 2^2 \times 5^3$.

- **8Ni3** Calculate squares, positive and negative square roots, cubes and cube roots; use the notation $\sqrt{49}$ and $\sqrt[3]{64}$ and index notation for positive integer powers.

Np Place value, ordering and rounding

- **8Np1** Read and write positive integer powers of 10; multiply and divide integers and decimals by 0.1, 0.01.

- **8Np2** Order decimals, including measurements, making use of the $=, \neq, >$ and $<$ signs.

- **8Np3** Round whole numbers to a positive integer power of 10, e.g. 10, 100, 1000 or decimals to the nearest whole number or one or two decimal places.

Nf Fractions, decimals, percentages, ratio and proportion

- **8Nf1** Find equivalent fractions, decimals and percentages by converting between them.

- **8Nf2** Convert a fraction to a decimal using division; know that a recurring decimal is a fraction.

- **8Nf3** Order fractions by writing with common denominators or dividing and converting to decimals.

- **8Nf4** Add and subtract fractions and mixed numbers; calculate fractions of quantities (fraction answers); multiply and divide an integer by a fraction.

- **8Nf5** Calculate and solve problems involving percentages of quantities and percentage increases or decreases; express one given number as a fraction or percentage of another.

- **8Nf6** Use equivalent fractions, decimals and percentages to compare different quantities.

- **8Nf7** Simplify ratios, including those expressed in different units; divide a quantity into more than two parts in a given ratio.

- **8Nf8** Use the unitary method to solve simple problems involving ratio and direct proportion.

N Number (continued)

Nc Calculation

Mental strategies

- **8Nc1** Use known facts to derive new facts, e.g. given 20 × 38 = 760, work out 21 × 38.

- **8Nc2** Recall squares to 20 × 20, cubes to 5 × 5 × 5, and corresponding roots.

- **8Nc3** Recall simple equivalent fractions, decimals and percentages.

- **8Nc4** Use known facts and place value to multiply and divide simple fractions.

- **8Nc5** Use known facts and place value to multiply and divide simple decimals, e.g. 0.07 × 9, 2.4 ÷ 3.

- **8Nc6** Use known facts and place value to calculate simple fractions and percentages of quantities.

- **8Nc7** Recall relationships between units of measurement.

- **8Nc8** Solve simple word problems including direct proportion problems.

- **8Nc9** Use the laws of arithmetic and inverse operations to simplify calculations with integers and fractions.

- **8Nc10** Use the order of operations, including brackets, with more complex calculations.

Addition and subtraction

- **8Nc11** Consolidate adding and subtracting integers and decimals, including numbers with differing numbers of decimal places.

Multiplication and division

- **8Nc12** Divide integers and decimals by a single-digit number, continuing the division to a specified number of decimal places, e.g. 68 ÷ 7.

- **8Nc13** Multiply and divide integers and decimals by decimals such as 0.6 or 0.06, understanding where to place the decimal point by considering equivalent calculations, e.g. 4.37 × 0.3 = (4.37 × 3) ÷ 10, 92.4 ÷ 0.06 = (92.4 × 100) ÷ 6.

Stage 8

A Algebra

Ae Expressions, equations and formulae

- **8Ae1** Know that letters play different roles in equations, formulae and functions; know the meanings of *formula* and *function*.

- **8Ae2** Know that algebraic operations, including brackets, follow the same order as arithmetic operations; use index notation for small positive integer powers.

- **8Ae3** Construct linear expressions.

- **8Ae4** Simplify or transform linear expressions with integer coefficients; collect like terms; multiply a single term over a bracket.

- **8Ae5** Derive and use simple formulae, e.g. to convert degrees Celsius (°C) to degrees Fahrenheit (°F).

- **8Ae6** Substitute positive and negative integers into formulae, linear expressions and expressions involving small powers, e.g. $3x^2 + 4$ or $2x^3$, including examples that lead to an equation to solve.

- **8Ae7** Construct and solve linear equations with integer coefficients (unknown on either or both sides, without or with brackets).

As Sequences, functions and graphs

- **8As1** Generate terms of a linear sequence using term-to-term and position-to-term rules; find term-to-term and position-to-term rules of sequences, including spatial patterns.

