The Royal School

Wolverhampton

Curriculum 2025 - 2026

MATHEMATICS

&

FURTHER MATHEMATICS

Curriculum 2025 - 2026 Mathematics

Mathematics Curriculum (INTENT)

Whilst following the guidelines of the National Curriculum we aim to offer a broad based curriculum which will result in acquisition of knowledge, develop enjoyment and confidence of learning which will equip our pupils for work and leisure as active, confident and responsible members of society.

In particular we aim to ensure that all pupils:

- 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.

Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programme of study for key stage 4 is organised into apparently distinct domains, but pupils should develop and consolidate connections across mathematical ideas. They should build on learning from key stage 3 to further develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge wherever relevant in other subjects and in financial contexts.

The expectation is that the majority of pupils will move through the programme of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils' understanding and their readiness to progress. Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on.

Together, the mathematical content set out in the key stage 3 and key stage 4 programmes of study covers the full range of material contained in the GCSE Mathematics qualification. Wherever it is appropriate, given pupils' security of understanding and readiness to progress, pupils should be taught the full content set out in this programme of study.

Mathematics Curriculum (IMPLEMENTATION)

In Mathematics we teach 4 lessons per week at KS3, 4 lessons per week at KS4 and 5 lessons per week at KS5. Our curriculum is structured in learning cycles. Each cycle lasts for 7 weeks and includes at least one assessment followed by a review where re-teaching or stretch and challenge opportunities, tailored to the needs of the pupils can take place. There are 5 learning cycles per year.

Each lesson follows The Royal lesson structure below:

- Date and learning question.
- Retrieval questions at the start of each lesson with answers to be self-assessed or peer assessed.
- Homework set at start of lesson.
- The learning journey shared including lesson objectives and success criteria.
- Challenge tasks set every lesson.
- Review learning objectives at end of lesson.

Our curriculum is implemented in many ways including taught lessons and extra curriculum activities such as UKMT challenges, national mathematics competitions, trips; as well as offering the opportunity to gain a GCSE further mathematics qualification during lesson 7.

Mathematics Curriculum (IMPACT)

The impact of our curriculum can be evaluated in many ways using both quantitative and qualitiative information indicating how ready pupils are for the next stage in their learning whether that be transition between key stages or leaving for universities, apprenticeships or work at the end of year 13.

This includes an assessment of

- The number of pupils achieving the national average at the end of their key stage indicating their readiness to move forward with the next stage of their learning journey.
- The number of pupils opting for Mathematics at A level
- The number of pupils opting for Further Mathematics at A Level
- The number of pupils paticipating extra curriculum activities

Further information that can be used to assess the impact of the curriculum includes:

- The number of pupils choosing mathematics to study at university
- The number of pupils gaining entry into their chosen career route including appreticeships and employment with a mathematical focus.

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MATHEMATICS KS3 Curriculum Mapping

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/840002/Secondary_national_curriculum_corrected_PDF.pdf

The mathematics curriculum is designed in stages.

"The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils understanding and their readiness to progress to the next stage. *Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content*. Those who are not sufficiently fluent with earlier material should consolidate their understanding, including through additional practice, before moving on."

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Mathematics Curriculum Map 2025-26 Overview

	Year 7 White Rose	Year 8 White Rose	Year 9 White Rose	Year 10 White Rose	Year 11 White Rose	Year 12 Edexcel	Year 13 Edexcel
LC1	Algebraic Thinking	Proportional Reasoning	Reasoning with Algebra	Similarity	Graphs	AS Pure AS Stats	A2 Pure A2 Stats
LC2	Place Value and Proportion	Representations	Constructing in 2 and 3 Dimensions	Developing Algebra	Algebra	AS Pure AS Stats	A2 Pure A2 Stats A2 Mech
LC3	Applications of Number and Fractional Thinking	Algebraic Techniques	Reasoning with Number	Geometry	Reasoning	AS Pure AS Stats AS Mech	A2 Pure A2 Mech
LC4	Lines and Angles	Developing Number and Geometry	Reasoning with Geometry	Proportion and Delving into Data	Revision and Communication	AS Pure AS Mech	A2 Pure A2 Mech
LC5	Reasoning with Number	Reasoning with Data	Reasoning with Proportion	Using Number and Expressions	GCSE/BTEC exams followed by A level bridging work	**A2 Pure** **A2 Pure**	A level/BTEC exams followed by University bridging work

In Year 7 & Year 8, students will be placed into mixed attainment groups.

From Year 9 onwards, students will be put into sets based on ability and prior attainment.

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Maths Curriculum Map 2025-26

	Year 7 White Rose	Year 8 White Rose	Year 9 White Rose
LC 1	*Sequences* *Understanding and use Algebraic Notation* *Equality and Equivalence*	*Ratio and Scale* *Multiplicative Change* *Multiplying and Dividing Fractions*	*Straight line graphs* *Forming & solving equations* *Testing conjectures*
LC 2	*Place Value and Ordering Integers and Decimals* *Fractions, Decimal and Percentage* *Solving Problems with Addition and Subtraction*	*Working in the Cartesian plane* *Representing data* *Tables & Probability*	*Three dimensional shapes* *Constructions & congruency* *Numbers*
LC 3	*Solving Problems with Multiplication and Division* *Fractions and Percentages* *Operations and Equations with Directed Number*	*Brackets, equations & inequalities* *Sequences* *Indices*	*Using percentages* *Maths & money* *Deduction*
LC 4	*Addition and Subtraction of Fractions* *Constructing, Measuring and Using Geometric Notation* *Developing Geometric Reasoning*	*Fractions & percentages* *Standard index form* *Number sense* *Angles in parallel lines & polygons*	*Rotation & translation* *Pythagoras' theorem* *Enlargement & similarity* *Solving ratio & proportion problems*
LC 5	*Developing Number Sense* *Sets and Probability* *Prime Numbers and Proof*	*Area of trapezia & circles* *Line symmetry & reflection* *The data handling cycle* *Measures of location*	*Rates* *Probability* *Algebraic Representation*

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Year 10 White Rose	Year 11 White Rose
Congruence, similarity & enlargement *Trigonometry* *Representing solutions of equations & inequalities*	*Gradients & lines* *Non-linear graphs* *Using graphs*
Simultaneous equations *Angles & bearings* *Working with circles*	*Expanding & factorising* *Changing the subject* *Functions*
Vectors *Ratios & fractions* *Percentages & Interest*	*Multiplicative reasoning* *Geometric reasoning* *Algebraic reasoning*
Probability *Collecting, representing & interpreting data* *Non-calculator methods*	*Transforming & Constructing* *Listing & describing* *Proof*
Types of number & sequences *Indices & roots* *Manipulating expressions*	GCSE/BTEC exams followed by A level bridging work

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	Resit – November Entries
LC 1	Summer 2025 Exam Paper November 2024 Exam Paper Summer 2024 Exam Paper November 2023 Exam Paper Summer 2023 Exam Paper November 2022 Exam Paper Summer 2022 Exam Paper
LC 2	FF01 – Types of Numbers FF02 – Using Number FF03 – Basic Probability FF04 – Ratio FF05 - Measures
LC 3	FF06 – Rounding and Estimation FF07 – Perimeter, Area and Volume FF08 – Proportion FF09 – Simplify and Solve FF10 – Percentages
LC 4	FF11 – Angle Properties FF12 – Representing Data FF13 – Solve and Graph FF14 – Averages and Spread FF15 - Transformations
LC 5	GCSE/BTEC exams followed by A level bridging work

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Year 12 – AS Level		Year 13 – A2 Level	
Pure Unit 2: Coordinate geometry Pure Unit 3: Further algebra	Stats Unit 1: Statistical sampling Stats Unit 2: Data presentation and interpretation	Pure: Sequences and Series Pure: Binomial Expansion Pure: Radians	Pure: Functions and Modelling Pure: Differentiation
Pure Unit 3: Further algebra Pure Unit 6: Differentiation Pure Unit 7: Integration	Stats Unit 2: Data presentation and interpretation Stats Unit 3: Probability Stats Unit 4: Statistical Distributions	Pure: Trigonometric Identities Pure: Trigonometric Modelling Pure: Parametric Equations	Pure: Numerical Methods Pure: Integration
Pure Unit 7: Integration Pure Unit 4: Trigonometry	Stats Unit 5: Statistical hypothesis testing Mech Unit 6: Quantities and units in mechanics Mech Unit 7: Kinematics 1	Pure: Vectors Mech: Moments Mech: Forces and Friction Mech: Projectiles	Pure: Integration Stats: Regression, Correlation and Hypothesis Testing
Pure Unit 4: Trigonometry Pure Unit 5: Vectors Pure Unit 8: Exponentials and logarithms	Mech Unit 7: Kinematics 1 Mech Unit 8: Forces and Newton's laws Mech Unit 9: Kinematics 2	Mech: Application of Forces Mech: Further Mechanics	Stats: Conditional Probability Stats: The Normal Distribution
Pure Unit 1: Proof Pure Unit 2: Algebraic and partial fractions	Pure Unit 4: Series and sequences Pure Unit 5: The binomial theorem	Revision	
		A level/BTEC exams followed by University bridging work	

