|  | | **HHT1**  **NUMBER** | **HT2**  **ALGEBRAIC THINKING/**  **TIME** | **HT3**  **NUMBER** | **HT4**  **GEOMETRY &**  **MEASURE & ANGLES** | **HT5**  **PROBABILITY & SHAPES** | **HT6**  **STATISTICS & Construction** |
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| Learning outcomes/ composite knowledge:  Pupils will be able to… | | **LO1: Place Value**  Solve number problems  involving addition, subtraction, multiplications and division  **LO2: Ordering decimals &**  **Integers.**  To compare and order whole  numbers and decimals.  **LO3: Calculations with**  **negative numbers.**  Calculate addition,  subtraction, multiplications  and division that involve  negative numbers.  **LO4: BIDMAS**  Use BIDMAS to work out  calculations including brackets, powers, roots and fractions.  Find the reciprocal of an  expression.  **LO5: Powers & Roots &**  **Primes and proof.**  Use power laws and understand the use of negative powers.  **LO6: Standard Form**  Convert between ordinary numbers and standard form for very large and very small numbers. | **LO1: Algebraic expressions.**  Expand and factorise single and double brackets.  **LO2: Solving Equations**  To understand how to solve equations containing fractions, brackets and variables on both sides.  **LO3: Writing formulas**  Write formulas, substitute values into formulas and rearrange formulas to make another letter the subject.  **LO4: Position to term rule.**  Use a position to term rule (nth term) to find terms and positions in a sequence.  Find the nth term rule for a sequence. | **LO1: Equivalent fractions**  Identify equivalent fractions,  simplify fractions, rewrite fractions over a common denominator and put fractions in order of size.  **LO2: Adding and subtracting**  **Fractions**  To apply the rules of  addition and subtraction of fractions  **L03: Mixed numbers &**  **Improper fractions.**  Convert between mixed  numbers add improper fractions.  Add and subtract two mixed  numbers.  **LO4: Multiplying whole**  **numbers by fractions.**  To apply the rules of  multiplying and dividing fractions  **LO5: Simplifying Ratio.**  Simplify Ratios and use ratios  to solve problems.  **LO6: Percentage Change.**  Find a percentage change or an  amount after a percentage  change.  Find the original value of an  item before a percentage  change.  Use simple interest. | **LO1: Properties of triangles &**  **Quadrilaterals.**  Find interior and exterior angles  in polygons, both regular and irregular.  **LO2: Deduction**  To extend and apply knowledge of angles and shapes to more complex problems  **LO3: Rotation and Translation**  To describe and implement different transformations.  **LO4: Vectors**  To work with vectors | **LO1: Probability Scale.**  Calculate probabilities.  **LO2: Sample space diagram.**  Draw sample space diagrams and use them to find probabilities.  **LO3: Venn Diagrams.**  Understand sets and set notation.  Draw and interpret Venn diagrams, and use them to calculate probabilities.  **LO4: Transformations.**  Carry out reflections, rotations, translations and enlargements.  **LO5: Three dimensional shape.**  To work with three dimensional shapes.  Find the volume and surface are of 3D shapes, Including cylinders.  **LO6: Pythagoras**  Understand and use Pythagoras’ Theorem.. | **LO1: Scatter graphs & Correlation.**  Draw and interpret scatter graphs.  Understand what is meant by an outlier.  **LO2: Lines of best fit**  Draw and interpret lines of best fit. Understand what is meant by an outlier.  **LO3: Mean, median, mode & Ranges.**  Find the range, mode, median and mean of a set of data, and use them to compare data set.  **LO4: Ungrouped& Grouped frequency tables.**  Find averages and the range from frequency tables, included ungrouped tables.  **LO5: Pictograms & Bar Charts.**  Complete and interpret frequency tables.  Draw and interpret bar chats, dual bar charts and pictograms.  **LO6: Construction**  Using mathematical equipment to construct a triangle, a perpendicular bisector of a line segment and an angle bisector. |
| Knowledge Components | Declarative knowledge | **LO3: Calculations with**  **negative numbers.**  I know mathematical rules for all 4 operations with directed number  **LO4: BIDMAS**  I know the order of operations.  I know what a reciprocal is.  **LO5: Powers & Roots &**  **Primes and proof.**  I know the laws of indices including with negative indices.  **LO6: Standard Form**  I know how to convert between ordinary numbers and standard form for very large and very small numbers. | **LO1: Algebraic expressions.**  I know how to expand and factorise single and double brackets.  **LO2: Solving Equations**  I know mathematical conventions for solving equations containing fractions, brackets and variables on both sides.  **LO4: Position to term rule.**  I know how to find a position to term rule (nth term) to find terms and positions in a sequence.  I know how to find the nth term rule for a sequence. | **LO1: Equivalent fractions**  I know what equivalent fractions are.  **LO2: Adding and subtracting**  **Fractions**  I know the rules of  addition and subtraction of fractions  **L03: Mixed numbers &**  **Improper fractions.**  I know that mixed numbers and improper fractions are the same fraction written in different ways. **LO4: Multiplying whole**  **numbers by fractions.**  I know the rules of  multiplying and dividing fractions  **LO5: Simplifying Ratio.**  I know how ratio links to fractions.  **LO6: Percentage Change.**  I know how to find a percentage change or an amount after a percentage change.  I know how to find the original value of an item before a percentage change.  I know how to calculate simple interest. | **LO1: Properties of triangles &**  **Quadrilaterals.**  I know how to find the sum of interior angles for shapes of n sides.  I know that exterior angles of any polygon add to 360.  **LO3: Rotation and Translation**  I can recognise rotational symmetry and a translation.  **LO4: Vectors**  I know what a vector is.  I know what a translation is. | **LO1: Probability Scale.**  I know that the sum of all possible probabilities is 1.  **LO3: Venn Diagrams.**  I understand sets and set notation.  **LO5: Three dimensional shape.**  I know the units that are used with volume.  I can describe the difference between volume and surface area.  **LO6: Pythagoras**  I know what Pythagoras’ Theorem is used for. | **LO1: Scatter graphs & Correlation.**  I know what is meant by an outlier and can identify one on a scatter diagram.  **LO3: Mean, median, mode & Ranges.**  I know what a range is.  I know how to calculate measures of central tendency.  **LO6: Construction**  I know what a perpendicular bisector is.  I know what an angle bisector is. |
