

	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  $\pi$  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 dividing 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

## 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 from 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  $n^{\text{th}}$  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  $n^{\text{th}}$  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

## 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)