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Year 12 – FM AS Level		Year 13 – FM A2 Level	
Core1: Roots of Polynomials Core: Matrices Core1: Linear Transformations	Core1: Complex Numbers	FPure1: Vectors FPure1: Conic Sections	FMech1: Momentum and Impulse FMech1: Work, Energy and Power
Core1: Proof by Induction Core: Vectors	Core1: Series Core1: Volumes of Revolution	FPure1: Inequalities FPure1: The t-formulae	FMech1: Elastic Strings and Springs
Core2: Methods in Calculus Core2: Polar Coordinates Core2: Hyperbolic Functions	Core2: Complex Numbers Core2: Series	FPure1: Taylor Series FPure1: Methods in Calculus	FMech1: Elastic Collisions in One Dimension
Core2: Methods in Differential Equations Core2: Modelling with Differential Equations	Core2: Series Core2: Volumes of Revolution	FPure1: Numerical Methods FPure1: Reducible Differential Equations	FMech1: Elastic Collisions in Two Dimensions
Mocks Review Core material in preparation for Year 13	Mocks Review Core material in preparation for Year 13	A level/BTEC exams followed by University bridging work	

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Maths Assessment Calendar 2024-2025

	Year 7	Year 8	Year 9	Year 10	Year 11 & Resit	Year 12 & FM	Year 13 & FM
	MM	MM	MM	PM	PM	PM	PM
LC1	Assessment w/c 6 Oct (LC1 W5)	Comp Assessment w/c 6 Oct (LC1 W5)	Assessment w/c 6 Oct (LC1 W5)	Comp Assessment w/c 13 Oct (LC1 W6)	Peer Assessment w/c 13 Oct (LC1 W6)	Suitability Assessment w/c 22 Sep (LC1 W4)	Assessment w/c 13 Oct (LC1 W6)
	Data Drop w/c 13 Oct (LC1 W6)	Data Drop w/c 13 Oct (LC1 W6)	Data Drop w/c 13 Oct (LC1 W6)	Data Drop w/c 20 Oct (LC1 W7)	Data Drop w/c 20 Oct (LC1 W7)	Data Drop w/c 13 Oct (LC1 W6)	Data Drop w/c 20 Oct (LC1 W7)
LC2	Comp Assessment w/c 24 Nov (LC2 W4)	Assessment w/c 24 Nov (LC2 W4)	Comp Assessment w/c 24 Nov (LC2 W4)	Comp Assessment w/c 1 Dec (LC2 W5)	Mock Week w/c 3 Nov (LC2 W1)	Peer Assessment w/c 1 Dec (LC2 W5)	Assessment w/c 1 Dec (LC2 W5)
	Data Drop w/c 1 Dec (LC2 W5)	Data Drop w/c 1 Dec (LC2 W5)	Data Drop w/c 1 Dec (LC2 W5)	Data Drop w/c 8 Dec (LC2 W6)	Mock Data w/c 1 Dec (LC2 W5)	Data Drop w/c 8 Dec (LC2 W6)	Data Drop w/c 8 Dec (LC2 W6)
LC3	Comp Assessment w/c 9 Mar (LC4 W1)	Comp Assessment w/c 9 Mar (LC4 W1)	Comp Assessment w/c 9 Mar (LC4 W1)	Peer Assessment w/c 16 Mar (LC4W2)	Mock Week w/c 23 Feb (LC3 W6)	Assessment w/c 16 Mar (LC4W2)	Assessment w/c 16 Mar (LC4W2)
	Data Drop w/c 16 Mar (LC4W2)	Data Drop w/c 16 Mar (LC4W2)	Data Drop w/c 16 Mar (LC4W2)	Data Drop w/c 23 Mar (LC4 W3)	Mock Drop w/c 23 Mar (LC4 W3)	Mock Data Drop w/c 23 Mar (LC4 W3)	Mock Data Drop w/c 23 Mar (LC4 W3)
LC4	Revision Card Assessment w/c 13 Apr (LC4 W4)	Revision Card Assessment w/c 13 Apr (LC4 W4)	End of Stage Assessment w/c 20 Apr (LC4 W5)	Mock Week w/c 13 Apr (LC4 W4)		Peer Assessment w/c 13 Apr (LC4 W4)	
			Full Report and Data w/c 27 Apr (LC4 W6)	Mock Drop w/c 11 May (LC5 W1)			
LC5	End of Stage Assessment w/c 1 Jun (LC5 W3)	End of Stage Assessment w/c 1 Jun (LC5 W3)		End of Stage Assessment w/c 15 Jun (LC5 W5)	GCSE Exams	Mock Week w/c 15 Jun (LC5 W5)	A Level Exams
	Data Drop w/c 8 Jun (LC5 W4)	Data Drop w/c 8 Jun (LC5 W4)				Data Drop w/c 29 Jun (LC5 W7)	

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KS3 Assessment Criteria

	Grade 9, 8, 7	Grade 6, 5	Grade 4, 3, 2
Y7	White Rose	White Rose	White Rose
Y8	White Rose	White Rose	White Rose
Y9	White Rose	White Rose	White Rose

WB – Working below end of year expectations	WT – Working towards end of year expectations	WAT – Working at end of year expectations	WA– Working above end of year expectations
Below 20%	**20% - 44%**	**45% - 69%**	**Above 70%**

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WRM – Year 7 Scheme of Learning

White Rose Maths

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	**Algebraic Thinking**						**Place Value and Proportion**					
	Sequences		Understand and use algebraic notation		Equality and equivalence		Place value and ordering integers and decimals			Fraction, decimal and percentage equivalence		
Spring	**Applications of Number**						**Directed Number**			**Fractional Thinking**		
	Solving problems with addition & subtraction		Solving problems with multiplication and division			Fractions & percentages of amounts	Operations and equations with directed number			Addition and subtraction of fractions		
Summer	**Lines and Angles**						**Reasoning with Number**					
	Constructing, measuring and using geometric notation			Developing geometric reasoning			Developing number sense		Sets and probability		Prime numbers and proof	

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WRM – Year 7 Scheme of Learning

Autumn 1: Algebraic thinking

Week 1 to 2: Exploring Sequences

Rather than rushing to find rules for n^{th} term, this week is spent exploring sequences in detail, using both diagrams and lists of numbers. Technology is used to produce graphs so students can appreciate and use the words "linear" and "non-linear" linking to the patterns they have spotted. Calculators are used throughout so number skills are not a barrier to finding the changes between terms or subsequent terms. Sequences are treated more formally later this unit.

National curriculum content covered:

- move freely between different numerical, algebraic, graphical and diagrammatic representations
- make and test conjectures about patterns and relationships
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately
- generate terms of a sequence from a term-to-term rule
- recognise arithmetic sequences
- recognise geometric sequences and appreciate other sequences that arise

Weeks 3 to 4: Understanding and using algebraic notation

The focus of these three weeks is developing a deep understanding of the basic algebraic forms, with more complex expressions being dealt with later. Function machines are used alongside bar models and letter notation, with time invested in single function machines and the links to inverse operations before moving on to series of two machines and substitution into short abstract expressions.

National curriculum content covered:

- move freely between different numerical, algebraic, graphical and diagrammatic representations
- use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships
- recognise and use relationships between operations including inverse operations
- model situations or procedures by translating them into algebraic expressions
- substitute values in expressions, rearrange and simplify expressions
- use and interpret algebraic notation, including:
  - ab in place of $a \times b$
  - $3y$ in place of $y + y + y$ and $3 \times y$
  - a^2 in place of $a \times a$
  - ab in place of $a \times b$
  - $\frac{a}{b}$ in place of $a \div b$
- generate terms of a sequence from a term-to-term rule
- produce graphs of linear functions of one variable

Weeks 5 and 6: Equality and equivalence

In this section students are introduced to forming and solving one-step linear equations, building on their study of inverse operations. The equations met will mainly require the use of a calculator, both to develop their skills and to ensure understanding of how to solve equations rather than spotting solutions. This work will be developed when two-step equations are met in the next place value unit and throughout the course. The unit finishes within consideration of equivalence and the difference between this and equality, illustrated through collecting like terms.

National curriculum content covered:

- use algebra to generalise the structure of arithmetic, including to formulate mathematical relationships
- simplify and manipulate algebraic expressions to maintain equivalence by collecting like terms
- use approximation through rounding to estimate answers
- use algebraic methods to solve linear equations in one variable

Autumn 2: Place Value and Proportion

Weeks 1 to 3: Place Value and Ordering

In this unit, students will explore integers up to one billion and decimals to hundredths, adapting these choices where appropriate for your groups e.g. standard index form could additionally be introduced to student following the Higher strand. Using and understanding number lines is a key strategy explored in depth, and will be useful for later work on scales for axes. When putting numbers in order, this is a suitable point to introduce both the median and the range, separating them from other measures to avoid getting them mixed up. Rounding to the nearest given positive power of ten is developed, alongside rounding to one significant figure. Decimal places will come later, again to avoid too similar concepts being covered at the same time. Topics from last term such as sequences and equations, will be interleaved into this unit.

