Toynbee Curriculum
KS3 Topic Summaries

MATHS (Year 8)

Toynbee School

Scheme of Learning: Year 8 Autumn Term

Topic Sequence: Proportional Reasoning

1	2	3
Ratio and Scale	**Multiplicative Change**	**Multiplying and Dividing Fractions**

Topic Overview: 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, the topic leads on to sharing in a ratio given the whole or one of the parts, and how to use different models (e.g., bar models) to ensure the correct approach to solving a problem. After this, simplifying ratios is focused on, using previous answers to deepen the understanding of equivalent ratios rather than "cancelling". Links between ratio and fractions are also explored and used to understand the use of π as the ratio of the circumference of a circle to its diameter.

Learning Sequence:

Understand the meaning and representation of ratio
This small step is to ensure that students have a firmer understanding of the meaning of ratio. They will be able to represent ratios pictorially and have knowledge of the language involved. In pictorial representations, it is important to emphasise the equal parts of a ratio.

Understand and use ratio notation
This small step will introduce the use of the colon in ratio notation and link it to the representations explored in the previous step. The importance of order of terms within ratio notation will be highlighted. Most questions feature ratio comparing two parts, but students will also be exposed to ratios involving multiple parts.

Solve problems involving ratios of the form 1 : n (or n : 1)
In this small step, students will use simple multiplicative reasoning with ratio. In this early stage of ratio learning, n will always be an integer. For larger values of n, students will be introduced to the advantages of a double number line to support their calculations.

Solve proportional problems involving the ratio m : n
Students will be familiar with terminology of, for example "for every 4, there are 3", from KS2. They will now develop their understanding of ratio alongside formal mathematical notation. Students will explore multiple methods including double number lines, finding multipliers or using bar models and then discuss which is most appropriate to the problem.

Divide a value into a given ratio
In this small step, students will be exposed to the many combinations of "sharing in a ratio" question that can be asked, and not just when the total is given. Bar modelling gives students a strategy to ensure that they have understood the information and can represent clearly what is known and what is unknown. Varying the ratios for a constant given total is useful.

Express ratios in their simplest integer form
The concept of simplifying by finding factors will be familiar to students from work on equivalent fractions. Ratios will be simplified to their smallest integer terms. Pictorial or concrete representations should be used to support understanding of the concept. Students will look at the answers to questions in previous steps and simplify these to see how the original ratio is obtained.

Compare ratios and related fractions
The previous small steps highlighted total number of parts in a ratio, which is looked at again here when finding each part as a fraction of the whole. Students often incorrectly think, for example the ratio 2 : 3 represents two-thirds of the whole. Pictorial support or using cubes etc is helpful here to address this misconception.

Understand π as the ratio between diameter and circumference
Measuring circumferences and diameters of circular objects helps to establish that the circumference is a multiple of the diameter and to find an approximation for π. Defining π as the ratio of the circumference to the diameter leads to $\pi = \frac{c}{d}$ and then the formula for the circumference.

Sequence of Learning:	
1	Understand the meaning and representation of ratio
2	Understand and use ratio notation
3	Solve problems involving ratios of the form 1 : n (or n : 1)
4	Solve proportional problems involving the ratio m : n
5	Divide a value into a given ratio
6	Express ratios in their simplest integer form
7	Compare ratios and related fractions
8	Understand π as the ratio between diameter and circumference

Topic Resources:	
Knowledge Maps:	Ratio and scale
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 8 Autumn Term

Topic Sequence: Proportional Reasoning

1	2	3
Ratio and Scale	Multiplicative Change	Multiplying and Dividing Fractions

Topic Overview: Ratio and Scale

Students now work with the link between ratio and scaling, including the idea of direct proportion, linking various forms 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.

Learning Sequence:

Solve problems involving direct proportion
In this small step, we will explore the fundamentals of direct proportion. Students could think of examples of direct proportion in real life, where as one variable doubles, so does the other. Multiple methods should be explored to give students strategies for the variety of problems that can be posed.

Explore conversion graphs
This is a particular skill that students will come across in many other topics in school. For more precise conversions, graph paper will be used practising the use of scales. Students will be encouraged to draw vertical and horizontal lines for the most accurate conversions from their graphs.

Convert between currencies
Conversion of currency brings together many of the ideas covered in previous small steps. We will explore the many different methods that can be employed in this topic. Students will be encouraged to estimate their answers before converting to ensure they have a sensible answer. Both calculator and non-calculator will be explored, considering which is appropriate when.

Explore relationships between similar shapes
Students have already been briefly exposed to similar shapes in their exploration of π and gradient. In this small step, we will focus on the fact that corresponding lengths on similar shapes are in the same ratio. Students will be familiar with similar shapes presented in different orientations. Exploration of examples and non-examples will be used to cement the concept of similar shapes.

