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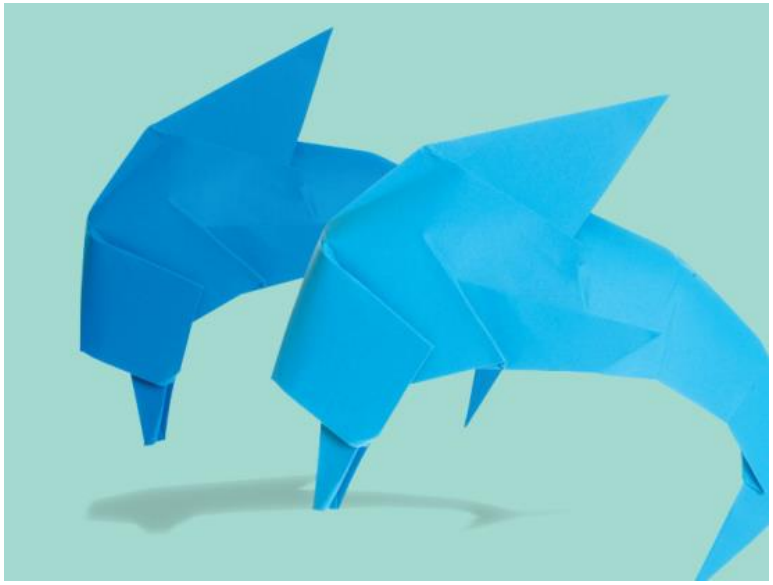

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Topic 1: Number **Time: 11 Hours**

Sub-topic	Previous Knowledge	New knowledge
1.1 Calculations	● Order positive and negative integers and decimals; ● Use the symbols =, <, >; ● Understand the meaning of the words less than. ● Find a fraction of a number. ● Understand the meaning of 'total'. ● Understand the commutative property of multiplication.	● Use priority of operations with positive and negative numbers. ● Simplify calculations by cancelling. ● Use inverse operations.
1.2 Decimal numbers	● Identify place value. ● Convert between metric measures.	● Round to a given number of decimal places. ● Multiply and divide decimal numbers.
1.3 Place value	● Round to the nearest 100, 10 and whole number. ● Multiply and divide by powers of 10.	● Write decimal numbers of millions. ● Round to a given number of significant figures. ● Estimate answers to calculations. ● Use one calculation to find the answer to another.
1.4 Factors and multiples	● Understand the meaning of the words prime, factor, multiple and product. ● List the multiples of a given number.	● Recognise 2-digit prime numbers. ● Find factors and multiples of numbers. ● Find common factors and common multiples of two numbers. ● Find the HCF and LCM of two numbers by listing.
1.5 Squares, cubes and roots	● Round numbers to a specified degree of accuracy.	● Find square roots and cube roots. ● Recognise powers of 2, 3, 4 and 5. ● Understand surd notation on a calculator.
1.6 Index notation	● Use simple powers of 10. ● Convert between metric units. ● Evaluate numeric expressions with powers.	● Use index notation for powers of 10. ● Use index notation in calculations. ● Use the laws of indices.
1.7 Prime factors	● Understand the meaning of the word prime ● List the factors of numbers; identify which factors are prime. ● Evaluate numeric expressions with powers.	● Write a number as the product of its prime factors. ● Use prime factor decomposition and Venn diagrams to find the HCF and LCM.
1.8 Prime factors		● Use a calculator effectively

Unit 1 Challenging exam questions

Topic 2: Algebra **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
2.1 Algebraic expressions	● Simplify simple algebraic expressions.	● Use correct algebraic notation. ● Write and simplify expressions.
2.2 Simplifying expressions	● Multiply and divide simple terms. ● Calculate with positive and negative integers. ● Use index notation.	● Use the index laws. ● Multiply and divide expressions.
2.3 Substitution	● Recognise equivalent expressions. ● Calculate with positive and negative integers. ● Apply the four operations. ● Substitute numbers into expressions.	● Substitute into and evaluate expressions.
2.4 Formulae	● Calculate with negative numbers and terms. ● Write simple expressions.	● Recognise the difference between a formula and an expression. ● Substitute numbers into a simple formula.
2.5 Expanding brackets	● Multiply negative and positive terms. ● Simplify algebraic expressions. ● Write simple formulae.	● Expand brackets. ● Simplify expressions with brackets. ● Substitute numbers into expressions with brackets and powers.
2.6 Factorising	● Find HCFs of number pairs. ● Multiply a single term over brackets.	● Recognise factors of algebraic terms. ● Factorise algebraic expressions. ● Use the identity symbol ≡ and the not equals symbol ≠
2.7 Using expressions and formulae	● Write simple expressions. ● Substitute into and evaluate expressions.	● Write expressions and simple formulae to solve problems. ● Use maths and science formulae.