National curriculum content covered:

- Consolidate their understanding of the number system and place value to include decimals
- 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 $=, \neq, <, \leq, \geq$
- work interchangeably with terminating decimals and their corresponding fractions
- round numbers to an appropriate degree of accuracy
- describe, interpret and compare observed distributions of a single variable through: the median and the range
- interpret and compare numbers in standard form

Weeks 4 to 6: Fraction, Decimal and Percentage Equivalence

Building on the recent work on decimals, the key focus for this three weeks is for students to gain a deep understanding of the links between fractions, decimals and percentages so that they can convert fluently between those most commonly seen in real-life. The Foundation strand will focus will be on multiples of one tenth and one quarter whilst the Higher strand will look at more complex conversions. Whilst looking at percentage is, pie charts will be introduced. In addition, various forms of representation of any fraction will be studied, focusing on equivalence, in an appropriate depth to the current attainment of students; this will be revisited later in the year. The focus is very much on a secure understanding of the most common fractions under one, but fractions above one will be touched upon, particularly in the Higher strand.

National curriculum content covered:

- consolidate their understanding of the number system and place value to include decimals, fractions
- move freely between different numerical representations [for example, equivalent fractions, fractions and decimals]
- extend their understanding of the number system; make connections between number relationships
- express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1
- define percentage as 'number of parts per hundred', interpret percentages as a fraction or a decimal
- compare two quantities using percentages
- work with percentages greater than 100%
- interpret pie charts

Spring 1: Application of Number

Weeks 1 & 2: Solving problems with addition & subtraction

The focus for these two weeks is building on the formal methods of addition and subtraction students have developed at Key Stage 2. All students will look at this in the context of interpreting and solving problems, for those for whom these skills are secure, there will be even more emphasis on this. Problems will be drawn from the contexts of perimeter, money, interpreting bar charts and tables and looking at frequency trees; we believe all these are better studied alongside addition and subtraction rather than separately. Calculators should be used to check and/or support calculations, with significant figures and equations explicitly revisited.

National curriculum content covered:

- use formal written methods, applied to positive integers and decimals
- recognise and use relationships between operations including inverse operations
- derive and apply formulae to calculate and solve problems involving: perimeter
- construct and interpret appropriate tables, charts, and diagrams, including frequency tables, bar charts and pictograms for categorical data, and vertical line (or bar) charts for ungrouped numerical data

Weeks 3 to 5: Solving problems with multiplication & division

The rest of the term is dedicated to the study of multiplication and division, so allowing for the study of forming and solving of two-step equations both with and without a calculator. Unit conversions will be the main context as multiplication by 10, 100 and 1000 are explored. As well as distinguishing between multiples and factors, substitution and simplification can also be revised and extended. Again, the emphasis will be on solving problems, particularly involving area of common shapes and the mean. Choosing the correct operation to solve a problem will also be a focus. There will also be some exploration of the order of operations, which will be reinforced alongside much of this content next term when studying directed number.

National curriculum content covered:

- use formal written methods, applied to positive integers and decimals
- select and use appropriate calculation strategies to solve increasingly complex problems
- recognise and use relationships between operations including inverse operations
- use the concepts and vocabulary factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple
- change freely between related standard units [time, length, area, volume/capacity, mass]
- derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, and trapezia **(H)**
- substitute numerical values into formulae and expressions, including scientific formulae
- use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)
- describe, interpret and compare observed distributions of a single variable through: the mean

Week 6: Fractions and percentages of amounts

This short block focuses on the key concept of working out fractions and percentages of quantities and the links between the two. This is studied in depth in Year 8

National curriculum content covered:

- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions
- interpret fractions and percentages as operators

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WRM – Year 7 Scheme of Learning

Spring 2: Directed Number and Fractional Thinking

Weeks 1 to 3: Directed number

Students will only have had limited experience of directed number at primary school, so this block is designed to extend and deepen their understanding of this. Multiple representations and contexts will be used to enable students to appreciate the meaning behind operations with negative integers rather than relying on a series of potentially confusing "rules". As well as exploring directed number in its own right, this block provides valuable opportunities for revising and extending earlier topics, notably algebraic areas such as substitution and the solution of equations; in particular students will be introduced to two-step equations for the first time in this block.

National curriculum content covered:

- select and use appropriate calculation strategies to solve increasingly complex problems
- use the four operations, including formal written methods, applied to integers, both positive and negative
- recognise and use relationships between operations including inverse operations
- use square and square roots
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately
- 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
- understand and use standard mathematical formulae

<u>Interleaving/Extension of previous work</u>

- use conventional notation for the priority of operations
- forming and solving linear equations, including two-step equations

Weeks 4 to 6: Fractional thinking

This block builds on the Autumn term study of "key" fractions, decimals and percentages. It will provide more experience of equivalence of fractions with any denominators, and to introduce the addition and subtraction of fractions. Bar models and concrete representations will be used extensively to support this. Adding fractions with the same denominators will lead to further exploration of fractions greater than one, and for the Core strand adding and subtracting with different denominators will be restricted to cases where one is a multiple of the other.

National curriculum content covered:

- move freely between different numerical, graphical and diagrammatic representations [for example, equivalent fractions, fractions and decimals]
- express one quantity as a fraction of another, where the fraction is less than 1 and greater than 1
- order positive and negative integers, decimals and fractions; use the number line as a model for ordering of the real numbers; use the symbols $=, \neq, <, \leq, \geq$
- select and use appropriate calculation strategies to solve increasingly complex problems
- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative
- work interchangeably with terminating decimals and their corresponding fractions

<u>Interleaving/Extension of previous work</u>

- finding the range and the median
- substitution into algebraic formulae
- forming and solving linear equations, including two-step equations

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WRM – Year 7 Scheme of Learning

Summer 1: Lines and Angles

Weeks 1 to 3: Construction, measurement and notation

Students will build on their KS2 skills using rulers, protractors and other measuring equipment to construct and measure increasingly complex diagrams using correct mathematical notation. This will include three letter notation for angles, the use of hatch marks to indicate equality and the use of arrows to indicate parallel lines. Pie charts will be studied here to gain further practice at drawing and measuring angles.

National curriculum content covered:

- use language and properties precisely to analyse 2-D shapes
- begin to reason deductively in geometry including using geometrical constructions
- 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 sides and angles
- construct and interpret pie charts for categorical, ungrouped and grouped numerical data
- Identify and construct triangles

<u>Interleaving/Extension of previous work</u>

- revisit four operations

Weeks 4 to 6: Geometric reasoning

This block covers basic geometric language, names and properties of types of triangles and quadrilaterals, and the names of other polygons. Angles rules will be introduced and used to form short chains of reasoning . The higher strand will take this further, investigating and using parallel line rules.

National curriculum content covered:

- use language and properties precisely to analyse 2-D shapes,
- begin to reason deductively in geometry including using geometrical constructions
- 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 sides and angles
- derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies
- apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles
- apply angle facts, triangle similarity and properties of quadrilaterals to derive results about angles and sides, and use known results to obtain simple proofs
- understand and use the relationship between parallel lines and alternate and corresponding angles **(H)**
- 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 **(H)**

<u>Interleaving/Extension of previous work</u>

- forming and solving linear equations
- revisiting addition and subtraction, including decimals

Summer 2: Reasoning with Number

Weeks 7 to 8: Developing Number Sense

Students will review and extend their mental strategies with a focus on using a known fact to find other facts. Strategies for simplifying complex calculations will also be explored. The skills gained in working with number facts will be extended to known algebraic facts.

National curriculum content covered:

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals, fractions, powers and roots
- select and use appropriate calculation strategies to solve increasingly complex problems
- begin to reason deductively in number and algebra

Interleaving/Extension of previous work

- Generating and describing sequences
- Substitution into expressions
- Order of operations

Weeks 9 to 10: Sets and Probability

FDP equivalence will be revisited in the study of probability, where students will also learn about sets, set notation and systematic listing strategies.

National curriculum content covered:

- 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 to 1
- 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 and mutually exclusive outcomes and use these to calculate theoretical probabilities
- appreciate the infinite nature of the sets of integers, real and rational numbers

Interleaving/Extension of previous work

- FDP equivalence
- Forming and solving equations
- Adding and subtracting fractions

Weeks 11 to 12: Prime Numbers and Proof

Factors and multiples will be revisited to introduce the concept of prime numbers, and the Higher strand will include using Venn diagrams from the previous block to solve more complex HCF and LCM problems. Odd, even, prime, square and triangular numbers will be used as the basis of forming and testing conjectures. The use of counterexamples will also be addressed.

