Curriculum Progression Map - Maths

Maths Intent (summary):

The Maths curriculum has been developed to allow our pupils to build on foundational knowledge through a broad, engaging and challenging curriculum. By the time students leave in Year 11, they will

- have a deep and broad understanding of the application of maths to a range of problems, as per the National Curriculum for KS3 and KS4.
- Pupils will possess a well-rounded knowledge of number properties, calculation skills and algebraic manipulation, an appreciation of shape, space and measure, an appreciation of ratio and proportion (and its role in life) and a broad understanding of statistics and probability.
- Pupils will be fluent in a range of skills across the 5 key areas of mathematics (number, algebra, ratio & proportion, shape, space & measure, and statistics & probability) achieved through clear expert instruction and refined through purposeful practice, interleaving and spaced practice.
- Pupils will be able to apply logic and reason to understand, unpick and solve a range of problems, including the skills of planning, conjecturing, making generalisations, developing a mathematical argument, justification, and proof.
- There will be an appreciation of mathematics in real life contexts and have some understanding of where the skills they have developed are used in society.
- There will an appreciation of literacy and the language of mathematics and be able to articulate their thoughts, ideas, and conjectures in a mathematically accurate way.

Maths is a true cross curriculum subject, and these transferrable skills are used and applied through different subjects highlighting the importance of skills of mathematics in practical contexts. This is achieved using a variety of concepts including misconception questions in the pursuit for pupils to be able to analyse and identify incorrect working demonstrating their working knowledge and processes required to achieve the correct answer. Most importantly the engaging curriculum will help develop and build resilience to change the mind set to an 'I can do Maths'.

Key Stage 3 and 4 Summary:

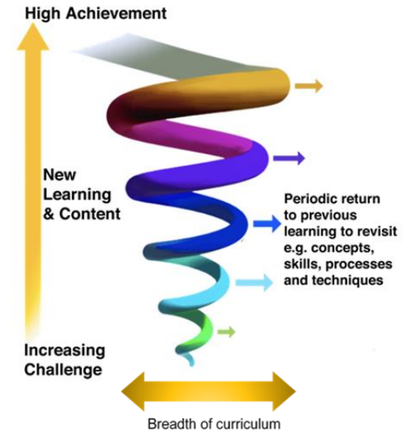
- Become **fluent** in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately.
- **Reason mathematically** by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language.
- Can **solve problems** by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions.

The programme of study for key stage 3 and 4 is organised into apparently distinct domains, but pupils will develop and consolidate connections across mathematical ideas.

Schemes of learning:

- Pupils to follow appropriate pathway dependent on personal ability and gaps in learning.
- In maths we use a spiralled curriculum model which allows for previous learning to be reinforced as well as allowing for related new content to be taught and learned. The spiral focuses on the sequencing and revisiting of themes enabling pupils to be extended and challenged whilst addressing and supporting gaps in learning.
- This achieved through a 'white rose maths curriculum' which follows a block-based structure that spirals back to each topic and encourages learners to revisit and build upon prior knowledge each year.
- GCSE foundation/ higher course and content taught through to year 11 – Alternate pathways for identified students to access functional skills mathematics from entry level 1 through to level 2.