| Procedural knowledge | **LO1: Place Value**  I can solve number problems  involving addition, subtraction, multiplications and division  **LO2: Ordering decimals &**  **Integers.**  I can compare and order whole numbers and decimals.  **LO3: Calculations with**  **negative numbers.**  I can calculate addition,  subtraction, multiplications  and division that involve  negative numbers.  **LO4: BIDMAS**  I can use BIDMAS to work out  calculations including brackets, powers, roots and fractions.  I can find the reciprocal of an  expression.  **LO5: Powers & Roots &**  **Primes and proof.**  I can use power laws and understand the use of negative powers.  **LO6: Standard Form**  I can convert between ordinary numbers and standard form for very large and very small numbers. | **LO1: Algebraic expressions.**  I can expand and factorise single and double brackets.  **LO2: Solving Equations**  I can solve equations containing fractions, brackets and variables on both sides.  **LO3: Writing formulas**  I can form formulas, substitute values into formulas and rearrange formulas to make another letter the subject.  **LO4: Position to term rule.**  I can use a position to term rule (nth term) to find terms and positions in a sequence.  I can find the nth term rule for a sequence. | **LO1: Equivalent fractions**  I can identify equivalent fractions, simplify fractions, rewrite fractions over a common denominator and put fractions in order of size.  **LO2: Adding and subtracting**  **Fractions**  I can apply the rules of  addition and subtraction of fractions  **L03: Mixed numbers &**  **Improper fractions.**  I can convert between mixed  numbers add improper fractions.  I can add and subtract two mixed numbers.    **LO4: Multiplying whole**  **numbers by fractions.**  I can apply the rules of  multiplying and dividing fractions  **LO5: Simplifying Ratio.**  I can simplify ratios and use ratios to solve problems.  **LO6: Percentage Change.**  I can find a percentage change or an amount after a percentage  change.  I can find the original value of an item before a percentage  change.  I can use simple interest. | **LO1: Properties of triangles &**  **Quadrilaterals.**  I can find interior and exterior angles in polygons, both regular and irregular.  **LO3: Rotation and Translation**  I can describe and implement different transformations.  **LO4: Vectors**  I can describe a translation using a vector.  I can translate a shape by a given vector. | **LO1: Probability Scale.**  I can calculate probabilities.  **LO2: Sample space diagram.**  I can draw sample space diagrams and use them to find probabilities.  **LO3: Venn Diagrams.**  I can draw and interpret Venn diagrams, and use them to calculate probabilities.  **LO4: Transformations.**  I can carry out reflections, rotations, translations and enlargements.  **LO5: Three dimensional shape.**  I can find the volume and surface are of 3D shapes, Including cylinders.  **L6: Pythagoras**  I can use Pythagoras’ Theorem to find missing sides of right angled triangles. | **LO1: Scatter graphs & Correlation.**  I can draw and interpret scatter graphs.  **LO2: Lines of best fit**  I can draw and interpret lines of best fit.  **LO3: Mean, median, mode & Ranges.**  I can find the range, mode, median and mean of a set of data, and use them to compare data sets.  **LO4: Ungrouped& Grouped frequency tables.**  I can find averages and the range from frequency tables, included ungrouped tables.  **LO5: Pictograms & Bar Charts.**  I can complete and interpret frequency tables.  I can draw and interpret bar chats, dual bar charts and pictograms.  **LO6: Construction**  I can use mathematical equipment to construct a triangle, angle bisector and a perpendicular bisector of a line segment. |
| Contextual knowledge | **LO6: Standard Form**  I can make sensible choices about when to write a number in standard form. | **LO3: Writing formulas**  I can read a worded question and from it form a mathematical equation. | **L03: Mixed numbers &**  **Improper fractions.**  I can decide when it is better to write a mixed number as an improper fraction  **LO6: Percentage Change.**  I can read a worded question and decide whether I am calculating a percentage increase or decrease. | **LO2: Deduction**  I can apply my knowledge of angles and shapes to more complex problems  **LO3: Rotation and Translation**  Given a transformation I can decide whether it is a reflection, rotation or a translation and provide reasons. | **LO4: Transformations.**  I can describe a given transformation using mathematical language. | **LO1: Scatter graphs & Correlation.**  I know when it would be appropriate to draw a scatter diagram.  **LO3: Mean, median, mode & Ranges.**  I can compare data sets using measures of central tendency and a measure of spread.  I can provide appropriate reasons about the best measure of central tendency to use based on the context of the data.  **LO5: Pictograms & Bar Charts.**  I can make an appropriate choice of the best graphical representation of a set of data.  **LO6: Construction**  I can read and interpret a mathematical question and identify whether it requires me to construct a perpendicular bisector or angle bisector. |