National curriculum content covered:

- 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 integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5
- make and test conjectures about patterns and relationships; look for proofs or counterexamples
- begin to reason deductively in number and algebra

Interleaving/Extension of previous work

- Generating and describing sequences
- Factors and multiples

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WRM – Year 8 Scheme of Learning

White Rose Maths

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	**Proportional Reasoning**						**Representations**					
	Ratio and scale		Multiplicative change		Multiplying and dividing fractions		Working in the Cartesian plane			Representing data		Tables & Probability
Spring	**Algebraic techniques**						**Developing Number**					
	Brackets, equations and inequalities				Sequences	Indices	Fractions and percentages			Standard index form		Number sense
Summer	**Developing Geometry**						**Reasoning with Data**					
	Angles in parallel lines and polygons			Area of trapezia and circles		Line symmetry and reflection	The data handling cycle				Measures of location	

Autumn 1: Proportional Reasoning

Weeks 1 and 2: Ratio and Scale

This unit focuses initially on the meaning of ratio and the various models that can be used to represent ratios. Based on this understanding, it moves on to sharing in a ratio given the whole or one of the parts, and how to use e.g. bar models to ensure the correct approach to solving a problem. After this we look at simplifying ratios, using previous answers to deepen the understanding of equivalent ratio rather than 'cancelling' purely as a procedure. We also explore the links between ratio and fractions and understand and use π as the ratio of the circumference of a circle to its diameter. Students following the higher strand also look at gradient in preparation for next half term.

National Curriculum content covered includes:

- make connections between number relationships, and their algebraic and graphical representations
- use scale factors, scale diagrams and maps
- understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction
- 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
- solve problems involving direct and inverse proportion

Weeks 3 and 4: Multiplicative Change

Students now work with the link between ratio and scaling, including the idea of direct proportion, linking various form including graphs and using context such as conversion of currencies which provides rich opportunities for problem solving. Conversion graphs will be looked at in this block and could be revisited in the more formal graphical work later in the term. Links are also made with maps and scales, and with the use of scale factors to find missing lengths in pairs of similar shapes.

National Curriculum content covered includes:

- extend and formalise their knowledge of ratio and proportion in working with measures and in formulating proportional relations algebraically
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning
- use scale factors, scale diagrams and maps
- solve problems involving direct and inverse proportion, including graphical and algebraic representations
- move freely between different numerical, algebraic, graphical and diagrammatic representations

Weeks 5 and 6: Multiplying and Dividing Fractions

Students will have had a little experience of multiplying and dividing fractions in Year 6; here we seek to deepen understanding by looking at multiple representations to see what underpins the (often confusing) algorithms. Multiplication and division by both integers and fractions are covered, with an emphasis on the understanding of the reciprocal and its uses. Links between fractions and decimals are also revisited. Students following the Higher strand will also cover multiplying and diving with mixed numbers and improper fractions.

National Curriculum content covered includes:

- consolidate their numerical and mathematical capability from key stage 2 and extend their understanding of the number system and place value to include decimals and fractions
- select and use appropriate calculation strategies to solve increasingly complex problems
- use the four operations, including formal written methods, applied to integers, decimals, proper and improper fractions, and mixed numbers, all both positive and negative

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Autumn 2: Representations

Weeks 1 to 3: Working in the Cartesian Plane

Building on their knowledge of coordinates from KS2, students will look formally at algebraic rules for straight lines, starting with lines parallel to the axes and moving on to the more general form. They can explore the notions of gradient and intercepts, but the focus at this stage is using the equations to produce lines rather than interpretation of m and c from a given equation; this will be covered in Year 9. Use of technology to illustrate graphs should be embedded. Appreciating the similarities and differences between sequences, lists of coordinates and lines is another key point. Students following the higher strand may also explore non-linear graphs and mid-points of line segments.

National curriculum content covered:

- move freely between different numerical, algebraic, graphical and diagrammatic representations
- develop algebraic and graphical fluency, including understanding linear (and simple quadratic) functions
- make connections between number relationships, and their algebraic and graphical representations
- substitute numerical values into formulae and expressions
- recognise, sketch and produce graphs of linear functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane

Weeks 4 and 5: Representing data

Students are introduced formally to bivariate data and the idea of linear correlation. They extend their knowledge of graphs and charts from Key Stage 2 to deal with both discrete and continuous data.

National curriculum content covered:

describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data

- 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
- use language and properties precisely to analyse probability and statistics

Weeks 6: Tables and Probability

Building form the Year 7 unit, this short block reminds students of the ideas of probability, in particular looking at sample spaces and the use of tables to represent these.

National curriculum content covered:

- 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
- 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 probability and statistics

Spring 1: Algebraic Techniques

Weeks 1 to 4: Brackets, Equations & Inequalities

Building on their understanding of equivalence from Year 7, students will explore expanding over a single bracket and factorising by taking out common factors. The higher strand will also explore expanding two binomials. All students will revisit and extend their knowledge of solving equations, now to include those with brackets and for the higher strand, with unknowns on both sides. Bar models will be recommended as a tool to help students make sense of the maths. Students will also learn to solve formal inequalities for the first time, learning the meaning of a solution set and exploring the similarities and differences compared to solving equations. Emphasis is placed on both forming and solving equations rather than just looking at procedural methods of finding solutions.

National curriculum content covered:

- identify variables and express relationships between variables algebraically
- begin to model situations mathematically and express the results using a range of formal mathematical representations
- 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
- use algebraic methods to solve linear equations in one variable

Week 5: Sequences

This short block reinforces students' learning from the start of Year 7, extending this to look at sequences with more complex algebraic rules now that students are more familiar with a wider range of notation. The higher strand includes finding a rule for the n^{th} term for a linear sequence, using objects and images to understand the meaning of the rule.

National curriculum content covered:

- 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} term
- recognise geometric sequences and appreciate other sequences that arise

Week 6: Indices

Before exploring the ideas behind the addition and subtraction laws of indices (which will be revisited when standard form is studied next term), the groundwork is laid by making sure students are comfortable with expressions involving powers, simplifying e.g. $3x^2y \times 5xy^3$. The higher strand also looks at finding powers of powers.

National curriculum content covered:

- use and interpret algebraic notation, including a^3 in place of $a \times a \times a$; a^2b in place of $a \times a \times b$
- use language and properties precisely to analyse algebraic expressions
- begin to model situations mathematically and express the results using a range of formal mathematical representations
- substitute values in expressions, rearrange and simplify expressions, and solve equations

Spring 2: Developing Number

Weeks 1 and 2: Fractions and Percentages

This block focuses on the relationships between fractions and percentages, including decimal equivalents, and using these to work out percentage increase and decrease. Students also explore expressing one number as a fraction and percentage of another. Both calculator and non-calculator methods are developed throughout to support students to choose efficient methods. Financial maths is developed through the contexts of e.g. profit, loss and interest The higher strand also looks at finding the original value given a percentage or after a percentage change.

National Curriculum content covered includes:

- develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics
- 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

Weeks 3 and 4: Standard Index Form

Higher strand students have already briefly looked at standard form in year 7 and now this knowledge is introduced to all students, building from their earlier work on indices last term. The use of context is important to help students make sense of the need for the notation and its uses. The higher strand includes a basic introduction to negative and fractional indices.

National Curriculum content covered includes:

- 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 $A \times 10^n$, $1 \leq A < 10$, where n is a positive or negative integer or zero

Weeks 5 and 6: Number Sense

This block provides a timely opportunity to revisit a lot of basic skills in a wide variety of contexts. Estimation is a key focus and the use of mental strategies will therefore be embedded throughout. We will also use conversion of metric units to revisit multiplying and dividing by 10, 100 and 1000 in context. The higher strand will extend this to look at the conversion of area and volume units, as well as having an extra step on the use of error notation. We also look explicitly at solving problems using the time and calendar as this area is sometimes neglected leaving gaps in student knowledge.

National Curriculum content covered includes:

- use standard units of mass, length, time, money and other measures, including with decimal quantities
- 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 $a < x \leq b$
- use a calculator and other technologies to calculate results accurately and then interpret them appropriately

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Summer 1: Developing Geometry

Weeks 1 and 2: Angles in parallel lines and polygons

This block builds on KS2 and Year 7 understanding of angle notation and relationships, extending all students to explore angles in parallel lines and thus solve increasingly complex missing angle problems. Links are then made to the closely connected properties of polygons and quadrilaterals. The use of dynamic geometry software to illustrate results is highly recommended, and students following the Higher strand will also develop their understanding of the idea of proof. They will also look start to explore constructions with rulers and pairs of compasses. This key block may take slightly longer than two weeks and the following blocks may need to be adjusted accordingly.
National Curriculum content covered includes:

- 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
- use the standard conventions for labelling the sides and angles of triangle ABC
- derive and illustrate properties of triangles, quadrilaterals, circles, and other plane figures [for example, equal lengths and angles] using appropriate language and technologies
- derive and use the standard ruler and compass constructions (H only)

Weeks 3 and 4: Area of trapezia and circles

Students following the Higher strand will have met the formulae for the area of a trapezium in Year 7; this knowledge is now extended to all students, along with the formula for the area of a circle.