Pearson | Edexcel



Curriculum Progression Map KS3 and 4

	Term 1 – 8 weeks	Term 2 – 7 weeks	Term 3 – 6 weeks	Term 4 – 6 weeks	Term 5 – 5 weeks	Term 6 – 7 weeks
KS3 – 1	**Sequences** **Key learning Content: A23** • Describe and continue sequences • Find the next term(s) • Linear and non-linear sequences • Continue linear sequences • Continue non-linear sequences • Term-to-term rules • Find missing terms (E) **Algebraic notation and substitution** **Key learning Content: A1, A2** • 1-step function machines (number) • 1-step function machines (algebra) • Find a function (one step) • Substitution (one step) • 2-step function machines (number) • 2-step function machines (algebra) • Find a function (two step) • Substitution (two step) **Expressions and equations** **Key learning Content: A3, A4, A17** • Equality and equivalence • Related facts • Like and unlike terms • Collect like terms • Solve 1-step equations (+/-) • Solve 1-step equations (x/÷) • Solve 2-step equations	**Place value and rounding** **Key learning Content: N1, N9** • Write integers in numerals and words • Intervals on a number line • Compare and order integers • Place value for decimals • Decimals on a number line • Compare and order decimals • Round to powers of 10 • Round to the nearest integer • Round to decimal places • Powers of 10 (E) • Numbers greater than 1 in standard form (E) • Negative powers of 10 (E) • Numbers between 0 and 1 in standard form (E) **Four operations** **Key learning: N2** • Add and subtract integers • Add and subtract decimals • Multiply and divide by 10, 100 and 1000 • Multiply by 0.1 and 0.01 (E) • Multiply integers • Divide integers • Multiply decimals • Divide decimals by integers • Divide by a decimal (E) • Order of operations **Averages and range** **Key learning Content: S4** • Mode, Mean, Median, Range • Solve problems with averages and range **Rounding and estimation** **Key learning Content: N14, N15** • Round to significant figures • Estimate answers to calculations • Solve problems with estimation • Understand and use error interval notation (E)	**Graphs and data** **Key learning Content: S2, S6** • Pictograms • Bar charts • Dual bar charts • Composite bar charts • Coordinates in the first quadrant • Scatter graphs • Correlation • Lines of best fit • Time-series graphs • Non-linear relationships **Fractions, decimals and percentages** **Key learning Content: N10, N12** • Represent tenths and hundredths • Number lines with fractions and decimals • Tenths, hundredths, fifths and quarters • Eighths and thousandths • Understand percentages • Convert simple fractions, decimals and percentages • Fractions as diagrams • Fractions on a number line • Equivalent fractions • Fractions as division • Convert fractions, decimals and percentages • Fraction, decimals and percentages greater than 1 (E)	**Directed number** **Key learning Content: N2, N3** • Directed number and number lines • Compare and order directed numbers • Calculations that cross zero • Directed number and zero pairs • Add directed numbers • Subtract directed numbers • Multiply and divide directed numbers • Order of operations with directed numbers • Use a calculator with directed numbers **Fractions, decimals and percentages of amounts** **Key learning Content: N10, N12, R9** • Fraction of an amount • Use a fraction to find the whole • Percentage of an amount (non-calculator) • Percentage of an amount (calculator) • Percentage increase and decrease • Use a percentage to find the whole (E) • Solve problems with fractions and percentages greater than 1 (E) **Perimeter and area** **Key learning Content: G16, G17** • Convert metric units of length • Perimeter of a polygon • Perimeter of a compound shape • Area of rectangles and parallelograms • Area of a triangle • Area of a trapezium • Solve problems with perimeter and area • Form expressions with perimeter and area (E)	**Speed, distance and time.** **Key learning Content: G14** • Convert between milliseconds, seconds, minutes and hours • Convert between hours, days and years • Fractions of time • Solve problems with tables and timetables • Solve problems with time and the calendar • Calculate speed • Calculate time and distance • Solve problems with speed, distance and time • Interpret distance-time graphs • Draw distance-time graphs • Calculate speed from a distance-time graph (E) **Properties of number** **Key learning Content: M4, N6, N7** • Multiples • Factors • Prime numbers • Write a number as a product of prime factors • Square, cube and triangular numbers • Square roots and cube roots • Explore higher powers and roots (E) • Highest common factor (HCF) • Lowest common multiple (LCM) • HCF and LCM from a Venn diagram (E) • Use factors to simplify calculations (E)	**Add and subtract fractions** **Key learning Content: N2** • Simplify a fraction • Convert between mixed numbers and improper fractions • Add and subtract fractions with the same denominator • Add and subtract with fractions and integers • Add and subtract fractions where denominators share a simple common multiple • Add and subtract fractions with any denominator • Add and subtract improper fractions and mixed numbers • Use equivalence to add and subtract decimals and fractions (E) • Add and subtract simple algebraic fractions (E) • Substitution and solving equations with fractions (E) **Angles and polygons.** **Key learning Content: G1, G3, G4** • Draw and measure lines and angles • Understand and use geometric notation • Angles around a point • Angles on a straight line • Vertically opposite angles • Recognise and name polygons • Angles in a triangle • Angles in a quadrilateral • Solve problems with angles • Parallel and perpendicular lines • Angles in parallel lines (E) • Angles in a polygon (E) • Simple proofs (E)