Understand scale factors as multiplicative representations
Bringing together work on ratio of 1 : n and similar shapes, this small step introduces enlargement scale factors, and may be taught in conjunction with the similar shapes small step. The focus is on length scale factor, not area or volume, though some students may naturally make observations.

Draw and interpret scale diagrams
Students can explore this step practically by creating and using scale drawings of items in the classroom etc. The link between scale, scale factors and ratio will be made explicit. This may be reinforced by linking back to earlier representations such as the double number line. Examples of diagrams that are not to scale may be useful to emphasise the key features of scale.

Interpret maps using scale factors and ratios
We may revisit metric unit conversions before starting this small step. Specifically, students need to be confident in working with large numbers (for example, above 10 000). This small step will be introduced using real-life maps, and the meaning of each scale. Using representations, such as double number lines, will help students to connect this small step to previous ones.

Sequence of Learning:	
1	Solve problems involving direct proportion
2	Explore conversion graphs
3	Convert between currencies
4	Explore relationships between similar shapes
5	Understand scale factors as multiplicative representations
6	Draw and interpret scale diagrams
7	Interpret maps using scale factors and ratios

Topic Resources:	
Knowledge Maps:	Compound and non-compound measures Ratio and Scale Direct and Inverse Proportion – number Direct and Inverse Proportion - algebraic
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
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Scheme of Learning: Year 8 Autumn Term

Topic Sequence: Proportional Reasoning

1	2	3
Ratio and Scale	**Multiplicative Change**	**Multiplying and Dividing Fractions**

Topic Overview: Ratio and Scale

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 that (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.

Learning Sequence:

Represent multiplication of fractions
Repeated addition is used here to help understand the multiplication of fractions. Students will also explore familiar representations of fractions from previous years. Manipulatives such as paper plates and fraction pieces can be used to demonstrate the multiplications. Paper strips and Cuisenaire rods link well to pictorial representations as well as bar models.

Multiply a fraction by an integer
In this small step, students explore and formalise multiplication of a fraction by an integer. Calculations supported with pictorial representations are still encouraged at this stage. Multiple methods will allow students to pick the strategy that best suits the question. It will be useful to remind students of the word "product" at this stage.

Find the product of a pair of unit fractions
This step gives students the chance to understand the underlying mathematics of multiplying any fractions together. When folding paper, students will be reminded that each side of the original shape has a unit length of 1. This links it to grid method multiplication and clearly shows the size of the product of unit fractions is always smaller than 1.

Find the product of a pair of any fractions
This small step will look at the multiple ways in which the students might approach finding the product of any two fractions, allowing students to come up with their own conjectures for "quick methods". Again, using familiar concrete and/or pictorial representations from previous steps will support abstract understanding.

Divide an integer by a fraction
In this small step, students understand the link between multiplying and dividing integers to multiplying and dividing fractions. A fact family with integer values will be intuitive but students may want to ask more questions when the fact family involves division of fractions. Demonstrations with bar models and fraction strips will be used to help explain this.

Divide a fraction by a unit fraction
As work with fractions becomes more abstract, it is useful to get students to reason their solutions. The questions asked in this small step will revolve around reasoning rather than procedure. The language of dividing, "How many … in …?", will help students to estimate answers before formally giving them.

Understand and use the reciprocal
Here, students will learn through investigation that the division of a number is equivalent to the multiplication by its reciprocal. They should be able to find the reciprocal of fractions and decimals and use these to answer questions on division. They should also understand that a number multiplied by its reciprocal is always 1.

Divide any pair of fractions
Students should now have developed their reasoning and so have many methods available for dividing fractions. This small step develops the concepts further so they can understand the division of any pair of fractions. Students will be encouraged to think about efficient methods depending on the question instead of relying solely on procedure.

Sequence of Learning:	
1	Represent multiplication of fractions
2	Multiply a fraction by an integer
3	Find the product of a pair of unit fractions
4	Find the product of a pair of any fractions
5	Divide an integer by a fraction
6	Divide a fraction by a unit fraction
7	Understand and use the reciprocal
8	Divide any pair of fractions

Topic Resources:	
Knowledge Maps:	Fractions
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 8 Autumn Term

Topic Sequence: Representations

4	5	6
Working in the Cartesian Plane	**Representing Data**	**Tables and Probability**

Topic Overview: Working in the Cartesian Plane

Building on KS2 knowledge of coordinates ,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 notion of gradient and intercept but focus is on using equations to plot lines – ma nd c will be covered fully in year 9. they will appreciate connections and similarities to sequences and lists of coordinates and lines. Higher strand students can explore non linear graphs and midpoints of line segments.

Lesson Sequence:

Work with coordinates in all four quadrants
Students build on KS2 knowledge of coordinate plane , created by the intersection of two number lines in 2D space, developing their understanding of x and y axes and the origin. Students can draw their own axes and need careful support with labelling. Students should be able to label the 4 quadrants.