- **8As2** Use a linear expression to describe the nth term of a simple arithmetic sequence, justifying its form by referring to the activity or practical context from which it was generated.

- **8As3** Express simple functions algebraically and represent them in mappings.

- **8As4** Construct tables of values and use all four quadrants to plot the graphs of linear functions, where y is given explicitly in terms of x; recognise that equations of the form $y = mx + c$ correspond to straight-line graphs.

Stage 8

G Geometry

Gs Shapes and geometric reasoning

- **8Gs1** Know that if two 2D shapes are congruent, corresponding sides and angles are equal.

- **8Gs2** Classify quadrilaterals according to their properties, including diagonal properties.

- **8Gs3** Know that the longest side of a right-angled triangle is called the hypotenuse.

- **8Gs4** Identify alternate angles and corresponding angles.

- **8Gs5** Understand a proof that:

  - the angle sum of a triangle is 180° and that of a quadrilateral is 360°

  - the exterior angle of a triangle is equal to the sum of the two interior opposite angles

- **8Gs6** Solve geometrical problems using properties of angles, of parallel and intersecting lines, and of triangles and special quadrilaterals, explaining reasoning with diagrams and text.

- **8Gs7** Draw simple nets of solids, e.g. cuboid, regular tetrahedron, square-based pyramid, triangular prism.

- **8Gs8** Identify all the symmetries of 2D shapes.

- **8Gs9** Use a straight edge and compasses to construct:

  - the midpoint and perpendicular bisector of a line segment

  - the bisector of an angle

- **8Gs10** Use a ruler and compasses to construct:

  - circles and arcs

  - a triangle, given three sides (SSS)

  - a triangle, given a right angle, hypotenuse and one side (RHS)

Gp Position and movement

- **8Gp1** Find the midpoint of the line segment AB, given the coordinates of points A and B.

- **8Gp2** Transform 2D shapes by rotation, reflection and translation, and simple combinations of these transformations.

- **8Gp3** Understand and use the language and notation associated with enlargement; enlarge 2D shapes, given a centre of enlargement and a positive integer scale factor.

- **8Gp4** Interpret and make simple scale drawings.

Cambridge Secondary 1 Mathematics Curriculum Framework (with codes)

Stage 8

G Measure

Gl Length, mass and capacity

8Gl1 • **8Ml1** Choose suitable units of measurement to estimate, measure, calculate and solve problems in a range of contexts, including units of mass, length, area, volume or capacity.

8Gl2 • **8Ml2** Know that distances in the USA, the UK and some other countries are measured in miles, and that one kilometre is about $\frac{5}{8}$ of a mile.

Gt Time and rates of change

8Gt1 • **8Mt1** Draw and interpret graphs in real life contexts involving more than one component, e.g. travel graphs with more than one person.

Ga Area, perimeter and volume

8Ga1 • **8Ma1** Know the definition of a circle and the names of its parts; know and use formulae for the circumference and area of a circle.

8Ga2 • **8Ma2** Derive and use formulae for the area of a triangle, parallelogram and trapezium; calculate areas of compound 2D shapes, and lengths, surface areas and volumes of cuboids.

8Ga3 • **8Ma3** Use simple nets of solids to work out their surface areas.

D Handling data

Dc Planning and collecting data

• **8Dc1** Identify and collect data to answer a question; select the method of collection, sample size and degree of accuracy needed for measurements.

• **8Dc2** Know the difference between discrete and continuous data.

• **8Dc3** Construct and use:

  – frequency tables with given equal class intervals to gather continuous data

  – two-way tables to record discrete data

Dp Processing and presenting data

• **8Dp1** Calculate statistics for sets of discrete and continuous data; recognise when to use the range, mean, median and mode and, for grouped data, the modal class.

• **8Dp2** Draw, and interpret:

  – frequency diagrams for discrete and continuous data

  – pie charts

  – simple line graphs for time series

  – stem-and-leaf diagrams

Stage 8

D Handling data (continued)

Di Interpreting and discussing results

- **8Di1** Interpret tables, graphs and diagrams for discrete and continuous data, and draw conclusions, relating statistics and findings to the original question.