Unit 2 Challenging exam questions

Topic 3: Graphs, tables & Charts **Time: 12 Hours**

Sub-topic	Previous Knowledge	New knowledge
3.1 Frequency tables	● Addition of numbers. ● Counting tally symbols and drawing tally charts. ● Interpret a frequency table, including calculating the total population.	● Designing tables and data collection sheets. ● Reading data from tables.
3.2 Two-way tables	● Understand use of fractions.	● Use data from tables. ● Design and use two-way tables.
3.3 Time	● Convert between 12 and 24 hour clock times. ● Calculate with time.	● Use timetables
3.4 Representing data	● Determine what features are missing from a graph. ● Interpret bar charts.	● Draw and interpret comparative and composite bar charts. ● Interpret and compare data shown in bar charts, line graphs and histograms.
3.5 Time series	● Write decimal numbers of millions. ● Plot a line graph.	● Plot and interpret time series graphs. ● Use trends to predict what might happen in the future.
3.6 Stem and leaf diagrams	● Place numbers in order of size.	● Construct and interpret stem and leaf and back-to-back stem and leaf diagrams.
3.7 Pie charts	● Express a part of a circle as a fraction or percentage of the whole. ● Know the number of degrees in a circle. ● Draw a circle. ● Draw a given angle.	● Draw and interpret pie charts.
3.8 Scatter graphs	● Understand depreciation of value as things age, as well as an understanding of exceptions (e.g. classic cars) ● Plot coordinates in the first quadrant.	● Plot and interpret scatter graphs. ● Determine whether or not there is a relationship between sets of data.
3.9 Line of best fit	● Recall definitions of positive, negative and no correlation. ● Read values from a graph.	● Draw a line of best fit on a scatter graph. ● Use the line of best fit to predict values.

Unit 3 Challenging exam questions

Topic 4: Fractions & Percentages **Time: 12 Hours**

Sub-topic	Previous Knowledge	New knowledge
4.1 Working with fractions	● Identify equivalence in fractions. ● Identify the denominator of a fraction. ● Identify the numerator of a fraction. ● Find the LCM. ● Write fractions in their simplest form.	● Compare fractions. ● Convert between mixed numbers and improper fractions.
4.2 Operations with fractions	● Convert between units of length. ● Add and subtract fractions.	● Add and subtract fractions. ● Find a fraction of a quantity or measurement. ● Use fractions to solve problems.
4.3 Multiplying fractions	● Know that 1000 g = 1 kg. ● Know the commutative rule a x b = b x a. ● Write 1 million pounds as a figure.	● Multiply whole numbers, fractions and mixed numbers. ● Simplify calculations by cancelling.
4.4 Dividing fractions	● Divide larger numbers by smaller numbers. ● Convert between mixed numbers and improper fractions. ● Multiply a whole number or a fraction by a fraction.	● Divide a whole number by a fraction. ● Divide a fraction by a whole number or a fraction.
4.5 Fractions and decimals	● Identify the (place) value of a digit in a decimal number. ● Convert between common fractions and decimals. ● Write one value as a fraction of another.	● Convert fractions to decimals and vice versa. ● Use decimals to find quantities. ● Write one number as a fraction of another.
4.6 Fractions and percentages	● Write common fractions and decimals as percentages.	● Convert percentages to fractions and vice versa. ● Write one number as a percentage of another.
4.7 Calculating percentages 1	● Find percentages of quantities. ● Convert a fraction to a decimal. ● Convert a percentage to a fraction.	● Convert percentages to decimals and vice versa. ● Find a percentage of a quantity. ● Use percentages to solve problems. ● Calculate simple interest.
4.8 Calculating percentages 2	● Calculate with percentages. ● Convert a percentage to a decimal. ● Find a percentage of a quantity.	● Calculate percentage increases and decreases. ● Use percentages in real-life situations. ● Calculate VAT (value added tax).