KS3 – 2	**Ratio** **Key learning Content R4, R5, R6** • Understand ratio • Ratio problems (whole given) • Ratio problems (part given) • Ratio problems (difference given) • Simplify ratios • Express ratios in the form 1:n and n:1 (E) • Compare ratios and fractions • Solve problems with ratio **Proportion and scale** **Key learning Content R2, R7, R10** • Direct proportion • Conversion graphs • Convert between currencies • Direct proportion graphs • Similar shapes • Convert metric units • Scale diagrams • Interpret maps using scale and ratios **Algebraic manipulation** **Key learning Content A3, A4** • Form algebraic expressions • Identify and use formulae, expressions, identities and equations • Simplify expressions • Use directed number with algebra • Substitution with directed number • Expand a single bracket • Factorise into a single bracket • Expand single brackets and simplify • Expand double brackets of the form (x±a)(x±b) (E) • Factorise quadratic expressions (E)	**Coordinates and graphs** **Key learning Content A8, A9, A10** • Coordinates in all four quadrants • Lines parallel to the axes • Table of values • Recognise and use the line y=x • Lines of the form y=mx • Link y=mx to direct proportion (E) • Introduce gradient (y=mx) • Lines with a negative gradient • Lines of the form y=x+c • Lines of the form y=mx+c • Find the midpoint of a line segment (E) • Solve problems with coordinates and graphs (E) • Quadratic graphs (E) **Multiplying and dividing fractions** **Key learning Content N2, A4** • Divide a fraction by an integer • Multiply a fraction by an integer • Multiply fractions • Understand reciprocals • Divide an integer by a fraction • Divide a fraction by a unit fraction • Divide fractions • Multiply and divide mixed numbers • Multiply and divide algebraic fractions (E) **Symmetry and reflection** **Key learning Content G1** • Line symmetry • Rotational symmetry • Reflect a shape in a horizontal or vertical line • Reflect a shape in a diagonal line • Reflect a shape given equation of a line (E) • Describe a reflection (E)	**Area, volume and density** **Key learning Content G14, G16, R1** • Name 2-D and 3-D shapes • Area of a 2-D shape • Area of a compound shape • Recognise prisms (including language of edges and vertices) • Volume of cubes and cuboids • Convert metric units of mass and capacity • Understand the units of mass/density/volume • Solve problems with density, mass and volume • Area and volume in similar shapes (E) **Equations and inequalities** **Key learning Content A3, A22** • Solve simple 1 and 2-step equations • Solve more complex equations • Solve factional equations • Form and solve equations • Solve equations with unknowns on both sides • Understand and use inequalities • Inequalities on a number line • Solve simple inequalities • Form and solve inequalities • Solve inequalities with unknowns on both sides (E) **Percentages** **Key learning Content R9, N12** • Percentage of an amount • Convert between percentages and decimals • Use multipliers to find percentages • Convert between decimals and percentages greater than 1 • Percentage increase using a multiplier • Percentage decrease using a multiplier • Percentage increase and decrease using a multiplier • Express one number as a fraction or a percentage of another (calculator) • Express one number as a fraction or a percentage of another (non-calculator) • Percentage change	**Indices** **Key learning Content N7, A4** • Add and subtract expressions with indices • Multiply and divide expressions with indices • Addition law for indices • Subtraction law for indices • Addition and subtraction laws for indices • Powers of powers (E) • Negative indices (E) • Fractional indices (E) **Standard form** **Key learning Content N9** • Positive and negative powers of 10 • Numbers greater than 1 in standard form • Numbers between 0 and 1 in standard form • Standard form on a calculator **Interpret and represent data** **Key learning Content S2, S3, S4** • Types of data • Outliers and errors • Averages and range • Choose the most appropriate average • Compare distributions using average and the range • Averages from an ungrouped frequency table • Represent and interpret grouped discrete data • Represent and interpret continuous data grouped into equal classes • Mean and mode from a grouped frequency table (E)	**Angles in parallel lines and polygons** **Key learning Content G3, G6** • Basic angles rules and notation • Angles between parallel lines and a transversal • Alternate and corresponding angles • Alternate, corresponding and co-interior angles • Solve complex problems with angles in parallel lines • Properties of special quadrilaterals and their diagonals • Find sides and angles in special quadrilaterals • Exterior angles of a polygon • Interior angles of a polygon • Interior angles in a regular polygon • Prove simple geometric facts (E) **Tables and probability** **Key learning Content P1,P2,P3,P4** • Probability vocabulary • The probability scale • Probability of a single event • Use the sum of probabilities being equal to 1 • Probability experiments • Sample spaces for 1 or more events • Probabilities from sample space diagrams • Two-way tables • Probabilities from two-way tables • Frequency trees • Probabilities from frequency trees	**Circles** **Key learning Content G17, G18** • Circle vocabulary • Pi as a ratio • Circumference of a circle • Perimeter of parts of a circle • Area of a circle • Area of parts of a circle • Area and circumference of a circle • Perimeter of compound shapes with circles • Perimeter and area of compound shapes with circles **Graphs and charts** **Key learning Content S2** • Pictograms and bar charts • Vertical line charts • Draw pie charts • Interpret pie charts • Line graphs • Choose the most appropriate graph or chart • Compare distributions using graphs • Misleading graphs and charts **Sequences** **Key learning Content A23, A24, A25** • Generate and describe a sequence given a rule in words • Generate a sequence given a simple algebraic rule • nth term of a linear sequence • Generate a sequence given a complex algebraic rule (E)