A key aspect of the unit is choosing and using the correct formula for the correct shape, reinforcing recognising the shapes, their properties and names and looking explicitly at compound shapes.
National Curriculum content covered includes:

- derive and apply formulae to calculate and solve problems involving: perimeter and area of triangles, parallelograms, trapezia
- calculate and solve problems involving: perimeters of 2-D shapes (including circles), areas of circles and composite shapes

Weeks 5 and 6: Line symmetry and reflection

The teaching of reflection is split from that of rotation and translation to try and ensure students attain a deeper understanding and avoid mixing up the different concepts. Although there is comparatively little content in this block, it is worth investing time to build confidence with shapes and lines in different orientations. Students can revisit and enhance their knowledge of special triangles and quadrilaterals and focus on key vocabulary such as object, image, congruent etc.
Rotation and translations will be explored in Year 9
National Curriculum content covered includes:

- 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
- identify properties of, and describe the results of reflections applied to given figures

Summer 2: Reasoning with Data

Weeks 1 to 4: The data handling cycle

Much of the statistics content in Key Stage 3 is a continuation of that studied at primary school, and many of the charts and graphs in this block have been used in Year 7 and earlier in Year 8. A particular focus is using charts to compare different distributions. We also explore when graphs may be misleading, an important real-life consideration. Collection of data is also covered, including designing and criticising questionnaires. As we are covering the elements of the data handling cycle, it may well be worth delivering these steps (and some of those in the next block) through an extended project so students become aware of the pitfalls and difficulties of data collection and interpretation as well as the procedural production of graphs and charts.

National Curriculum content covered includes:

- 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

Weeks 5 and 6: Measures of Location

Students have already met the median and the mean earlier in KS3. This block introduces the mode and also looks at when and why each average should be used. Students following the Higher strand will look at the mean from grouped and ungrouped frequency tables, and these steps may well also be accessible to the vast majority of students following the Core strand. The previous block is built on as students have the opportunity to compare distributions, use these averages and the range. We also consider outliers, considering what effect these have on all the measures studied, and whether they should be included or excluded in our calculations. Again, much of the material in the block is suitable for exploring through project work.

National Curriculum content covered includes:

- describe, interpret and compare observed distributions of a single variable through appropriate measures of central tendency (mean, mode, median) and spread (range, consideration of outliers)

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WRM – Year 9 Scheme of Learning

White Rose Maths

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	**Reasoning with Algebra**						**Constructing in 2 and 3 Dimensions**					
	Straight line graphs		Forming and solving equations		Testing conjectures		Three-dimensional shapes			Constructions and congruency		
Spring	**Reasoning with Number**						**Reasoning with Geometry**					
	Numbers		Using percentages		Maths and money		Deduction		Rotation and translation		Pythagoras' Theorem	
Summer	**Reasoning with Proportion**						**Representations and Revision**					
	Enlargement and similarity		Solving ratio & proportion problems		Rates		Probability		Algebraic representation		Revision	

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WRM – Year 9 Scheme of Learning

Autumn 1: Reasoning with Algebra

Weeks 1 and 2: Straight line graphs

This block builds on Year 8 content where students plotted simple straight line graphs. They now study $y = mx + c$ as the general form of the equation of a straight line, interpreting m and c in abstract and real-life contexts, and reducing to this form in simple cases. This will be explored further in the next block when students rearrange formulae. Higher strand students will also consider inverse relationships and perpendicular lines.

National Curriculum content covered includes:

- develop algebraic and graphical fluency, including understanding linear and simple quadratic functions
- 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
- interpret mathematical relationships both algebraically and graphically
- reduce a given linear equation in two variables to the standard form $y = mx + c$; 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
- solve problems involving direct and inverse proportion, including graphical and algebraic representations

Weeks 3 and 4: Equations and inequalities

Students revisit and extend their knowledge of forming and solving linear equations and inequalities, including those related to different parts of the mathematics curriculum. They also explore rearranging formulae, seeing how this links to solving equations and reinforcing their understanding of the difference between equations, formulae, identities and expressions. This is a good opportunity to practise non-calculator skills if appropriate.

National Curriculum content covered includes:

- move freely between different numerical, algebraic, graphical and diagrammatic representations [for example…equations and graphs]
- use algebraic methods to solve linear equations in one variable (including all forms that require rearrangement)
- 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

Weeks 5 and 6: Testing conjectures

Reasoning is encouraged throughout the White Rose Maths scheme of learning, and this block allows time for direct teaching of this. The opportunity is taken to revisit primes, factors and multiples, which provides a wealth of opportunity to make and test simple conjectures. As well as testing given conjectures, students should be encouraged to create and test their own. An example given in the block is through looking at relationships in a 100 square; another great source of patterns is Pascal's triangle. Students also develop their algebraic skills through developing chains of reasoning and learning how to expand a pair of binomials, which Higher strand students met in Y8

National Curriculum content covered includes:

- make and test conjectures about patterns and relationships; look for proofs or counterexamples
- begin to reason deductively in geometry, number and algebra
- use the concepts and vocabulary of prime numbers, factors (or divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation
- simplify and manipulate algebraic expressions to maintain equivalence by expanding products of two or more binomials

WRM – Year 9 Scheme of Learning

Autumn 2: Constructions in 2 and 3 Dimensions

Weeks 1 to 3: Three-dimensional shapes

This is the first time students have studied 3-D shapes formally at KS3, so they will need reminding about the associated vocabulary. Students could be supported by the use of practical equipment such as cubes, squared and isometric paper. As well as surface area and volume, students will also explore plans and elevations. There is a wide variety of software available to support this, and again practical work is very useful to develop visualisation and understanding. For students following the Higher strand, there is a step on investigating volumes of other 3-D shapes; as this is KS4 content this could be omitted if time is short.

National Curriculum content covered includes:

- use language and properties precisely to analyse numbers, algebraic expressions, 2-D and 3-D shapes
- use the properties of faces, surfaces, edges and vertices of cubes, cuboids, prisms, cylinders, pyramids, cones and spheres to solve problems in 3-D
- 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)

Weeks 4 to 6: Constructions and Congruency

This block builds on the constructions studied during Years 7 and 8 to formally look at the idea of a locus and the standard constructions using a straight edge and a pair of compasses. This is a very practical unit and it is useful to explore the loci using objects and rulers as well as the paper-based approach. Indeed 'human geometry' is a very engaging way of promoting understanding through e.g. asking students to all line up 2 m from a point or 2 m from a wall to explore the different loci formed. Congruency is also explored, again taking a practical approach to compare congruent figures of all kinds before looking at the formal aspect of identifying congruent triangles.

National Curriculum content covered includes:

- draw and measure line segments and angles in geometric figures, including interpreting scale drawings
- 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
- 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

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WRM – Year 9 Scheme of Learning

Spring 1: Reasoning with Number

Weeks 1 and 2: Numbers

Students will develop their knowledge of the number system to include rational and real numbers, with the higher strand also looking at simple surds. The block provides plenty of opportunity for students to revisit and practise their number skills both with and without a calculator as necessary. Standard form and HCF/LCM are also revisited.

National Curriculum content covered includes:

- 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 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
- interpret and compare numbers in standard form $A \times 10^n, 1 \leq n < 10$ where n is a positive or negative integer or zero
- appreciate the infinite nature of the sets of integers, real and rational numbers.

Weeks 3 and 4: Using Percentages

Building on their revision of fractions in the last block, students relate these to fractions and decimals, extending their learning in Year 8. All students will look at 'reverse' percentage problems with higher attainers stretched by looking at repeated percentage change. Both calculator and non-calculator methods are encouraged, with the use of decimal multipliers again key.

National Curriculum content covered includes:

- define percentage as 'number of parts per hundred', interpret 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
- solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics

Weeks 5 and 6: Maths and Money

Students practise their number skills in various financial contexts in this block. The language of financial mathematics, already introduced in Years 7 and 8 is further developed. Simple ideas of tax and wages are introduced, and the percentages studied in the last block are applied in various contexts including simple and compound interest.

National Curriculum content covered includes:

- solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics
- select and use appropriate calculation strategies to solve increasingly complex problems
- interpret when the structure of a numerical problem requires additive, multiplicative or proportional reasoning
- develop their use of formal mathematical knowledge to interpret and solve problems, including in financial mathematics

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WRM – Year 9 Scheme of Learning

White Rose Maths

Spring 2: Reasoning with Geometry

Weeks 1 and 2: Deduction

In this block students revise and extend their knowledge of angles rules and properties of shapes, applying them to increasingly complex problems. The block also builds on the ideas of the earlier Testing Conjectures block looking at deduction in a geometric rather than algebraic and numerical contexts. Students also revise the constructions covered in Year 8 and look more deeply at how and why these work.

National Curriculum content covered includes:

- 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
- 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
- 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

Weeks 3 and 4: Rotation and Translation

Building on their study of line symmetry and refection in Year 8, students now look at rotational symmetry and rotation. They then move on to study translations, which are described in vector form They compare the different effects of the transformations studied so far, noticing that the objects and images are congruent.