Unit 4 Challenging exam questions

Topic 5: Equations, Inequalities & Sequences **Time: 12 Hours**

Sub-topic	Previous Knowledge	New knowledge
5.1 Solving equations 1	● Understand the meaning of the term 'inverse operation'. ● Find the output of a function machine when given the input.	● Understand and use inverse equations. ● Rearrange simple linear equations. ● Solve simple linear equations.
5.2 Solving equations 2	● Use all four operations to solve simple, single one-step equations. ● Work out the outputs of a function machine. ● Simplify expressions.	● Solve two-step equations.
5.3 Solving equations with brackets	● Expand a single bracket, involving positive and negative numbers. ● Solve two-step equations.	● Solve linear equations with brackets. ● Solve equations with unknowns on both sides.
5.4 Introducing inequalities	● Identify numbers that satisfy an inequality. ● Use the inequality signs between numbers.	● Use correct notation to show inclusive and exclusive inequalities. ● Solve simple linear inequalities. ● Write down whole numbers which satisfy an inequality. ● Represent inequalities on a number line.
5.5 More inequalities	● List integer values that satisfy an inequality.	● Solve two-sided inequalities.
5.6 More formulae	● Identify the inverse of all four operations. ● Substitute into and evaluate expressions.	● Substitute values into formulae and solve equations. ● Change the subject of a formula. ● Know the difference between an expression, an equation, a formula and an identity.
5.7 Generating sequences	● Find the missing numbers in simple arithmetic sequences. ● Write down missing terms in sequences. ● Find the term-to-term rule.	● Recognise and extend sequences.
5.8 Using the *n*th term of a sequence	● Substitute into a simple expression. ● Solve simple equations.	● Use the nth term to generate terms of a sequence. ● Find the nth term of an arithmetic sequence.

Unit 5 Challenging exam questions

Topic 6: Angles **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
6.1 Properties of shapes	● Identify lines of symmetry and rotational symmetry in 2D shapes. ● Draw and measure angles.	● Identify congruent shapes. ● Use letters to identify points, lines and angles. ● Use two-letter notation for a line and three-letter notation for an angle.
6.2 Angles in triangles	● Know that the angles on a straight line sum to 180°. ● Know that the angles at a point sum to 360°. ● Know that vertically opposite angles are equal. ● Know that the angles in a triangle sum to 180°.	● Solve angle problems in triangles. ● Understand angle proofs about triangles.
6.3 Angles in quadrilaterals	● Identify different types of quadrilateral. ● Know that the angles in a quadrilateral sum to 360°.	● Solve geometric problems using side and angle properties of quadrilaterals.
6.4 Angles in parallel lines	● Identify parallel and perpendicular lines. ● Identify acute and obtuse angles.	● Understand and use the angle properties of parallel lines. ● Find missing angles using corresponding and alternate angles.
6.5 Exterior and interior angles	● Recall the number of sides of different polygons. ● Know the properties of special triangles and quadrilaterals.	● Calculate the interior and exterior angles of regular polygons.
6.6 More exterior and interior angles	● Recall the number of interior angles in different polygons. ● Identify exterior and interior angles.	● Calculate the interior and exterior angles of polygons. ● Explain why some polygons fit together and some others do not
6.7 Geometrical patterns	● Using angle facts to find missing angles. ● Write an equation to solve a problem.	● Solve angle problems using equations. ● Solve geometrical problems showing reasoning.

Unit 6 Challenging exam questions

Topic 7: Averages and Range **Time: 8 Hours**

Sub-topic	Previous Knowledge	New knowledge
7.1 Mean and range	● Understand that sharing equally involves dividing a total. ● Identify the mode.	● Calculate the mean from a list and from a frequency table. ● Compare sets of data using the mean and range.
7.2 Mode, median and range	● Identify the mode, median and range. ● Identify an incorrect value. ● Draw a stem and leaf diagram. ● Understand inequality notation.	● Find the mode, median and range from a stem and leaf diagram. ● Identify outliers. ● Estimate the range from a grouped frequency table.
7.3 Types of average	● Find the mode, median and mean.	● Recognise the advantages and disadvantages of each type of average. ● Find the modal class. ● Find the median from a frequency table.
7.4 Estimating the mean	● Calculate the value halfway between pairs of numbers. ● Calculate the mean. ● Read data from a frequency table. ● Understand inequality notation.	● Estimate the mean of grouped data. ● Identify the interval containing the median.
7.5 Sampling	● Understand the use of random numbers in a real-life situation.	● Understand the need for sampling. ● Understand how to avoid bias.
7.6 Types of Data		● Primary secondary, quantitative and qualitative.