			• Find the original value given a percentage • Choose appropriate methods to solve percentage problems			
KS3 – 3	**Properties of numbers** **Key learning Content N4** • Factors, multiples and primes • Write a number as a product of prime factors • Use prime factors (E) • Highest common factor (HCF) and lowest common multiple (LCM) • Venn diagrams • Use a Venn diagram to calculate the HCF and LCM • Integers, real numbers and rational numbers • Introduction to surds (E) **Percentages** **Key learning Content R9, R16** • Percentage increase and decrease • Express a change as a percentage • Find the original value after a percentage change • Solve problems with percentages (non-calculator) • Solve problems with percentages (calculator) • Repeated percentage change • Understand interest • Simple interest • Compound interest **Area and volume** **Key learning Content G12, G16, G17** • Nets • Area of a 2-D shape • Area and circumference of a circle • Surface area of cubes and cuboids • Surface area of a triangular prism (E) • Surface area of a cylinder (E) • Volume of a prism • Volume of a cylinder • Volume of cones, pyramids and spheres (E) • Convert metric units of area and volume (E)	**Equations inequalities and formulae** **Key learning Content A2, A3, A5, A17, A22** • Solve equations and inequalities • Solve equations and inequalities with brackets • Inequalities with negative numbers (E) • Solve equations and inequalities with unknowns on both sides • Solve problems with equations and inequalities • Substitute into formulae and equations • Change the subject of a formula (one-step) • Change the subject of a formula (two-step) • Change the subject of complex formula (E) **Fractions** **Key learning Content N8, N12,** • Add and subtract fractions • Multiply and divide fractions • Fraction of an amount **Rates** **Key learning Content R1, A14** • Speed, distance and time • Distance-time graphs • Solve flow problems and their graphs • Rates of change and their units • Convert compound units (E) **Standard form** **Key learning Content N9** • Numbers in standard form • Compare and order numbers in standard form • Multiply and divide numbers in standard form • Add and subtract numbers in standard form	**Maths and money** **Key learning Content R1, R 9, R11, N13** • Understand a bank account • Spending • Ways to pay • Ways to save • Jobs and pay • Investing • Borrowing (buying a house) • Running a house or a business • Budgeting • Borrowing (loans) • Spending overseas • Insurance **Straight lines** **Key learning Content A9, A10, A11, A14** • Lines, parallel to the axes, y=x and y=-x • Explore gradients • Explore intercepts • y=mx+c • Rearrange equations to the form y=mx+c (E) • Find the equation of a line from a graph • Interpret gradient and intercepts of real-life graphs • Graph inequalities (E) **Ratio and proportion** **Key learning Content R7, R10, R13** • Direct proportion • Direct proportion and conversion graphs • Inverse proportion • Inverse proportion graphs (E) • Ratio problems (whole or part given) • Solve problems with ratio and algebra (E)	**Constructions and congruence** **Key learning Content G2, G5, G7** • Draw and measure angles • Construct and interpret scale drawings • Construct triangles using ASA, SAS and SSS • Construct an angle bisector • Construct a perpendicular bisector • Construct a perpendicular from or to a point • Construct more complex polygons • Identify congruent figures • Congruent triangles **Similarity** **Key learning Content G6** • Recognise enlargement and similarity • Work out unknown lengths and angles in similar shapes • Solve problems with similar triangles (E) • Ratio in right-angled triangles (E) **Algebraic manipulation** **Key learning Content A4, A6, A18** • Expand single brackets and simplify • Factorise into a single bracket • Expand double brackets • Use identities • Factorise quadratic expressions (E) • Solve quadratic equations (E) • Expand triple brackets (E)	**Pythagoras theorem** **Key learning Content G6, G20** • Solve equations with squares and square roots • Identify the hypotenuse • Determine whether a triangle is right-angled • Pythagoras theorem (find the hypotenuse)' • Pythagoras theorem (find any side)' • Use Pythagoras theorem on coordinate axes' • Proofs of Pythagoras theorem (E)' • Pythagoras theorem in 3-D shapes (E)' **Non-linear graphs** **Key learning Content A11, A12** • Substitute into quadratic expressions • Draw simple quadratic graphs • Draw more complex quadratic graphs • Interpret quadratic graphs • Interpret reciprocal and exponential graphs • Draw cubic graphs (E) • Interpret cubic graphs (E) • Interpret roots, intercepts and turning points (E) **Probability** **Key learning Content P3, P6, P8** • Identify and represent sets • Intersection of a set • Union of a set • Complement of a set (E) • Probability of a single event • Use diagrams to work out probabilities • Relative frequency • Expected outcomes • Independent events • Probabilities from Venn diagrams	**Transformations** **Key learning Content G1, G7, G8** • Enlargement (positive scale factor) • Enlargement from a point (positive scale factor) • Enlargement (fractional scale factor) • Enlargement (negative scale factor) (E) • Describe an enlargement • Rotation about a point • Describe a rotation • Translation • Describe a translation • Reflection • Find the result of a series of transformations (E) **Simultaneous equations*** **Key learning Content A19, A21** • Use one value to find another • Introduction to simultaneous equations • Solve simultaneous equations using graphs • Solve simultaneous equations (no adjustments) • Manipulating equations • Solve simultaneous equations (adjust one) • Solve simultaneous equations (adjust both) (E) • Solve simultaneous equations by substitution (E) **Trigonometry*** **Key learning Content R12, G20, A12** • Identify hypotenuse, opposite and adjacent sides • Use the tangent ratio to find unknown side lengths • Use sine and cosine ratios to find unknown side lengths • Use sine, cosine and tangent ratios to find unknown angles • Choose the right method • Key angles in right-angled triangles (E) • Trigonometry in 3-D shapes (E)

Year 10

Algebraic manipulation

Key learning Content: A4

- Substitution
- Collect like terms
- Simplify expressions
- Addition and subtraction laws for indices
- Powers of powers
- Expand a single bracket
- Factorise into a single bracket

Equations, inequalities and formulae

Key learning Content:A3, A5, A17

- Solve equations
- Solve fractional equations
- Solve equations with unknowns on both sides
- Understand inequalities
- Solve inequalities
- Represent solutions to inequalities using set notation (H)
- Change the subject of a simple formula
- Change the subject of a known formula
- Change the subject of a complex formula
- Change the subject where the subject appears more than once (H)

Quadratic expressions and equations

Key learning Content: A4, A11, A12, A18

- Expand double brackets
- Expand triple brackets (H)
- Factorise quadratic expressions (positive)
- Factorise more complex quadratic expressions (H)
- Difference of two squares (CO)
- Solve quadratic equations equal to 0
- Solve quadratic equations by factorisation
- Solve more complex quadratic equations by factorisation (H)
- Complete the square
- Solve quadratic equations by completing the square (H)