National Curriculum content covered includes:

- identify properties of, and describe the results of, translations, rotations and reflections applied to given figures
- 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
- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems

Weeks 5 and 6: Pythagoras' Theorem

Students revise squares and square roots before moving on to investigate the relationship between the sides of a right-angled triangle. The converse of the theorem is emphasised so that students are aware that if the sides of a triangle satisfy the rule $a^2 + b^2 = c^2$ then the triangle must be right-angled. Students explore using the theorem in a variety of context, including on coordinate axes, and a higher step is included using 3-D shapes. There is an opportunity to revisit the learning in the next block when students explore similarity in right-angled triangles as an introduction to trigonometry.

National Curriculum content covered includes:

- use Pythagoras' Theorem to solve problems involving right-angled triangles
- 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
- interpret mathematical relationships both algebraically and geometrically
- begin to reason deductively in geometry, number and algebra, including using geometrical constructions
- begin to model situations mathematically and express the results using a range of formal mathematical representations

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WRM – Year 9 Scheme of Learning

Summer 1 : Reasoning with Proportion

Weeks 1 and 2: Enlargement and Similarity

Students develop their knowledge of transformations to include enlargement, learning the mathematical meaning of the word similar. You can link back to other transformations as necessary. If appropriate students can move on to negative scales factors. All students should experience finding unknown sides in similar shapes and this can be extended to formal similar triangles problems and trigonometry in the 30/60/90 triangle. General trigonometry is introduced at the start of Year 10.

National Curriculum content covered includes:

- construct similar shapes by enlargement, with and without coordinate grids
- use scale factors, scale diagrams and maps
- apply angle facts, triangle congruence, similarity and properties of quadrilaterals to derive results about angles and sides
- understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction
- use Pythagoras' Theorem and trigonometric ratios in similar triangles to solve problems involving right-angled triangles

Weeks 3 and 4: Ratio and Proportion

Building on students' experience in previous years, here they solve all types of ratio problems and make the links with direct proportion and graphs. Students formally study inverse proportion for the first time, and if following the Higher strand they also look at graphs of inverse relationships. If appropriate, students could also look at more complex problems involving algebra. Students also revisit 'best buys' comparing unit pricing from earlier in the year with alternative methods such as using scaling.

National Curriculum content covered includes:

- 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
- 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

Weeks 5 and 6: Rates

Students develop their knowledge of inverse relationships to explore speed, distance and time in detail. They also look at graphs and the link between the speed/distance/time formulae and density/mass/volume. Students go on to explore other compound units including exploring flow problems such as how long it will take to fill/empty tanks of different shapes at different rates. Students following the Higher strand will also look at converting compound units such as m/s to km/h. You could also include metric and imperial conversions here if desired.

National Curriculum content covered includes:

- use compound units such as speed, unit pricing and density to solve problems
- understand that a multiplicative relationship between two quantities can be expressed as a ratio or a fraction
- change freely between related standard units [for example time, length, area, volume/capacity, mass]

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WRM – Year 9 Scheme of Learning

Summer 2 : Representations and Revision

Weeks 1 and 2: Probability

In this block students build on their learning in Year 7 and 8 to calculate the probabilities of single and combined events. A key focus is the introduction of the idea of independent events and the use of the multiplication rule for these. Students also look at a variety of diagrams that support probability such as sample space diagrams,Venn diagrams and two-way tables. Tree diagrams, considering both with and without replacement, are included as Higher steps.
National Curriculum content covered includes:

- 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 to 1
- 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

Week 3: Algebraic representation

Students extend their knowledge of graphs to look at interpretation and creation of different types of graphs. The first non-linear graph explored is the quadratic graph, where students are encouraged to look at the symmetry of the curve and read off x/y values. They also explore reciprocal end exponential graphs. Although students need to be able to plot curves and practising this is important, they can also use graphing software to explore the general forms of the curves as this will save a lot of time and be more accurate. Students knowledge of straight line graphs is extended by looking at inequalities graphical, and these are also represented as number lines. In addition, solution of simultaneous equations by graphical methods is also included as a Higher step.

National Curriculum content covered includes:

- recognise, sketch and produce graphs of quadratic functions of one variable with appropriate scaling, using equations in x and y and the Cartesian plane
- use quadratic graphs to estimate values of y for given values of x and vice versa
- find approximate solutions to contextual problems from given graphs of a variety of functions, including piece-wise linear, exponential and reciprocal graphs
- use linear graphs to estimate values of y for given values of x and vice versa and to find approximate solutions of simultaneous linear equations
- understand and use the concepts and vocabulary of expressions, equations, inequalities, terms and factors

Weeks 4 to 6: Revision

The last three weeks of the summer term are unassigned in order to allow you time to review any areas of the KS3 curriculum that you feel your students would benefit from as they prepare to transition to KS4, or to deepen their knowledge of an area if appropriate.
You may wish to include:

- Handling Data – there is no explicit data coverage in Year 9, so you could revise the learning of Year 7 and 8, possibly through projects, and include the Y8 Higher steps around mean averages from a frequency table
- Sequences – there is no new sequence content in Year 9. If your class did not cover the Higher step for finding the rule for the nth term of a linear sequence, you could do this here.
- Error intervals – also only covered as a Higher step in Y8
- Trigonometry – you could develop the brief introduction to trigonometry in Summer Block 1 to study this in more detail, but please note this is covered in depth in the first block of our Year 10 scheme of learning

National Curriculum content covered depends on your choices.

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WRM – Year 10 Scheme of Learning

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	**Similarity**						**Developing Algebra**					
	Congruence, similarity and enlargement			Trigonometry			Equations and inequalities		Representing solutions		Simultaneous equations	
Spring	**Geometry**						**Proportions and Proportional Change**					
	Angles & bearings		Working with circles		Vectors		Ratios & fractions		Percentages and Interest		Probability	
Summer	**Delving into data**						**Using number**					
	Collecting, representing and interpreting data						Non-calculator methods		Types of number and sequences		Indices and Roots	

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WRM – Year 10 Scheme of Learning

Autumn 1: Similarity

Weeks 1 & 2: Congruence, Similarity and Enlargement

Building on their experience of enlargement and similarity in previous years, this unit extends students' experiences and looks more formally at dealing with topics such as similar triangles. It would be useful to use ICT to demonstrate what changes and what stays the same when manipulating similar shapes. Parallel line angle rules are revisited to support establishment of similarity. Congruency is introduced through considering what information is needed to produce a unique triangle. Higher level content extends enlargement to explore negative scale factors, and also looks at establishing that a pair of triangles are congruent through formal proof.

National curriculum content covered **(Higher content in bold)**:

- extend and formalise their knowledge of ratio and proportion in working with measures and geometry
- compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity
- interpret and use fractional **{and negative}** scale factors for enlargements
- apply the concepts of congruence and similarity, including the relationships between lengths, **{areas and volumes}** in similar figures
- use mathematical language and properties precisely
- make and test conjectures about the generalisations that underlie patterns and relationships; look for proofs or counter-examples
- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems

Weeks 3 to 6: Trigonometry

Trigonometry is introduced as a special case of similarity within right-angled triangles. Emphasis is placed throughout the steps on linking the trig functions to ratios, rather than just functions. This key topic is introduced early in Year 10 to allow regular revisiting e.g. when looking at bearings.
For the Higher tier, calculation with trigonometry is covered now and graphical representation is covered in Year 11

National curriculum content covered:

- extend and formalise their knowledge of ratio and proportion, including trigonometric ratios
- apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles {and, where possible, general triangles} in two **{and three}** dimensional figures
- know the exact values of $\sin\theta$, $\cos\theta$, $\tan\theta$ for required angles
- **{know and apply the sine rule and cosine rule to find unknown lengths and angles}**
- **{know and apply to calculate the area, sides or angles of any triangle}**
- develop their mathematical knowledge, in part through solving problems and evaluating the outcomes, including multi-step problems
- make and use connections between different parts of mathematics to solve problems
- model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem.

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Autumn 2: Developing Algebra

Weeks 7 to 9: Equations and Inequalities

Students will have covered both equations and inequalities at key stage 3,and this unit offers the opportunity to revisit and reinforce standard techniques and deepen their understanding. Looking at the difference between equations and inequalities, students will establish the difference between a solution and a solution set; they will also explore how number lines and graphs can be used to represent the solutions to inequalities.
As well as solving equations, emphasis needs to be placed on forming equations from given information. This provides an excellent opportunity to revisit other topics in the curriculum such as angles on a straight line/in shapes/parallel lines, probability, area and perimeter etc.
Factorising quadratics to solve equations is covered in the Higher strand here and is revisited in the Core strand in Year 11

National curriculum content covered (Higher content in bold):

- consolidate their algebraic capability from key stage 3 and extend their understanding of algebraic simplification and manipulation to include quadratic expressions
- translate simple situations or procedures into algebraic expressions or formulae; derive an equation, solve the equation and interpret the solution
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem.
- recognise, sketch and interpret graphs of linear functions,
- factorising quadratic expressions of the form $x^2 + bx + c$ (Higher only at this stage)
- solve quadratic equations algebraically by factorising (Higher only at this stage)
- 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}**

Weeks 10 to 12: Simultaneous Equations

Students now move on to the solution of simultaneous equations by both algebraic and graphical methods. The method of substitution will be dealt with before elimination, considering the substitution of a known value and then an expression. With elimination, all types of equations will be considered, covering simple addition and subtraction up to complex pairs where both equations need adjustment. Links will be made to graphs and forming the equations will be explored as well as solving them.
The Higher strand will include the solution of a pair of simultaneous equations where one is a quadratic, again dealing with factorisation only at this stage.