Unit 7 Challenging exam questions

Topic 8: Perimeter, Area and Volume **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
8.1 Rectangles, parallelograms and triangles	● Understand the meaning of 'perpendicular'. ● Work out the perimeter of triangles and rectangles.	● Calculate the area of rectangles, parallelograms and triangles. ● Calculate a missing length, given the area.
8.2 Trapezia and changing units	● Multiplying and dividing by powers of 10, converting between millimetres, centimetres and metres.	● Calculate the area of trapezia. ● Find the height of a trapezium given its area. ● Convert between area measures.
8.3 Compound shapes	● Know that 1 km = 1000 m ● Multiply and divide by powers of 10. ● Convert between metric measures of area.	● Calculate the perimeter and area of shapes made from triangles and rectangles. ● Calculate perimeters of compound shapes. ● Calculate areas in hectares, and convert between ha and m2.
8.4 Surface area of 3D solids	● Describe shapes using correct vocabulary, including face, edge and vertex. ● Sketch the net of a cuboid. ● Work out the area of rectangles, triangles and trapezia. ● Identify and name common solids: cube, cuboid, cylinder, prism, pyramid, sphere and cone	● Calculate the surface area of a cuboid. ● Calculate the surface area of a prism.
8.5 Volume of prisms	● Identify cross sections of prisms. ● Decide whether a 3D solid is a prism.	● Calculate the volume of a cuboid. ● Calculate the volume of a prism.
8.6 More volume and surface area	● Multiply and divide by large powers of 10. ● Know that 1 litre = 1000 ml. ● Work out the volume and surface area of a prism.	● Solve problems involving surface area and volume. ● Convert between measures of volume.
8.7 Real Life		● Make sensible estimates of a range of measures in everyday settings

Unit 8 Challenging exam questions

Topic 9: Graphs **Time: 12 Hours**

Sub-topic	Previous Knowledge	New knowledge
9.1 Coordinates	● Halve a number. ● Draw, label and scale axes ● Plot and recognise co-ordinates in all four quadrants ● Substitute into an equation, and solve for an unknown.	● Find the midpoint of a line segment. ● Recognise, name and plot straight-line graphs parallel to the axes. ● Recognise, name and plot the graphs of y=a, x=a, y = x and y = –x.
9.2 Linear graphs	● Use a function machine. ● Read scales	● Generate and plot coordinates from a rule. ● Plot straight-line graphs from tables of values. ● Draw graphs to represent relationships.
9.3 Gradient	● Understand that parallel lines will never meet. ● Identify which line is steepest.	● Find the gradient of a line. ● Identify and interpret the gradient from an equation. ● Understand that parallel lines have the same gradient.
9.4 *y = mx + c*	● Understand that in a linear equation, the coefficient of x is the gradient. ● Understand that parallel lines have the same gradient. ● Draw a line with a given gradient.	● Understand what m and c represent in y = mx + c. ● Find the equations of straight-line graphs from the graph. ● Find the equations of straight-line graphs from a point and the gradient. ● Sketch graphs given the values of m and c.
9.5 Real-life graphs	● Interpret scales. ● Draw a graph of an equation in the form y = mx + c.	● Draw and interpret graphs from real data. ● Interpret Conversion graphs
9.6 Distance-time graphs	● Understand and use the relationship between distance, average speed and time.	● Use distance–time graphs to solve problems. ● Draw distance–time graphs. ● Interpret a distance–time graph.
9.7 More real-life graphs	● Recall the definitions of positive, negative and no correlation. ● Find the equation of a line.	● Draw and interpret a range of graphs, including distance-time and velocity-time. ● Understand when predictions are reliable. ● Interpret rate of change graphs.