Percentages

Key learning Content: R9, R16 N12

- Percentage of an amount
- Percentage increase and decrease
- Repeated percentage change (CO)
- Express one number as a fraction or a percentage of another
- Express a change as a percentage
- Find the original value after a percentage change
- Simple interest
- Compound interest (CO)
- Choose appropriate methods to solve percentage problems

Ratio and scale

Key learning Content: R4, R5, R6, R8, R12

- Equivalent ratios
- Share in a ratio (total given)
- Share in a ratio (part or difference given)
- Link ratios and fractions
- Combine a set of ratios (CO)
- Share in a ratio (algebraically) (H)
- Ratios and scales
- solve problems with ratio and algebra

Working with fractions

Key learning Content: N2, R1, R3, R6, A4

- Fraction of an amount
- Increase or decrease an amount by a fraction
- Use a fraction to find the whole
- Equivalent fractions and mixed numbers
- Add and subtract fractions
- Multiply fractions and divide fractions
- Solve problems with fractions
- Add and subtract algebraic fractions
- Multiply algebraic fractions
- Divide algebraic fractions
- Simplify algebraic fractions
- Add and subtract more complex algebraic fractions (H)
- Multiply and divide more complex algebraic fractions (H)
- Solve equations with algebraic fractions (H)

Non-calculator methods

Key learning Content:N1,N2,N3,N10

- Place value for integers and decimals
- Compare and order numbers
- Add and subtract integers and decimals
- Multiply and divide integers and decimals
- Four operations with directed number
- Order of operations
- Related calculations
- Solve multi-step problems
- Convert recurring decimals to fractions(H)
- Convert more complex recurring decimals to fractions (H)

Straight line graphs

Key learning Content:A9, A10,A11,A14,A22

- Plot straight line graphs
- Find solutions to equations using straight line graphs
- Explore gradients
- y = mx + c
- Find the equation of a line from a graph (CO)
- Find the midpoint of a line segment
- Equation of a straight-line graph given one point and a gradient
- Equation of a straight-line graph given two points (CO)
- Real-life straight-line graphs (CO)
- Represent solutions to single inequalities on a graph (H)
- Represent solutions to multiple inequalities on a graph (H)
- Equations of perpendicular lines (H)

probability

Key learning Content: P4, P5, P7, P8

- Find the probability of a single event
- Use the property that probabilities sum to 1
- List outcomes
- Relative frequency
- Sample spaces for 1 or more events
- Two-way tables
- Frequency trees
- Independent events

Rounding and estimation

Key learning Content: N14, N15, N16

- Round to decimal places and significant figures
- Estimate answers to calculations
- Use of a calculator
- Error intervals (including truncation)
- Upper and lower bounds (H)

Perimeter, area and volume.

Key learning Content: G4, G11, G13, G16, G17

- Name 2-D and 3-D shapes
- Perimeter of a 2-D shape
- Area of a 2-D shape
- Area of a compound shape
- Recognise and label parts of a circle
- Area and circumference of a circle
- Arc length and perimeter
- Area of a sector
- Volume of a prism
- Volume of a cylinder
- Nets
- Surface area of a prism
- Surface area of a cylinder

Interpret and represent data

Key learning Content: S2, S3, S4, S5, S6

- Averages and range
- Averages from an ungrouped frequency table
- Mean from a grouped frequency table
- Averages from a grouped frequency table
- Use data to compare distributions (CO)
- Types of data
- Sampling
- Scatter graphs
- Interpolation and extrapolation (E)

Non-linear graphs

Key learning Content: A11, A12, A15, A16, A18

- Quadratic graphs
- Intercepts and roots of quadratic graphs
- Turning points

Angles

Key learning Content: G1, G3, G4, G6

- Angles around a point, on a straight line and vertically opposite
- Angles in triangles and quadrilaterals
- Exterior angles of any polygon
- Interior angles of any polygon
- Solve problems with angles in polygons
- Alternate, corresponding and co-interior angles
- Solve problems with angles in parallel lines
- Solve problems with angles and algebra (H)
- Prove geometric facts (CO)

Graphs and diagrams

Key learning Content: S2, S3, S4

- Pictograms
- Line and bar charts
- Dual and composite bar charts
- Draw and Interpret pie charts
- Time-series graphs
- Frequency polygons
- Stem-and-leaf diagrams
- Draw histograms (H)
- Interpret histograms (H)
- Draw cumulative frequency diagrams (H)
- Interpret cumulative frequency diagrams (H)
- Box plots (H)
- Compare distributions using box plots (H)

Vectors

Key learning Content: G24, G25

- Understand and represent vectors
- Vector notation
- Vectors multiplied by a scalar
- Add vectors
- Add and subtract vectors
- Translate by a vector
- Solve problems with vectors (CO)
- Vector journeys in shapes
- Vectors in quadrilaterals
- Parallel vectors