- **8Di2** Compare two distributions, using the range and one or more of the mode, median and mean.

- **8Di3** Compare proportions in two pie charts that represent different totals.

Db Probability

- **8Db1** Know that if the probability of an event occurring is p, then the probability of it not occurring is $1 - p$.

- **8Db2** Find probabilities based on equally likely outcomes in practical contexts.

- **8Db3** Find and list systematically all possible mutually exclusive outcomes for single events and for two successive events.

- **8Db4** Compare estimated experimental probabilities with theoretical probabilities, recognising that:

  – when experiments are repeated different outcomes may result

  – increasing the number of times an experiment is repeated generally leads to better estimates of probability

Problem solving

Using techniques and skills in solving mathematical problems

- **8Pt1** Calculate accurately, choosing operations and mental or written methods appropriate to the numbers and context.

- **8Pt2** Use the order of operations, including brackets, with more complex calculations.

- **8Pt3** Manipulate numbers, algebraic expressions and equations, and apply routine algorithms.

- **8Pt4** Understand everyday measurement systems, using them to estimate, measure and calculate.

- **8Pt5** Recognise and use spatial relationships in two and three dimensions.

- **8Pt6** Draw accurate mathematical diagrams, graphs and constructions.

- **8Pt7** Estimate, approximate and check working.

- **8Pt8** Solve word problems involving calculations with whole numbers, fractions, percentages, decimals, money or measures, including multi-step problems.

Problem solving (continued)

Using understanding and strategies in solving problems

- **8Ps1** Identify the mathematical features of a context or problem; try out and compare mathematical representations using accurate notation.

- **8Ps2** Conjecture and generalise, identifying exceptional cases or counter-examples.

- **8Ps3** Use logical argument to interpret the mathematics in a context or to establish the truth of a statement.

- **8Ps4** Give accurate solutions appropriate to the context or problem.

- **8Ps5** Record and compare reasoning, solutions and conclusions.

- **8Ps6** Refine approaches and findings on the basis of discussions with others.

N Number

Ni Integers, powers and roots

- **9Ni1** Add, subtract, multiply and divide directed numbers.

- **9Ni2** Estimate square roots and cube roots.

- **9Ni3** Use positive, negative and zero indices and the index laws for multiplication and division of positive integer powers.

Np Place value, ordering and rounding

- **9Np1** Recognise the equivalence of 0.1, $\frac{1}{10}$ and 10^{-1}; multiply and divide whole numbers and decimals by 10 to the power of any positive or negative integer.

- **9Np2** Round numbers to a given number of decimal places or significant figures; use to give solutions to problems with an appropriate degree of accuracy.

- **9Np3** Use the order of operations, including brackets and powers.

Nf Fractions, decimals, percentages, ratio and proportion

- **9Nf1** Consolidate writing a fraction in its simplest form by cancelling common factors.

- **9Nf2** Add, subtract, multiply and divide fractions, interpreting division as a multiplicative inverse, and cancelling common factors before multiplying or dividing.

- **9Nf3** Solve problems involving percentage changes, choosing the correct numbers to take as 100% or as a whole, including simple problems involving personal or household finance, e.g. simple interest, discount, profit, loss and tax.

- **9Nf4** Recognise when fractions or percentages are needed to compare different quantities.

- **9Nf5** Compare two ratios; interpret and use ratio in a range of contexts.

- **9Nf6** Recognise when two quantities are directly proportional; solve problems involving proportionality, e.g. converting between different currencies.

Nc Calculation

Mental strategies

- **9Nc1** Extend mental methods of calculation, working with decimals, fractions, percentages and factors, using jottings where appropriate.

- **9Nc2** Solve word problems mentally.

- **9Nc3** Consolidate use of the rules of arithmetic and inverse operations to simplify calculations.

Multiplication and division

- **9Nc4** Multiply by decimals, understanding where to position the decimal point by considering equivalent calculations; divide by decimals by transforming to division by an integer.

- **9Nc5** Recognise the effects of multiplying and dividing by numbers between 0 and 1.