Unit 9 Challenging exam questions

Topic 10: Transformations **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
10.1 Translation	● List the four types of transformations	● Translate a shape on a coordinate grid. ● Use a column vector to describe a translation.
10.2 Reflection	● Define the word perpendicular ● Reflect a shape in a mirror line.	● Draw a reflection of a shape in a mirror line. ● Draw reflections on a coordinate grid. ● Describe reflections on a coordinate grid including giving the equation of the mirror line.
10.3 Rotation	● Know the number of degrees in fractions of a turn. ● Use the words clockwise and anticlockwise.	● Rotate a shape on a coordinate grid. ● Describe a rotation.
10.4 Enlargement	● Find scale factor from object to image and from image to object.	● Enlarge a shape by a scale factor. ● Enlarge a shape using a centre of enlargement.
10.5 Describing enlargements	● Recognise the properties of enlargements. ● Simplify fractions.	● Identify the scale factor of an enlargement. ● Find the centre of enlargement. ● Describe an enlargement.
10.6 Combining transformations	● State key information for describing transformations. ● Identify the type of transformation used. ● Recognise congruent shapes by eye.	● Transform shapes using more than one transformation. ● Describe combined transformations of shapes on a grid.

Unit 10 Challenging exam questions

Topic 11: Ratio and Proportion **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
11.1 Writing ratios	● Multiply and divide whole numbers.	● Use ratio notation. ● Write a ratio in its simplest form. ● Write a ratio as a fraction.
11.2 Using ratios 1	● Know and use metric conversions. ● Find the HCF of a pair of numbers.	● Solve simple problems using ratios. ● use a ratio to find one quantity when the other is known.
11.3 Ratios and measures	● Convert units of weight, length, capacity and time. ● Use index notation. ● Work out areas of rectangles and volumes of cubes.	● Use ratios to convert between units. ● Write and use ratios for shapes and their enlargements.
11.4 Using ratios 2	● Write ratios using correct notation. ● Round to a specified degree of accuracy. ● Write a ratio in its simplest form.	● Divide a quantity into 2 parts in a given ratio. ● Divide a quantity into 3 parts in a given ratio. ● Solve word problems using ratios.
11.5 Comparing using ratios	● Interpret ratios. ● Write a ratio in its simplest form.	● Use ratios involving decimals. ● Compare ratios. ● Solve ratio and proportion problems.
11.6 Using proportion	● Understand and use place value to order decimals. ● Write a ratio in the form 1 : n.	● Use the unitary method to solve proportion problems. ● Solve proportion problems in words. ● Scale up recipes. ● Work out which product is better value for money.
11.7 Proportion and graphs	● Understand and use y = mx + c. ● Use conversion graphs. ● Plot a line graph from a table of values.	● Recognise and use direct proportion on a graph. ● Understand the link between the unit ratio and the gradient.
11.8 Proportion problems	● Relate common sense to real life problems.	● Recognise different types of proportion. ● Solve word problems involving direct and inverse proportion.

Unit 11 Challenging exam questions

Topic 12: Right-angled Triangles **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
12.1 Pythagoras' theorem 1	● Calculate of simple squares and square roots. ● Substitute into and evaluate expressions. ● Round answers to a specified degree of accuracy.	● Understand Pythagoras' theorem. ● Calculate the length of the hypotenuse in a right-angled triangle. ● Solve problems using Pythagoras' theorem.
12.2 Pythagoras' theorem 2	● Understand the meaning of ≠. ● Interpret a surd expression shown on the calculator display. ● Identify the hypotenuse, and calculate its length.	● Calculate the length of a line segment AB. ● Calculate the length of a shorter side in a right-angled triangle.
12.3 Trigonometry: the sine ratio 1	● Simplify fractions. ● Convert fractions to decimals using a calculator.	● Understand and recall the sine ratio in right-angled triangles. ● Use the sine ratio to calculate the length of a side in a right-angled triangle. ● Use the sine ratio to solve problems.
12.4 Trigonometry: the sine ratio 2	● Calculate the sine of an angle in a right-angled triangle. ● Use the sin key on a calculator.	● Use the sine ratio to calculate an angle in a right-angled triangle. ● Use the sine ratio to solve problems.
12.5 Trigonometry: the cosine ratio	● Identify the hypotenuse and adjacent side in a right-angled triangle.	● Understand and recall the cosine ratio in right-angled triangles. ● Use the cosine ratio to calculate the length of a side in a right-angled triangle. ● Use the cosine ratio to calculate an angle in a right-angled triangle. ● Use the cosine ratio to solve problems.
12.6 Trigonometry: the tangent ratio	● Identify the opposite and adjacent sides in right-angled triangles.	● Understand and recall the tangent ratio in right-angled triangles. ● Use the tangent ratio to calculate the length of a side in a right-angled triangle. ● Use the tangent ratio to calculate an angle in a right-angled triangle. ● Solve problems using an angle of elevation or depression.
12.7 Finding lengths and angles using trigonometry	● Identify the sine, cosine and tangent ratios.	● Understand and recall trigonometric ratios in right-angled triangles. ● Use trigonometric ratios to solve problems.
12.8 Knowing exact values for trigonometric ratios	● Identify the sine, cosine and tangent ratios. ● Pythagoras's Theorem	● Know the exact values of the sine, cosine and tangent of 0°, 30°, 45°, 60° and 90° (not tan of 90°)