Factors and powers

Key learning Content: A3, A4, N7, N8

- Factors, multiples and primes
- HCF and LCM
- Prime factorisation, HCF and LCM
- Powers, roots and negative indices
- Fractional indices
- Irrational numbers and surds
- Four operations with surds
- Simplify surds
- Expand single brackets with surds
- Rationalise the denominator
- Expand double brackets with surds
- Rationalise the denominator with more complex denominators (H)
- Solve problems with surds

Pythagoras and trigonometry

Key learning Content: G6, G20, G21, G22, G23

- Pythagoras' theorem (find any side)
- Pythagoras' theorem (find the hypotenuse)
- Pythagoras' theorem (find any side)
- Identify hypotenuse, opposite and adjacent sides
- Ratios in right-angled triangles
- Use trigonometric ratios to find an unknown side length
- Use trigonometric ratios to find an unknown angle
- Use the tangent ratio to find an unknown side length
- Use the sine and cosine ratio to find an unknown side length
- Use trigonometric ratios to find an unknown side length
- Use trigonometric ratios to find an unknown angle
- Exact trigonometrical values
- Trigonometry in 3-D shapes
- Area of a non-right-angled triangle
- Use the sine rule to find an unknown length
- Use the sine rule to find an unknown angle
- Use the cosine rule to find an unknown length
- Use the cosine rule to find an unknown angle

	• Complete the square with more complex quadratic expressions (H) • Solve quadratic equations using the quadratic formula • Quadratic graphs of the form $y=x^2+a$		• Tree diagrams for independent events • Tree diagrams for dependent events (CO) • Two-way tables and frequency trees (H) • Conditional probability (Tree diagrams) (H)	• Cubic graphs • Approximate solutions to equations using graphs • Equation of the tangent to a curve (H) • Estimate the area under a curve (H) • Equation of a circle (H) • Equation of a tangent to a circle (H)		**Simultaneous equations** **Key learning Content: A19, A21** • Use one value to find another • Introduction to simultaneous equations • Solve simultaneous equations using graphs • Solve simultaneous equations (no adjustments) • Manipulating equations • Solve simultaneous equations (adjust one) • Solve simultaneous equations (adjust both) (CO) • Solve simultaneous equations by substitution (H) • Solve problems with simultaneous equations • Solve simultaneous equations (one linear, one non-linear) using graphs (H) • Solve simultaneous equations (one linear, one non-linear) by equating expressions (H) • Solve simultaneous equations (one linear, one non-linear) using substitution (H)

Year 11

Ratio and proportion

Key learning Content: R5,R7, R10, R13

- Solve problems with ratio
- Direct proportion
- Best buy problems
- Conversion graphs
- Exchange rates
- Inverse proportion
- Direct proportion equations (H)
- Direct and inverse proportion graphs (H)
- Complex direct proportion equations (H)
- Inverse proportion equations (H)

Area and volume

Key learning Content: G13, G16, G17,G19

- Isometric drawings
- Plans and elevations
- Volume of a cylinder
- Volume of a sphere
- Volume of cones and pyramids
- Surface area of a sphere
- Surface area of a cylinder (CO)
- Surface area of pyramids (CO)
- Surface area of cones (CO)
- Convert metric units of area (H)
- Convert metric units of volume (H)
- Volume and surface area of a frustum (H)

Similarity and congruence.

Key learning Content:G5, G6, G7, G19

- Find unknown lengths and angles in similar shapes
- Identify similar triangles
- Solve problems with similar shapes
- Prove a pair of triangles are similar
- Areas of similar shapes
- Volumes of similar shapes
- Solve problems with area and volume in similar shapes
- Congruence
- Prove a pair of triangles are congruent (H)

Sequences and proof

Key learning Content: A23, A24, A25

- Describe and continue arithmetic and geometric sequences
- Generate a sequence given an algebraic rule
- Explore sequences with algebraic terms
- nth term of a linear sequence
- Represent numbers algebraically (H)
- Arguments and counterexamples (H)
- Describe and continue sequences involving surds (H)
- nth term of a quadratic sequence (H)

Standard form

Key learning Content: N9

- Numbers greater than 1 in standard form
- Numbers between 0 and 1 in standard form
- Adjust a number to standard form
- Multiply and divide numbers in standard form (E)
- Add and subtract numbers in standard form (E)

Working with circles

Key learning Content: G9, G17, G18

- Area and circumference of a circle
- Fractional parts of a circle (area)
- Area of a sector (H)
- Fractional parts of a circle (perimeter)
- Arc length and perimeter (H)
- Area and perimeter of compound shapes with circles
- Solve problems with circles
- ***Circle theorems (Higher) G10, A16***
- Angles in circles
- Circle theorem (angles at the centre and circumference)
- Circle theorem (angles in a semicircle)
- Circle theorem (angles in the same segment)
- Circle theorem (angles in a cyclic quadrilateral)
- Circle theorem (angle between radius and tangent)
- Circle theorem (two tangents from a point)
- Circle theorem (alternate segment theorem)
- Solve problems with circle theorems

Set notation and Venn diagrams.