| National Curriculum References | | Extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations ;  Begin to reason deductively in geometry, number and algebra, including using geometrical constructions;  Interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning; Understand and use place value for decimals, measures and integers of any size;  Order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥;  Use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation property;  Use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative; Use conventional notation for the priority of operations, including brackets, powers, roots and reciprocals;  Recognise and use relationships between operations including inverse operations;  Use integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5 and distinguish between exact representations of roots and their decimal approximations; Interpret and compare numbers in standard form A x 10n 1≤A<10, where n is a positive or negative integer or zero;  Work interchangeably with terminating decimals and their corresponding fractions;  Round numbers and measures to an appropriate degree of accuracy [for example, to a number of decimal places or significant figures];  Use approximation through rounding to estimate answers and calculate possible resulting errors expressed using inequality notation *a*<*x*≤*b ;*  Use a calculator and other technologies to calculate results accurately and then interpret them appropriately; Appreciate the infinite nature of the sets of integers, real and rational numbers; | Select and use appropriate calculation strategies to solve increasingly complex problems;  Use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships;  Substitute values in expressions, rearrange and simplify expressions, and solve equations;  Move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs];  Develop algebraic and graphical fluency, including understanding linear and simple quadratic functions;  Use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics;  Extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations;  Identify variables and express relations between variables algebraically and graphically; Make and test conjectures about patterns and relationships; look for proofs or counter- examples;  Begin to reason deductively in geometry, number and algebra, including using geometrical constructions;  Use and interpret algebraic notation, including  *ab* in place of *a* × *b*  3*y* in place of *y* + *y* + *y* and 3 × *y*  *a*2 in place of *a* × *a*, *a*3 in place of *a* × *a* × *a*; *a*2*b* in place of *a* × *a* × *b*  *a* in place of *a*  *b*  coefficients written as fractions rather than as decimals  brackets;  Substitute numerical values into formulae and expressions, including scientific formulae; Understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors; Simplify and manipulate algebraic expressions to maintain equivalence by collecting like terms  multiplying a single term over a bracket  taking out common factors  expanding products of two or more binomials;  Understand and use standard mathematical formulae; rearrange formulae to change the subject;  Model situations or procedures by translating them into algebraic expressions or formulae and by using graphs; Use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement);  Interpret mathematical relationships both algebraically and graphically;  Recognise, sketch and produce graphs of linear and quadratic functions of one variable with appropriate scaling, using equations in *x* and *y* and the Cartesian plane;  Reduce a given linear equation in two variables to the standard form *y* = m*x* + c; calculate and interpret gradients and intercepts of graphs of such linear equations numerically, graphically and algebraically; Use linear and quadratic graphs to estimate values of *y* for given values of *x* and vice versa and to find approximate solutions of simultaneous linear equations; Find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs;  Generate terms of a sequence from either a term-to-term or a position-to-term rule,  Recognise arithmetic sequences and find the *n*th; Recognise geometric sequences and appreciate other sequences that arise. | Select and use appropriate calculation strategies to solve increasingly complex problems; Move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs];  Use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics;  Extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations;  Extend and formalise their knowledge of ratio and proportion in working with measures and geometry, and in formulating proportional relations algebraically;  Make and test conjectures about patterns and relationships; look for proofs or counter- examples;  Begin to reason deductively in geometry, number and algebra, including using geometrical constructions;  Interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning;  Order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols =, ≠, <, >, ≤, ≥;  Use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative; Recognise and use relationships between operations including inverse operations;  Work interchangeably with terminating decimals and their corresponding fractions;  Define percentage as ‘number of parts per hundred’, interpret percentages and percentage changes as a fraction or a decimal, interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%;  Interpret fractions and percentages as operators;  Use a calculator and other technologies to calculate results accurately and then interpret them appropriately; c  hange freely between related standard units [for example time, length, area, volume/capacity, mass];  Use scale factors, scale diagrams and maps;  Express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1;  Use ratio notation, including reduction to simplest form; Divide a given quantity into two parts in a given part:part or part:whole ratio;  Express the division of a quantity into two parts as a ratio;  Understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction;  Relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions;  Solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics;  Solve problems involving direct and inverse proportion, including graphical and algebraic representations; use compound units such as speed, unit pricing and density to solve problems; | Move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs];  Use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics;  Extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations;  Make and test conjectures about patterns and relationships; look for proofs or counter- examples; Begin to reason deductively in geometry, number and algebra, including using geometrical constructions;  Model situations or procedures by translating them into algebraic expressions or formulae and by using graphs;  Use scale factors, scale diagrams and maps;  Derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders);  Draw and measure line segments and angles in geometric figures, including interpreting scale drawings;  Describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric;  Use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles;  Derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies; Identify properties of, and describe the results of, translations, rotations and reflections applied to given figures;  Apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles;  Understand and use the relationship between parallel lines and alternate and corresponding angles;  Derive and use the sum of angles in a triangle and use it to deduce the angle sum in any polygon, and to derive properties of regular polygons;  Interpret mathematical relationships both algebraically and geometrically;  Calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes; Describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric;  Use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles;  Identify properties of, and describe the results of, translations, rotations and reflections applied to given figures;  Identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids; | Move freely between different numerical, algebraic, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals, and equations and graphs];  Use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics;  Extend their understanding of the number system; make connections between number relationships, and their algebraic and graphical representations;  Make and test conjectures about patterns and relationships; look for proofs or counter- examples ;  Begin to reason deductively in geometry, number and algebra, including using geometrical constructions;  Use a calculator and other technologies to calculate results accurately and then interpret them appropriately;  Derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia, volume of cuboids (including cubes) and other prisms (including cylinders); Describe, sketch and draw using conventional terms and notations: points, lines, parallel lines, perpendicular lines, right angles, regular polygons, and other polygons that are reflectively and rotationally symmetric;  Use the standard conventions for labelling the sides and angles of triangle ABC, and know and use the criteria for congruence of triangles;  Identify properties of, and describe the results of, translations, rotations and reflections applied to given figures;  Identify and construct congruent triangles, and construct similar shapes by enlargement, with and without coordinate grids;  Apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides, including Pythagoras’ Theorem, and use known results to obtain simple proofs;  Use Pythagoras’ Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles; Use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D;  Interpret mathematical relationships both algebraically and geometrically;  Record, describe and analyse the frequency of outcomes of simple probability experiments involving randomness, fairness, equally and unequally likely outcomes, using appropriate language and the 0-1 probability scale;  Understand that the probabilities of all possible outcomes sum to1;  Enumerate sets and unions/intersections of sets systematically, using tables, grids and Venn diagrams;  Generate theoretical sample spaces for single and combined events with equally likely, mutually exclusive outcomes and use these to calculate theoretical probabilities. | Use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes, probability and statistics;  Identify variables and express relations between variables algebraically and graphically;  Make and test conjectures about patterns and relationships; look for proofs or counter- examples; Explore what can and cannot be inferred in statistical and probabilistic settings, and begin to express their arguments formally;  Use a calculator and other technologies to calculate results accurately and then interpret them appropriately;  Describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data; and appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers);  Construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts, pie charts, and pictograms for categorical data, and vertical line (or bar) charts for ungrouped and grouped numerical data;  Describe simple mathematical relationships between two variables (bivariate data) in observational and experimental contexts and illustrate using scatter graphs.  Derive and use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); recognise and use the perpendicular distance from a point to a line as the shortest distance to the line |
| Develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems;  Develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics;  Begin to model situations mathematically and express the results using a range of formal mathematical representations;  Select appropriate concepts, methods and techniques to apply to unfamiliar and non- routine problems. | | | | | |