Stage 9

A Algebra

Ae Expressions, equations and formulae

- **9Ae1** Know the origins of the word *algebra* and its links to the work of the Arab mathematician Al'Khwarizmi.

- **9Ae2** Use index notation for positive integer powers; apply the index laws for multiplication and division to simple algebraic expressions.

- **9Ae3** Construct algebraic expressions.

- **9Ae4** Simplify or transform algebraic expressions by taking out single-term common factors.

- **9Ae5** Add and subtract simple algebraic fractions.

- **9Ae6** Derive formulae and, in simple cases, change the subject; use formulae from mathematics and other subjects.

- **9Ae7** Substitute positive and negative numbers into expressions and formulae.

- **9Ae8** Construct and solve linear equations with integer coefficients (with and without brackets, negative signs anywhere in the equation, positive or negative solution); solve a number problem by constructing and solving a linear equation.

- **9Ae9** Solve a simple pair of simultaneous linear equations by eliminating one variable.

- **9Ae10** Expand the product of two linear expressions of the form $x \pm n$ and simplify the corresponding quadratic expression.

- **9Ae11** Understand and use inequality signs ($<$, $>$, $\leqslant$, $\geqslant$); construct and solve linear inequalities in one variable; represent the solution set on a number line.

As Sequences, functions and graphs

- **9As1** Generate terms of a sequence using term-to-term and position-to-term rules.

- **9As2** Derive an expression to describe the nth term of an arithmetic sequence.

- **9As3** Find the inverse of a linear function.

- **9As4** Construct tables of values and plot the graphs of linear functions, where y is given implicitly in terms of x, rearranging the equation into the form $y = mx + c$; know the significance of m and find the gradient of a straight line graph.

- **9As5** Find the approximate solutions of a simple pair of simultaneous linear equations by finding the point of intersection of their graphs.

- **9As6** Use systematic trial and improvement methods to find approximate solutions of equations such as $x^2 + 2x = 20$ (1, 2 and 7).

- **9As7** Construct functions arising from real-life problems; draw and interpret their graphs.

- **9As8** Use algebraic methods to solve problems involving direct proportion, relating solutions to graphs of the equations.

Stage 9

G Geometry

Gs Shapes and geometric reasoning

- **9Gs1** Calculate the interior or exterior angle of any regular polygon; prove and use the formula for the sum of the interior angles of any polygon; prove that the sum of the exterior angles of any polygon is 360°.

- **9Gs2** Solve problems using properties of angles, of parallel and intersecting lines, and of triangles, other polygons and circles, justifying inferences and explaining reasoning with diagrams and text.

- **9Gs3** Draw 3D shapes on isometric paper.

- **9Gs4** Analyse 3D shapes through plans and elevations.

- **9Gs5** Identify reflection symmetry in 3D shapes.

- **9Gs6** Use a straight edge and compasses to:

  – construct the perpendicular from a point to a line and the perpendicular from a point on a line

  – inscribe squares, equilateral triangles, and regular hexagons and octagons by constructing equal divisions of a circle

- **9Gs7** Know and use Pythagoras' theorem to solve two-dimensional problems involving right-angled triangles.

Gp Position and movement

- **9Gp1** Tessellate triangles and quadrilaterals and relate to angle sums and half-turn rotations; know which regular polygons tessellate, and explain why others will not.

- **9Gp2** Use the coordinate grid to solve problems involving translations, rotations, reflections and enlargements.

- **9Gp3** Transform 2D shapes by combinations of rotations, reflections and translations; describe the transformation that maps an object onto its image.

- **9Gp4** Enlarge 2D shapes, given a centre and positive integer scale factor; identify the scale factor of an enlargement as the ratio of the lengths of any two corresponding line segments.

- **9Gp5** Recognise that translations, rotations and reflections preserve length and angle, and map objects on to congruent images, and that enlargements preserve angle but not length.

- **9Gp6** Know what is needed to give a precise description of a reflection, rotation, translation or enlargement.

- **9Gp7** Use bearings (angles measured clockwise from the north) to solve problems involving distance and direction.

- **9Gp8** Make and use scale drawings and interpret maps.

