

Secondary Stage 8 Mathematics for Year 8

Number

Integers, powers and roots

- Add, subtract, multiply and divide integers.
- 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. $500 = 2^2 \times 5^3$.
- Calculate squares, positive and negative square roots, cubes and cube roots; use the notation 49 and $64^{\frac{1}{3}}$ and index notation for positive integer powers.

Place value, ordering and rounding

- Read and write positive integer powers of 10; multiply and divide integers and decimals by 0.1, 0.01.
- Order decimals, including measurements, making use of the =, ≠, > and < signs.
- 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.

Fractions, decimals, percentages, ratio and proportion

- Find equivalent fractions, decimals and percentages by converting between them.
- Convert a fraction to a decimal using division; know that a recurring decimal is a fraction.
- Order fractions by writing with common denominators or dividing and converting to decimals.
- Add and subtract fractions and mixed numbers; calculate fractions of quantities (fraction answers); multiply and divide an integer by a fraction.
- Calculate and solve problems involving percentages of quantities and percentage increases or decreases; express one given number as a fraction or percentage of another.
- Use equivalent fractions, decimals and percentages to compare different quantities.
- Simplify ratios, including those expressed in different units; divide a quantity into more than two parts in a given ratio.
- Use the unitary method to solve simple problems involving ratio and direct proportion.

Calculation

Mental strategies

- Use known facts to derive new facts, e.g. given $20 \times 38 = 760$, work out 21×38 .
- Recall squares to 20×20 , cubes to $5 \times 5 \times 5$, and corresponding roots.
- Recall simple equivalent fractions, decimals and percentages.
- Use known facts and place value to multiply and divide simple fractions.
- Use known facts and place value to multiply and divide simple decimals, e.g. 0.07×9 , $2.4 \div 3$.
- Use known facts and place value to calculate simple fractions and percentages of quantities.
- Recall relationships between units of measurement.
- Solve simple word problems including direct proportion problems.
- Use the laws of arithmetic and inverse operations to simplify calculations with integers and fractions.
- Use the order of operations, including brackets, with more complex calculations.

Addition and subtraction

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

Multiplication and division

- Divide integers and decimals by a single-digit number, continuing the division to a specified number of decimal places, e.g. $68 \div 7$.
- 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. $4.37 \times 0.3 = (4.37 \times 3) \div 10$, $92.4 \div 0.06 = (92.4 \times 100) \div 6$.

Algebra

Expressions, equations and formulae

- Know that letters play different roles in equations, formulae and functions; know the meanings of formula and function.
- Know that algebraic operations, including brackets, follow the same order as arithmetic operations; use index notation for small positive integer powers.
- Construct linear expressions.
- Simplify or transform linear expressions with integer coefficients; collect like terms; multiply a single term over a bracket.
- Derive and use simple formulae, e.g. to convert degrees Celsius ($^{\circ}\text{C}$) to degrees Fahrenheit ($^{\circ}\text{F}$).
- 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.
- Construct and solve linear equations with integer coefficients (unknown on either or both sides, without or with brackets).

Sequences, functions and graphs

- 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.
- Use a linear expression to describe the n th term of a simple arithmetic sequence, justifying its form by referring to the activity or practical context from which it was generated.
- Express simple functions algebraically and represent them in mappings.
- 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.

Geometry

Shapes and geometric reasoning

- Know that if two 2D shapes are congruent, corresponding sides and angles are equal.
- Classify quadrilaterals according to their properties, including diagonal properties.
- Know that the longest side of a right-angled triangle is called the hypotenuse.
- Identify alternate angles and corresponding angles.
- 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.
- Solve geometrical problems using properties of angles, of parallel and intersecting lines, and of triangles and special quadrilaterals, explaining reasoning with diagrams and text.
- Draw simple nets of solids, e.g. cuboid, regular tetrahedron, square based pyramid, triangular prism.
- Identify all the symmetries of 2D shapes.
- Use a straight edge and compasses to construct:
 - the midpoint and perpendicular bisector of a line segment
 - the bisector of an angle.
- 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).

Position and movement

- Find the midpoint of the line segment AB, given the coordinates of points A and B.
- Transform 2D shapes by rotation, reflection and translation, and simple combinations of these transformations.

- Understand and use the language and notation associated with enlargement; enlarge 2D shapes, given a centre of enlargement and a positive integer scale factor.
- Interpret and make simple scale drawings.

Measure

Length, mass and capacity

- 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.
- 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.

Time and rates of change

- Draw and interpret graphs in real life contexts involving more than one component, e.g. travel graphs with more than one person.

Area, perimeter and volume

- Know the definition of a circle and the names of its parts; know and use formulae for the circumference and area of a circle.
- 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.
- Use simple nets of solids to work out their surface areas.

Handling data

Planning and collecting data

- Identify and collect data to answer a question; select the method of collection, sample size and degree of accuracy needed for measurements.
- Know the difference between discrete and continuous data.
- Construct and use:
 - frequency tables with given equal class intervals to gather continuous data
 - two-way tables to record discrete data.

Processing and presenting data

- 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.
- Draw, and interpret:
 - frequency diagrams for discrete and continuous data
 - pie charts
 - simple line graphs for time series
 - stem-and-leaf diagrams.

Interpreting and discussing results

- Interpret tables, graphs and diagrams for discrete and continuous data, and draw conclusions, relating statistics and findings to the original question.
- Compare two distributions, using the range and one or more of the mode, median and mean.
- Compare proportions in two pie charts that represent different totals.

Probability

- Know that if the probability of an event occurring is p , then the probability of it not occurring is $1 - p$.
- Find probabilities based on equally likely outcomes in practical contexts.
- Find and list systematically all possible mutually exclusive outcomes for single events and for two successive events.
- 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

- Calculate accurately, choosing operations and mental or written methods appropriate to the numbers and context.
- Use the order of operations, including brackets, with more complex calculations.
- Manipulate numbers, algebraic expressions and equations, and apply routine algorithms.
- Understand everyday measurement systems, using them to estimate, measure and calculate.
- Recognise and use spatial relationships in two and three dimensions.
- Draw accurate mathematical diagrams, graphs and constructions.
- Estimate, approximate and check working.
- Solve word problems involving calculations with whole numbers, fractions, percentages, decimals, money or measures, including multi-step problems.

Using understanding and strategies in solving problems

- Identify the mathematical features of a context or problem; try out and compare mathematical representations using accurate notation.
- Conjecture and generalise, identifying exceptional cases or counterexamples.
- Use logical argument to interpret the mathematics in a context or to establish the truth of a statement.
- Give accurate solutions appropriate to the context or problem.
- Record and compare reasoning, solutions and conclusions.
- Refine approaches and findings on the basis of discussions with others.