Key learning Content: P6, P9

- Set notation
- Venn diagrams
- Solve problems with Venn diagrams
- Conditional probability (Venn diagrams and two-way tables) (E)

Functions and graphs

Key learning Content:A11, A12, A13, A14

- Function machines and Inverse functions
- Write an expression or formula from a function machine
- Quadratic graphs
- Cubic graphs
- Reciprocal graphs
- Recognise and sketch graphs
- Exponential graphs
- Trigonometric graphs (CO)
- Recognise and sketch graphs
- Translation of a graph (CO)
- Reflection of a graph (CO)

Equations and formulae

Key learning Content: A3, A17, A18, A19, A20, A21

- Solve equations
- Form and solve equations
- Form and solve equations with unknowns on both sides (CO)
- Solve inequalities
- Form and solve inequalities (CO)
- Form and solve more complex equations and inequalities (CO)
- Solve simultaneous equations (CO)
- Solve problems with simultaneous equations
- Quadratic equations
- Quadratic inequalities (H)
- Understand iterative processes
- Solve equations by iteration
- Solve simultaneous equations (one linear, one non-linear) (H)
- Solve a pair of simultaneous equations involving algebraic constants for a third unknown (H)

Rates

Key learning Content: R1, R11

- Convert between hours and minutes
- Speed, distance and time
- Interpret distance-time graphs
- Draw distance-time graphs
- Density and pressure (CO)
- Convert compound units (H)
- Velocity-time graphs (H)

Angles, bearings and trigonometry

Key learning Content: G1, G3, G15, G6, G20

- Angles in lines and shapes
- Solve problems with angles in parallel lines
- Solve problems with angles and algebra (CO)
- Compass points and related angles
- Understand and represent bearings
- Measure and read bearings
- Scale drawings using bearings
- Calculate bearings using angles rules (CO)
- Choose appropriate methods to solve problems with right-angled triangles (CO)
- Solve bearings problems using Pythagoras and trigonometry (H)
- Sine and cosine rules (H)
- Solve bearings problems using the sine and cosine rules (H)

Constructions and loci

Key learning Content: G2, G7

- Use geometrical equipment
- Construct triangles
- Construct polygons (CO)
- Construct an angle bisector
- Construct a perpendicular bisector
- Construct a perpendicular from or to a point
- Locus of distance from a point and a straight line
- Locus equidistant from two points and perpendicular bisectors
- Locus equidistant from two lines and angle bisectors
- Solve problems with loci

Transformations

Key learning Content:G1, G7

- Enlargement (positive integer and fractional scale factor)
- Line symmetry and rotational symmetry.
- Reflection, Rotation, Translation
- Describe a transformation
- Find the result of a series of transformations (CO)
- Invariant points and lines (H)

Revision and consolidation past papers exam practice

Revision and examinations

National curriculum statements - Knowledge skills and understanding

1. Number

Structure and calculation

N1 order positive and negative integers, decimals and fractions; use the symbols =, ≠, , ≤, ≥

N2 apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative; understand and use place value (e.g. when working with very large or very small numbers, and when calculating with decimals)

N3 recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals.

N4 use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem

N5 apply systematic listing strategies, including use of the product rule for counting (i.e. if there are m ways of doing one task and for each of these, there are n ways of doing another task, then the total number of ways the two tasks can be done is m × n ways)

N6 use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5; estimate powers and roots of any given positive number

N7 calculate with roots, and with integer and fractional indices

N8 calculate exactly with fractions, surds and multiples of π; simplify surd expressions involving squares

2. Algebra Notation

vocabulary and manipulation

A1 use and interpret algebraic manipulation, including:

- ab in place of a × b
- 3y 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 b in place of a ÷ b
- coefficients written as fractions rather than as decimals
- brackets

A2 substitute numerical values into formulae and expressions, including scientific formulae

A3 understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors.

A4 simplify and manipulate algebraic expressions (including those involving surds and algebraic fractions) by:

- collecting like terms
- multiplying a single term over a bracket
- taking out common factors
- expanding products of two or more binomials
- factorising quadratic expressions of the form x 2 + bx + c, including the difference of two squares; factorising quadratic expressions of the form ax 2 + bx + c
- simplifying expressions involving sums, products and powers, including the laws of indices

A5 understand and use standard mathematical formulae; rearrange formulae to change the subject

A6 know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments and proofs

A7 where appropriate, interpret simple expressions as functions with inputs and outputs; interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function' (the use of formal function notation is expected)

3. Ratio, proportion and rates of change

R1 change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts

R2 use scale factors, scale diagrams and maps

R3 express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1

R4 use ratio notation, including reduction to simplest form

R5 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; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)

R6 express a multiplicative relationship between two quantities as a ratio or a fraction

R7 understand and use proportion as equality of ratios

R8 relate ratios to fractions and to linear functions

R9 define percentage as 'number of parts per hundred'; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; express one quantity as a percentage of another; compare two quantities using percentages; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics

R10 solve problems involving direct and inverse proportion, including graphical and algebraic representations

R11 use compound units such as speed, rates of pay, unit pricing, density and pressure

R12 compare lengths, areas and volumes using ratio notation; make links to similarity (including trigonometric ratios) and scale factors

R13 understand that X is inversely proportional to Y is equivalent to X is

4. Geometry and measures

Properties and constructions

G1 use conventional terms and notations: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description