Unit 12 Challenging exam questions

Topic 13: Probability **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
13.1 Calculating probability	● Write probability as a fraction or a decimal ● Add and subtract fractions and decimals.	● Calculate simple probabilities from equally likely events. ● Understand mutually exclusive and exhaustive outcomes.
13.2 Two events	● List outcomes. ● Simplify fractions.	● Use two-way tables (sample space diagrams) to record the outcomes from two events. ● Work out probabilities from sample space diagrams.
13.3 Experimental probability	● Convert fractions, decimals and percentages. ● Compare fractions. ● Understand theoretical probability (single event). ● Use two-way tables.	● Find and interpret probabilities based on experimental data. ● Make predictions from experimental data.
13.4 Venn diagrams	● Add and subtracting equivalent fractions. ● List primes and multiples. ● Calculate probabilities.	● Use Venn diagrams to work out probabilities. ● Understand the language of sets and Venn diagrams.
13.5 Tree diagrams	● Calculate with fractions. ● List the possible outcomes for two events. ● Work out the probability of something not happening. ● Calculate probabilities.	● Use frequency trees and tree diagrams. ● Work out probabilities using tree diagrams. ● Understand independent events.
13.6 More tree diagrams	● Calculate with and simplify fractions. ● Work out probabilities using tree diagrams.	● Understand when events are not independent. ● Solve probability problems involving events that are not independent.

Unit 13 Challenging exam questions

Topic 14: Multiplicative reasoning **Time: 9 Hours**

Sub-topic	Previous Knowledge	New knowledge
14.1 Percentages	● Convert percentages to decimals. ● Express one number as a percentage of another. ● Work out percentage increases and decreases.	● Calculate a percentage profit or loss. ● Express a given number as a percentage of another in more complex situations. ● Find the original amount given the final amount after a percentage increase or decrease
14.2 Growth and decay	● Write powers of numbers in index form. ● Relate percentages to decimals.	● Find an amount after repeated percentage change. ● Solve growth and decay problems.
14.3 Compound measures	● Understand 'rate' as a mathematical concept. ● Substitute into and solve equations. ● Rearrange equations. ● Convert between metric units of volume. ● Calculate the area of a trapezium. ● Calculate the volume of a prism.	● Solve problems involving compound measures.
14.4 Distance, speed and time	● Find speed in km/h, given distance travelled in minutes. ● Convert between metric units of length.	● Convert between metric speed measures. ● Calculate average speed, distance and time. ● Use formulae to calculate speed and acceleration.
14.5 Direct and inverse proportion	● Identify graphs showing direct proportion. ● Write a ratio as a unit ratio.	● Use ratio and proportion in measures and conversions. ● Use inverse proportions.