National curriculum content covered (Higher content in bold):

- consolidate their algebraic capability from key stage 3 and extend their understanding of algebraic simplification and manipulation to include quadratic expressions
- model situations mathematically and express the results using a range of formal mathematical representations, reflecting on how their solutions may have been affected by any modelling assumptions
- 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
- select appropriate concepts, methods and techniques to apply to unfamiliar and non-routine problems; interpret their solution in the context of the given problem.
- solve two simultaneous equations in two variables (linear/linear **{or linear/quadratic})** algebraically;
- recognise, sketch and interpret graphs of linear functions and quadratic functions.

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Spring 1: Geometry

Weeks 1 and 2: Angles and bearings

As well as the formal introduction of bearings, this block provides a great opportunity to revisit other materials and make links across the mathematics curriculum. Accurate drawing and use of scales will be vital, as is the use of parallel line angles rules; all of these have been covered at Key Stage 3. Students will also reinforce their understanding of trigonometry and Pythagoras from earlier this year, applying their skills in another context as well as using mathematics to model real-life situations.

National curriculum content covered:

- interpret and use bearings
- compare lengths…using scale factors
- apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles {and, where possible, general triangles} in two dimensional figures
- {know and apply the sine rule and cosine rule to find unknown lengths and angles}
- use mathematical language and properties precisely
- reason deductively in geometry, number and algebra, including using geometrical constructions
- make and use connections between different parts of mathematics to solve problems

Weeks 4 and 5: Working with circles

This block also introduces new content whilst making use of and extending prior learning. The formulae for arc length and sector area are built up from students' understanding of fractions They are also introduced to the formulae for surface area and volume of spheres and cones; here higher students can enhance their knowledge and skills of working with area and volume ratios.

Higher tier students are also introduced to four of the circle theorems; the remaining theorems will be introduced in Year 11 when these four will be revisited.

National curriculum content covered:

- identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
- calculate arc lengths, angles and areas of sectors of circles
- calculate surface areas and volumes of spheres, pyramids, cones and composite solids
- apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results

Weeks 5 and 6: Vectors

Students will have met vectors to describe translations during Key Stage 3 This will be revisited and used as the basis for looking more formally at vectors, discovering the meaning of $-\boldsymbol{a}$ compared to $\boldsymbol{a}$ to make sense of operations such as addition, subtraction and multiplication of vectors. This will connect to exploring 'journeys' within shapes linking the notation $\overrightarrow{AB}$ with $\boldsymbol{b}-\boldsymbol{a}$ etc. Higher tier students will then use this understanding as the basis for developing geometric proof, making links to their knowledge of properties of shape and parallel lines.

National curriculum content covered:

- describe translations as 2D vectors
- 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}.

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White Rose Maths

Spring 2: Proportions and Proportional Change

Weeks 1 and 2: Ratios and Fractions

This block builds on KS3 work on ratio and fractions, highlighting similarities and differences and links to other areas of mathematics including both algebra and geometry. The focus is on reasoning and understanding notation to support the solution of increasingly complex problems that include information presented in a variety of forms. The bar model is a key tool used to support representing and solving these problems.

National curriculum content covered:

- Consolidating subject content from key stage 3:
  - 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.
  - Relate the language of ratios and the associated calculations to the arithmetic of fractions and to linear functions.
  - Use compound units such as speed, unit pricing and density to solve problems.
- Compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity.
- Apply the concepts of congruence and similarity, including the relationships between lengths, **{areas and volumes}** in similar figures.

Weeks 4 and 5: Percentages and Interest

Although percentages are not specifically mentioned in the KS4 national curriculum, they feature heavily in GCSE papers and this block builds on the understanding gained in KS3. Calculator methods are encouraged throughout and are essential for repeated percentage change/growth and decay problems. Use of financial contexts is central to this block, helping students to maintain familiarity with the vocabulary they are unlikely to use outside school.

National curriculum content covered:

- Consolidating subject content from key stage 3:
  - Interpret these multiplicatively, express one quantity as a percentage of another, compare two quantities using percentages, and work with percentages greater than 100%.
  - Solve problems involving percentage change, including: percentage increase, decrease and original value problems and simple interest in financial mathematics.
- Set up, solve and interpret the answers in growth and decay problems, including compound interest **{and work with general iterative processes}.**

Weeks 5 and 6: Probability

This block also builds on KS3 and provides a good context in which to revisit fraction arithmetic and conversion between fractions, decimals and percentages. Tables and Venn diagrams are revisited and understanding and use of tree diagrams is developed at both tiers, with conditional probability being a key focus for Higher tier students.

National curriculum content covered:

- Apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one.
- Use a probability model to predict the outcomes of future experiments; understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size.
- Calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions.
- **{Calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams}.**

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Summer 1: Delving into Data

This block builds on KS3 work on the collection, representation and use of summary statistics to describe data. Much of the content is familiar, both from previous study within and beyond mathematics (including Geography and Science) and from everyday life. The steps have been chosen to balance consolidation of existing knowledge with extending and deepening, particularly in terms of interpretation of results and evaluating and criticising statistical methods and diagrams. For students following Higher tier, there is additional content relating to continuous data including histograms, cumulative frequency diagrams, box plots and associated measures such as quartiles and the interquartile range. Again the emphasis with these topics should be on interpretation (particularly in making comparisons) and not just construction. A possible approach to teaching this unit would be project-based, where students collect primary data (or select samples from secondary data) from which they make and test hypotheses, thus giving a purpose to the creation and analysis of the diagrams and measures involved. Looking at data from other subject areas might again be useful here.

National curriculum content covered:

- consolidating subject content from key stage 3:
- use describe, interpret and compare observed distributions of a single variable through: appropriate graphical representation involving discrete, continuous and grouped data
- 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, 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)
- infer properties of populations or distributions from a sample, whilst knowing the limitations of sampling
- interpret and construct tables and line graphs for time series data
- **{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}**
- 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}**
- apply statistics to describe a population
- interpret, analyse and compare the distributions of data sets from univariate empirical distributions through appropriate measures of central tendency (including modal class) and spread **{including quartiles and inter-quartile range}**

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Summer 2: Using Number

Weeks 1 and 2: Non-calculator methods

This block revises and builds on KS3 content for calculation. Mental methods and using number sense are to be encouraged alongside the formal methods for all four operations with integers, decimals and fractions. Where possible this should be covered through problems, particularly multi-step problems in preparation for GSCE. The limits of accuracy of truncation are explored and compared to rounding, and Higher tier students will look at all aspects of irrational numbers including surds. This block may take longer than the following blocks and timings may need to be adjusted accordingly.

National curriculum content covered:

- consolidate their numerical and mathematical capability from key stage 3
- calculate exactly with fractions, **{surds}** and multiples of π; **{simplify surd expressions involving squares and rationalise denominators}**
- **{change recurring decimals into their corresponding fractions and vice versa}**
- apply and interpret limits of accuracy when rounding or truncating, **{including upper and lower bounds}**
- develop their use of formal mathematical knowledge to interpret and solve problems, including in financial contexts
- make and use connections between different parts of mathematics to solve problems

Weeks 4 and 5: Types of Number and Sequences

This block again mainly revises KS3 content, reviewing prime factorisation and associated number content such as HCF and LCM. Sequences is extended for Higher Tier to include surds and finding the formula for a quadratic sequence.

National curriculum content covered:

- Consolidating subject content from key stage 3:
  - Factors, multiples, primes, HCF and LCM
  - Describe and continue sequences
- recognise and use sequences of triangular, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r^n where n is an integer, and r is a positive rational number **{or a surd}**) **{and other sequences}**
- deduce expressions to calculate the nth term of linear **{and quadratic}** sequences

Weeks 5 and 6: Indices and roots

This final block of Year 10 consolidates the pervious two blocks focusing on understanding powers generally, and in particular in standard form. Negative and fractional indices are explored in detail. Again, much of this content will be familiar from KS3, particularly for Higher tier students, so this consolidation material may be covered in less than two weeks allowing more time for general non-calculator and problem-solving practice.