G2 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); use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line

G3 apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)

G4 derive and apply the properties and definitions of: special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language

G5 use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)

G6 apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs

G7 identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection,

5. Probability

P1 record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees

P2 apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments

P3 relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale

P4 apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one

P5 understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size

P6 enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams

P7 construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities

P8 calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions

P9 calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams

6. Statistics

S1 infer properties of populations or distributions from a sample, while knowing the limitations of sampling

S2 interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use

S3 construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use

S4 interpret, analyse and compare the distributions of data sets from univariate empirical distributions through:

- appropriate graphical representation involving discrete, continuous and grouped data, including box plots
- appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers, quartiles and inter-quartile range)

S5 apply statistics to describe a population

S6 use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing

	(e.g. √12 = √(4 × 3) = √4 × √3 = 2√3) and rationalise denominators **N9** calculate with and interpret standard form A × 10n, where 1 ≤ A < 10 and n is an integer *Fractions, decimals and percentages* **N10** work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7 2 or 0.375 or 3 8); change recurring decimals into their corresponding fractions and vice versa **N11** identify and work with fractions in ratio problems **N12** interpret fractions and percentages as operators. *Measures and accuracy* **N13** use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate **N14** estimate answers; check calculations using approximation and estimation, including answers obtained using technology **N15** round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures); use inequality notation to specify simple error intervals due to truncation or rounding **N16** apply and interpret limits of accuracy, including upper and lower bounds	*Graphs* **A8** work with coordinates in all four quadrants **A9** plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form y = mx + c to identify parallel and perpendicular lines; find the equation of the line through two given points or through one point with a given gradient **A10** identify and interpret gradients and intercepts of linear functions graphically and algebraically **A11** identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically and turning points by completing the square **A12** recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function 1 y x = with x ≠ 0, exponential functions y = kx for positive values of k, and the trigonometric functions (with arguments in degrees) y = sin x, y = cos x and y = tan x for angles of any size **A13** sketch translations and reflections of a given function **A14** plot and interpret graphs (including reciprocal graphs and exponential graphs) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration **A15** calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts (this does not include calculus) **A16** recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point *Solving equations and inequalities* **A17** solve linear equations in one unknown algebraically (including those with the unknown on both sides of the	proportional to 1 Y ; construct and interpret equations that describe direct and inverse proportion **R14** interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion **R15** interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of average and instantaneous rate of change (gradients of chords and tangents) in numerical, algebraic and graphical contexts (this does not include calculus) **R16** set up, solve and interpret the answers in growth and decay problems, including compound interest and work with general iterative processes	translation and enlargement (including fractional and negative scale factors) **G8** describe the changes and invariance achieved by combinations of rotations, reflections and translations **G9** identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment **G10** apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results **G11** solve geometrical problems on coordinate axes **G12** identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres **G13** construct and interpret plans and elevations of 3D shapes *Mensuration and calculation* **G14** use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.) **G15** measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings **G16** know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders) **G17** know the formulae: circumference of a circle = 2πr = πd , area of a circle = πr 2 ; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; surface area and volume of spheres, pyramids, cones and composite solids **G18** calculate arc lengths, angles and areas of sectors of circles **G19** apply the concepts of congruence and similarity, including the relationships between lengths, areas and volumes in similar figures **G20** know the formulae for: Pythagoras' theorem a 2 + b2 = c 2 ,		

		equation); find approximate solutions using a graph **A18** solve quadratic equations (including those that require rearrangement) algebraically by factorising, by completing the square and by using the quadratic formula; find approximate solutions using a graph **A19** solve two simultaneous equations in two variables (linear/linear or linear/quadratic) algebraically; find approximate solutions using a graph **A20** find approximate solutions to equations numerically using iteration **A21** translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution **A22** solve linear inequalities in one or two variable(s), and quadratic inequalities in one variable; represent the solution set on a number line, using set notation and on a graph *Sequences* **A23** generate terms of a sequence from either a term-to-term or a position-to term rule **A24** recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r n where n is an integer, and r is a rational number > 0 or a surd) and other sequences **A25** deduce expressions to calculate the nth term of linear and quadratic sequences		and the trigonometric ratios, sin θ = opposite hypotenuse , cos θ = adjacent hypotenuse and tan θ = opposite adjacent ; apply them to find angles and lengths in right-angled triangles and, where possible, general triangles in two and three dimensional figures **G21** know the exact values of sin θ and cos θ for θ = 0°, 30°, 45°, 60° and 90°; know the exact value of tan θ for θ = 0°, 30°, 45° and 60° **G22** know and apply the sine rule a sin A = b sin B = c sin C , and cosine rule a 2 = b2 + c 2 – 2bc cos A, to find unknown lengths and angles **G23** know and apply Area = ab sin C 2 1 to calculate the area, sides or angles of any triangle *Vectors* **G24** describe translations as 2D vectors **G25** apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; use vectors to construct geometric arguments and proofs		

Codes:

(E) – Extend

(CO) – crossover GCSE foundation and higher content

(H) – Higher