Unit 14 Challenging exam questions

Topic 15: Constructions, loci and bearings **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
15.1 3D solids	● Recall names of common 2D shapes.	● Recognise 3D shapes and their properties. ● Describe 3D shapes using the correct mathematical words. ● Understand the 2D shapes that make up 3D objects.
15.2 Plans and elevations	● Identify names of 2D shapes from faces of 3D solids. ● Recall names of common 3D shapes. ● Know the properties of special triangles and quadrilaterals.	● Identify and sketch planes of symmetry of 3D shapes. ● Understand and draw plans and elevations of 3D shapes. ● Sketch 3D shapes based on their plans and elevations.
15.3 Accurate drawings 1	● Understand of the meaning of 'congruence'. ● Draw lines, angles and circles accurately	● Make accurate drawings of triangles using a ruler, protractor and compasses. ● Identify SSS, ASA, SAS and RHS triangles as unique from a given description. ● Identify congruent triangles
15.4 Scale drawings and maps	● Work out scale factor of an enlargement. ● Write a ratio in the form 1 : m, and write equivalent ratios. ● Convert between metric measurements of length.	● Draw diagrams to scale. ● Correctly interpret scales in real-life contexts. ● Use scales on maps and diagrams to work out lengths and distances. ● Know when to use exact measurements and estimations on scale drawings and maps. ● Draw lengths and distances correctly on given scale drawings.
15.5 Accurate drawings 2	● Knowledge of scale factors of enlargement. ● Identify a solid from its net.	● Accurately draw angles and 2D shapes using a ruler, protractor and compasses. ● Construct a polygon inside a circle. ● Recognise nets and make accurate drawings of nets of common 3D objects.
15.6 Constructions	● Identify parallel and perpendicular lines. ● Draw lines accurately.	● Draw accurately using rulers and compasses. ● Bisect angles and lines using rulers and compasses.
15.7 Loci and regions	● Convert distances from map scale to real life distance and vice versa. ● Construct the perpendicular bisector.	● Draw loci for the path of points that follow a given rule. ● Identify regions bounded by loci to solve practical problems.
15.8 Bearings	● Working out the complement to 180 or 360 (addition and subtraction). ● Recall the properties of angles at a point, angles on a straight line, alternate and corresponding angles.	● Find and use three-figure bearings. ● Use angles at parallel lines to work out bearings. ● Solve problems involving bearings and scale diagrams.

Unit 15 Challenging exam questions

Topic 16: Quadratic equations and graphs **Time: 11 Hours**

Sub-topic	Previous Knowledge	New knowledge
16.1 Expanding double brackets	● Be able to work out area of a shape using algebraic terms. ● Simplify algebraic expressions. ● Multiply a single term over brackets.	● Multiply double brackets. ● Recognise quadratic expressions. ● Square single brackets.
16.2 Plotting quadratic graphs	● Be able to square terms. ● Identify the equation of the mirror line. ● Copy and complete a table of values and plot a straight line graph.	● Plot graphs of quadratic functions. ● Recognise a quadratic function. ● Use quadratic graphs to solve problems.
16.3 Using quadratic graphs	● Define the origin and x-axis on a graph. ● Copy and complete a table of values and plot a quadratic graph.	● Solve quadratic equations $ax^2 + bx + c = 0$ using a graph. ● Solve quadratic equations $ax^2 + bx + c = k$ ● Using a graph.
16.4 Factorising quadratic expressions	● Work out factor pairs of negative numbers ● Multiply double brackets.	● Factorise quadratic expressions.
16.5 Solving quadratic equations algebraically	● Know that taking the square root of a number will result in both a positive and a negative answer. ● Factorise quadratic expressions.	● Solve quadratic functions algebraically.

Unit 16 Challenging exam questions

Topic 17: Perimeter, area and volume 2 **Time: 12 Hours**

Sub-topic	Previous Knowledge	New knowledge
17.1 Circumference of a circle 1	● Round accurately to a given number of significant figures or decimal place. ● Rearrange equations.	● Calculate the circumference of a circle. ● Solve problems involving the circumference of a circle.
17.2 Circumference of a circle 2	● Round to nearest metre. ● Solve equations. ● Understand inequality notation. ● Rearrange equations.	● Calculate the circumference and radius of a circle. ● Work out percentage error intervals.
17.3 Area of a circle	● Evaluate squares and square roots. ● Substitute into formulae and solve for the unknown.	● Work out the area of a circle. ● Work out the radius or diameter of a circle. ● Solve problems involving the area of a circle. ● Give answers in terms of π.
17.4 Semicircles and sectors	● Know number of degrees in a full turn, half turn or quarter turn. ● Simplify fractions. ● Find the area and circumference of a circle.	● Understand and use maths language for circles and perimeters. ● Work out areas of semicircles and quarter circle and perimeters. ● Solve problems involving sectors of circles.
17.5 Composite 2D shapes and cylinders	● Know and use the formula for the volume of a prism. ● Sketch the net of a cylinder. ● Work out the area and perimeter of rectangles, semicircles and quarter circles. ● Give answers in terms of π.	● Solve problems involving areas and perimeters of 2D shapes. ● Work out the volume and surface area of cylinders.
17.6 Pyramids and cones	● Understand and use maths language for 3-D shapes. ● Work out the area of 2D shapes. ● Give answers in terms of π.	● Work out the volume of a pyramid. ● Work out the surface area of a pyramid. ● Work out the volume of a cone. ● Work out the surface area of a cone.
17.7 Spheres and composite solids	● Know volume and surface area formulae. ● Work out the length of the hypotenuse using Pythagoras' theorem.	● Work out the volume of a sphere. ● Work out the surface area of a sphere. ● Work out the volume and surface area of composite solids.