National curriculum content covered:

- recognise and use sequences of square and cube numbers
- **{estimate powers and roots of any given positive number}**
- calculate with roots, and with integer **{and fractional}** indices
- calculate with numbers in standard form $A \times 10^n$, where $1 \leq A \leq< 10$ and n is an integer
- simplifying expressions involving sums, products and powers, including the laws of indices

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WRM – Year 11 Scheme of Learning

White Rose Maths

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12
Autumn	**Graphs**						**Algebra**					
	Gradients & lines		Non-linear graphs		Using graphs		Expanding & factorising		Changing the subject		Functions	
Spring	**Reasoning**						**Revision and Communication**					
	Multiplicative		Geometric		Algebraic		Transforming & constructing		Listing & describing		Show that...	
Summer	**Revision**						**Examinations**					

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Autumn 1: Graphs

Weeks 1 and 2: Gradients and lines

This block builds on earlier study of straight line graphs in years 9 and 10. Students plot straight lines from a given equation, and find and interpret the equation of a straight line from a variety of situations and given information. There is the opportunity to revisit graphical solutions of simultaneous equations. Higher tier students also study the equations of perpendicular lines.
National Curriculum content covered includes:

- move freely between different numerical, algebraic, graphical and diagrammatic representations
- plot and interpret graphs
- interpret the gradient of a straight line graph as a rate of change
- use the form $y = mc + c$ to identify parallel **{and perpendicular}** lines; find the equation of the line through two given points, or through one point with a given gradient
- find approximate solutions to two simultaneous equations in two variables (linear/linear **{or linear/quadratic})** using a graph

Weeks 3 and 4: Non-linear graphs

Students develop their knowledge of non-linear graphs in this block, looking at quadratic, cubic and reciprocal graphs, so they recognise the different shapes. They find the roots of quadratics graphically, and will revisit this when they look at algebraic methods in the Functions block during Autumn 2, where they will also look at turning points. Higher tier students also look at simple exponential graphs and the equation of a circle. Note that the equation of the tangent to a circle is covered later when the circle theorem of tangent/radius is met. Higher students also extend their understanding of gradient to include instantaneous rates of change considering the gradient of a curve at a point.
National Curriculum content covered includes:

- move freely between different numerical, algebraic, graphical and diagrammatic representations
- recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function 1 **{the exponential function $y = k^x$ for positive values of k}**
- plot and interpret graphs (including reciprocal graphs **{and exponential graphs}**)
- find approximate solutions using a graph
- identify and interpret roots, intercepts of quadratic functions graphically
- **{recognise and use the equation of a circle with centre at the origin;}**

Weeks 5 and 6: Using graphs

This block revises conversion graphs and reflection in straight lines. Students also study other real-life graphs, including speed/distance/time, constructing and interpreting these. Higher tier students also investigate the area under a curve.
National Curriculum content covered includes:

- plot and interpret graphs of non-standard functions in real contexts, to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
- **{interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of instantaneous and average rate of change (gradients of tangents and chords) in numerical, algebraic and graphical contexts}**
- **{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}**

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Autumn 2: Algebra

Weeks 1 and 2: Expanding and factorising

This block reviews expanding and factorising with a single bracket before moving on to quadratics. The use of algebra tiles to develop conceptual understanding is encouraged throughout. Context questions are included to revisit e.g. area and Pythagoras' theorem.

National Curriculum content covered includes:

- 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}**
- simplify and manipulate algebraic expressions by: factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares; **{factorising quadratic expressions of the form $ax^2 + bx + c$}**
- know the difference between an equation and an identity; solve quadratic equations **{including those that require rearrangement}** algebraically by factorising, **{by completing the square and by using the quadratic formula}**
- identify and interpret roots; deduce roots algebraically **{and turning points by completing the square}**
- solve two simultaneous equations in two variables (linear/linear **{or linear/quadratic}**) algebraically; find approximate solutions using a graph

Weeks 3 and 4: Changing the subject

Students consolidate and build on their study of changing the subject in Year 9. The block begins with a review of solving equations and inequalities before moving on to rearrangement of both familiar and unfamiliar formulae. Checking by substitution is encouraged throughout. Higher tier students also study solving equations by iteration.

National Curriculum content covered includes:

- solve linear inequalities in one variable
- 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}**
- 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
- **{find approximate solutions to equations numerically using iteration}**

Weeks 5 and 6: Functions

As well as introducing formal function notation, this block brings together and builds on recent study of quadratic functions and graphs. This is also an opportunity to revisit trigonometric functions, first studied at the start of Year 10.

National Curriculum content covered includes:

- 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'}**
- solve two simultaneous equations in two variables (linear/linear **{or linear/quadratic}**) algebraically; find approximate solutions using a graph
- identify and interpret roots; deduce roots algebraically **{and turning points by completing the square}**
- 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}**
- recognise, sketch and interpret graphs of quadratic functions
- apply Pythagoras' Theorem and trigonometric ratios to find angles and lengths in right-angled triangles **{and, where possible, general triangles}** in two **{and three}** dimensional figures

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Spring 1 : Reasoning

Weeks 1 and 2: Multiplicative Reasoning

Students develop their multiplicative reasoning in a variety of contexts, from simple scale factors through to complex equations involving direct and inverse proportion. They link inverse proportion with the formulae for pressure and density. There is also the opportunity to review ratio problems.

National Curriculum content covered includes:

- compare lengths, areas and volumes using ratio notation and/or scale factors; make links to similarity
- understand that X is inversely proportional to Y is equivalent to X is proportional to $\frac{1}{Y}$
- **{construct and}** interpret equations that describe direct and inverse proportion
- extend and formalise their knowledge of ratio and proportion, including trigonometric ratios, in working with measures and geometry, and in working with proportional relations algebraically and graphically

Weeks 3 and 4: Geometric Reasoning

Students consolidate their knowledge of angles facts and develop increasingly complex chains of reasoning to solve geometric problems. Higher tier students revise the first four circle theorems studied in Year 10 and learn the remaining theorems. Students also revisit vectors and the key topics of Pythagoras' theorem and trigonometry.

National Curriculum content covered includes

- reason deductively in geometry, number and algebra, including using geometrical constructions
- **{apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results}**
- interpret and use bearings
- 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}**

Weeks 5 and 6: Algebraic Reasoning

Students develop their algebraic reasoning by looking at more complex situations. They use their knowledge of sequences and rules to made inferences, and Higher tier students move towards formal algebraic proof. Forming and solving complex equations, including simultaneous equations, is revisited. Higher tier students also look at solving inequalities in more than one variable.

National Curriculum content covered includes:

- make and test conjectures about the generalisations that underlie patterns and relationships; look for proofs or counter-examples; begin to use algebra to support and construct arguments **{and proofs}**
- deduce expressions to calculate the n^{th} term of linear **{and quadratic}** sequences
- solve two simultaneous equations in two variables (linear/linear **{or linear/quadratic}**) algebraically; find approximate solutions using a graph
- 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}**

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WRM – Year 11 Scheme of Learning

Spring 2 : Revision & Communication

Weeks 1 and 2: Transforming & Constructing

Students revise and extend their learning from Key Stage 3, exploring all the transformations and constructions, relating these to symmetry and properties of shapes when appropriate. There is an emphasis on describing as well as performing transformations as using the language promotes deeper thinking and understanding. Higher tier students extend their learning to explore the idea of invariance and look at trigonometric graphs as a vehicle for exploring graph transformations.

National Curriculum content covered includes:

- describe translations as 2D vectors
- reason deductively in geometry, number and algebra, including using geometrical constructions
- interpret and use fractional **{and negative}** scale factors for enlargements
- **{describe the changes and invariance achieved by combinations of rotations, reflections and translations}**
- recognise, sketch and interpret graphs of **{the trigonometric functions (with arguments in degrees) for angles of any size}**
- **{sketch translations and reflections of the graph of a given function}**

Weeks 3 and 4: Listing & Describing

This block is another vehicle for revision as the examinations draw closer. Students look at organisation information, with Higher tier students extending this to include the product rule for counting. Links are made to probability and other aspects of Data Handling such as describing and comparing distributions and scatter diagrams. Plans and elevations are also revised. You can adapt the exact content to suit the needs of your class.

National Curriculum content covered includes:

- explore what can and cannot be inferred in statistical and probabilistic settings, and express their arguments formally
- calculate the probability of independent and dependent combined events, including using tree diagrams and other representations, and know the underlying assumptions
- **{calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams}**
- apply systematic listing strategies, **{including use of the product rule for counting}**
- construct and interpret plans and elevations of 3D shapes

Weeks 5 and 6: Show that

This is another block designed to be adapted to suit the needs of your class. Examples of communication in various areas of mathematics are provided in order to highlight gaps in knowledge that need addressing in the run up to the examinations. "Show that" is used to encourage students to communicate in a clear mathematical fashion, and this skill should be transferred to their writing of solutions to any type of question.

National Curriculum content covered includes:

- 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}**
- apply the concepts of congruence and similarity
- make and use connections between different parts of mathematics to solve problems
- **{change recurring decimals into their corresponding fractions and vice versa}**
- 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}**