- **9Gp9** Find by reasoning the locus of a point that moves at a given distance from a fixed point, or at a given distance from a fixed straight line.

Stage 9

G Measure

Gl Length, mass and capacity

9Gl1 • **9Ml1** Solve problems involving measurements in a variety of contexts.

Gt Time and rates of change

8Gt1 • **9Mt1** Solve problems involving average speed.

8Gt2 • **9Mt2** Use compound measures to make comparisons in real-life contexts, e.g. travel graphs and value for money.

Ga Area, perimeter and volume

8Ga1 • **9Ma1** Convert between metric units of area, e.g. mm^2 and cm^2, cm^2 and m^2 and volume, e.g. mm^3 and cm^3, cm^3 and m^3; know and use the relationship $1\,cm^3 = 1\,ml$.

8Ga2 • **9Ma2** Know that land area is measured in hectares (ha), and that 1 hectare = $10\,000\,m^2$; convert between hectares and square metres.

8Ga3 • **9Ma3** Solve problems involving the circumference and area of circles, including by using the π key of a calculator.

8Ga4 • **9Ma4** Calculate lengths, surface areas and volumes in right-angled prisms and cylinders.

D Handling data

Dc Planning and collecting data

• **9Dc1** Suggest a question to explore using statistical methods; identify the sets of data needed, how to collect them, sample sizes and degree of accuracy.

• **9Dc2** Identify primary or secondary sources of suitable data.

• **9Dc3** Design, trial and refine data collection sheets.

• **9Dc4** Collect and tabulate discrete and continuous data, choosing suitable equal class intervals where appropriate.

Dp Processing and presenting data

• **9Dp1** Calculate statistics and select those most appropriate to the problem.

• **9Dp2** Select, draw, and interpret diagrams and graphs, including:

– frequency diagrams for discrete and continuous data

– line graphs for time series

– scatter graphs to develop understanding of correlation

– back to back stem-and-leaf diagrams

D Handling data (continued)

Di Interpreting and discussing results

- **9Di1** Interpret tables, graphs and diagrams and make inferences to support or cast doubt on initial conjectures; have a basic understanding of correlation.

- **9Di2** Compare two or more distributions; make inferences, using the shape of the distributions and appropriate statistics.

- **9Di3** Relate results and conclusions to the original question.

Db Probability

- **9Db1** Know that the sum of probabilities of all mutually exclusive outcomes is 1 and use this when solving probability problems.

- **9Db2** Find and record all outcomes for two successive events in a sample space diagram.

- **9Db3** Understand relative frequency as an estimate of probability and use this to compare outcomes of experiments in a range of contexts.

Problem solving

Using techniques and skills in solving mathematical problems

- **9Pt1** Calculate accurately, choosing operations and mental or written methods appropriate to the numbers and context.

- **9Pt2** Manipulate numbers, algebraic expressions and equations, and apply routine algorithms.

- **9Pt3** Understand everyday systems of measurement and use them to estimate, measure and calculate.

- **9Pt4** Recognise and use spatial relationships in two dimensions and three dimensions.

- **9Pt5** Draw accurate mathematical diagrams, graphs and constructions.

- **9Pt6** Decide how to check results, by:

  – using rounding to estimate numbers to one significant figure and calculating mentally then comparing with the estimate

  – considering whether an answer is reasonable in the context of the problem

  – using inverse operations

- **9Pt7** Estimate, approximate and check their working. Solve a range of word problems involving single or multi-step calculations.

Stage 9

Problem solving (continued)

Using understanding and strategies in solving problems

- **9Ps1** Identify, organise, represent and interpret information accurately in written, tabular, graphical and diagrammatic forms.

- **9Ps2** Explore the effect of varying values in order to generalise.

- **9Ps3** Find a counter-example to show that a conjecture is not true.

- **9Ps4** Present concise, reasoned arguments to justify solutions or generalisations using symbols, diagrams or graphs and related explanations.

- **9Ps5** Recognise the impact of constraints or assumptions.

- **9Ps6** Recognise connections with similar situations and outcomes.

- **9Ps7** Consider and evaluate the efficiency of alternative strategies and approaches and refine solutions in the light of these.

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