Unit 17 Challenging exam questions

Topic 18: Fractions, indices and standard form **Time: 10 Hours**

Sub-topic	Previous Knowledge	New knowledge
18.1 Multiplying and dividing fractions	● Convert between fractions, mixed numbers and improper fractions. ● Work out reciprocals of whole numbers, fractions, and decimals. ● Four operations with fractions.	● Multiply and divide mixed numbers and fractions.
18.2 The laws of indices	● Evaluate simple powers. ● Recall the index laws for multiplying and dividing positive integer powers.	● To know and use the laws of indices.
18.3 Writing large numbers in standard form	● Evaluate powers of 10. ● Write 1 million and 1 billion in figures.	● Write large numbers in standard form. ● Convert large numbers from standard form into ordinary numbers.
18.4 Writing small numbers in standard form	● Divide integers and decimals by powers of ten.	● Write small numbers in standard form. ● Convert numbers from standard form with negative powers of ordinary numbers
18.5 Calculating with standard form	● Use correct priority of operations. ● Write numbers in standard form.	● To multiply and divide numbers in standard form. ● To add and subtract numbers in standard form.

Unit 18 Challenging exam questions

Topic 19: Congruence, similarity and vectors **Time: 12 Hours**

Sub-topic	Previous Knowledge	New knowledge
19.1 Similarity and enlargement	● Understand the scale factor of an enlargement. ● Equivalent fractions.	● Understand similarity. ● Use similarity to solve angle problems.
19.2 More similarity	● Calculating fractions of whole numbers. ● Using similarity of triangles to identify equal angles and lengths of corresponding sides. ● Identify similar shapes.	● Find the scale factor of an enlargement. ● Use similarity to solve problems.
19.3 Using similarity	● Understand squares and cubes of whole numbers and decimals. ● Use similarity to find unknown lengths.	● Understand the similarity of regular polygons. ● Calculate perimeters of similar shapes.
19.4 Congruence 1	● Know that the sum of the angles in a triangle must be 180°. ● Identify congrent shapes.	● Recognise congruent shapes. ● Use congruence to work out unknown angles.
19.5 Congruence 2	● Recognise corresponding and alternate angles. ● Find angles using corresponding and alternate angles. ● Draw triangles accurately.	● Use congruence to work out unknown sides.
19.6 Vectors 1	● Add and subtract with negative numbers. ● Use column vectors.	● Add and subtract vectors. ● Find the resultant of two vectors.
19.7 Vectors 2	● Calculate with negative numbers. ● Find the resultant of two vectors.	● Subtract vectors. ● Find multiples of a vector.

Unit 19 Challenging exam questions

Topic 20: More algebra **Time: 12 Hours**

Sub-topic	Previous Knowledge	New knowledge
20.1 Graphs of cubic and reciprocal functions	● Recognise the shape of linear and quadratic graphs. ● Find reciprocals of fractions and integers.	● Draw and interpret graphs of cubic functions. ● Draw and interpret graphs of y = 1/x.
20.2 Non-linear graphs	● Recognise statements and equations describing direct and indirect proportion. ● Recognise the graphs of y = x and y = 1/x.	● Draw and interpret non-linear graphs to solve problems.
20.3 Solving simultaneous equations graphically	● Write algebraic expressions.	● Solve simultaneous equations by drawing a graph. ● Write and solve simultaneous equations.
20.4 Solving simultaneous equations algebraically	● Add and subtract positive and negative terms, substitute integer and decimal values into a simple expression.	● Solve simultaneous equations algebraically.
20.5 Rearranging formulae	● Identify inverse operations for algebraic terms. ● Identify parallel lines from the equations of the lines.	● Change the subject of a formula.
20.6 Proof	● Identify expressions, formulae and equations from a list.	● Identify expressions, equations, formulae and identities. ● Prove results using algebra.

Unit 20 Challenging exam questions