Lines parallel to the axes
Idea of straight line as infinite set of points with common feature. Understand that lines parallel to axes take form of y = a and x = a.

Recognise and use the line y = x
First diagonal line that they will study – explicitly cover that only be a 45 degree angle if scale on both axes is the same. Higher students will look at y = -x.

Recognise and use the line y = kx
This step builds on understanding of y = x by introducing k and highlighting its effect on line steepness.

Direct proportion using y = kx
Introduce the idea of direct proportion with tables and link variables to x and y axes.

Gradient of line y = x
Gradient introduced with triangle on a straight line. Examples of mountains to explain steepness.

Lines in the form y = x + a
Students now consider the impact of adding a constant to line y = x. Students encouraged to explore effect this has on straight line by generating tables of values and plotting these.

Graphs with negative gradients
Introduce negative gradient with idea of ski slope. Then students can draw linear graphs with a negative gradient.

Linking graphs to sequences
Students link prior knowledge of sequences with linear equations and their respective graphs.

Plotting y = mx + c graphs
Students develop understanding of equations of straight lines by using general form of y = mx + c Interpretation will be covered in later steps

Exploring non-linear graphs (H)
Introduction to plotting non linear graphs . Discuss why it is inappropriate to join coordinates with a straight line.

Midpoint of line segment (H)
Students firstly consider midpoints on number lines. They build on this to find coordinates of line segment.

Work with coordinates in all four quadrants
Students need to be confident in drawing and labelling axes. A wide range of examples will be used as well as examples of appropriate and unappropriate

Sequence of Lessons:	
1	Work with coordinates in all four quadrants
2	Identify and draw lines parallel to axes
3	Recognise and use line y = x
4	Recognise and use lines in form y = kx
5	Link y = kx to direct proportion
6	Explore gradient of y = kx (H)
7	Recognise and use lines in form y = x + a
8	Explore graphs with negative gradient
9	Link graphs to linear sequences
10	Plot graphs in form y = mx + c
11	Explore non linear graphs (H)
12	Find midpoint of line segment (H)

Topic Resources:	
Knowledge Map:	Linear Graphs
Assessment:	
Knowledge:	End of Topic Test
Application of Knowledge:	Termly Summative Assessments
Supportive Reading:	
Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
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Scheme of Learning: Year 8 Autumn Term

Topic Sequence: Representations

4	5	6
Working in the Cartesian Plane	Representing Data	Tables and Probability

Topic Overview: 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.

Lesson Sequence:

Draw and interpret scatter graphs
Students need to be confident in drawing and labelling axes. A wide range of examples will be used including a discussion ofappropriate and inappropriate pairs of variables.

Linear correlation
Positive and negative correlation is explored including classification of weak and strong. Students will be able to decide if there is no correlation or nonlinear correlation.

Draw and use line of best fit
Student misconceptions need to be checked – the line does not need to go through the origin. Students need to understand that there are approximately the same number of points above and below the line. Also explore why the line is straight and not curved. Students need to show how they arrive at estimate by drawing additional lines on the graph. Explain term 'extrapolation and ensure that students are aware of why it is not always sensible to make estimate outside range of data. Introduce outliers to students.

Identify non-linear relationships
Students decide if there is no correlation or non linear correlation. Explore possibility that with non linear correlation there may still be a relationship between the variables.

Identify different types of data
Students are introduced to discrete and continuous data, qualitative and quantitative data. Establish knowledge of different data types and which graphs and calculations are appropriate for each.

Ungrouped frequency tables
Students understand the word 'frequency' by counting numbers in given list and by completing tables. They interpret data from information in the table to answer questions in context.

Read and interpret grouped tables
Students explore when and when not to use an ungrouped frequency table. They consider sensible class boundaries for grouped frequency tables.

Represent grouped discrete data
Students populate grouped frequency tables from different types of sources.

Represent continuous data
Idea of rounding continuous data is explored, linking it to the use of inequality signs when writing class boundaries.

Represent data in two-way tables
Students start with concrete or pictorial representations to help them understand structure and purpose of a two-way table. Fractions, decimals and percentages are easily interweaved into this topic.

Sequence of Lessons:	
1	Draw and interpret scatter graphs
2	Linear correlation
3	Draw and use line of best fit
4	Identify non-linear relationships
5	Identify different types of data
6	Read and interpret ungrouped frequency tables
7	Read and interpret grouped frequency tables
8	Represent grouped discrete data
9	Represent continuous data grouped into equal classes
10	Represent data in two-way tables
18	

Topic Resources:	
Knowledge Map:	Statistics – Ungrouped Data
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
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Scheme of Learning: Year 8 Autumn Term

Topic Sequence: Representations

4	6	6
Working in the Cartesian Plane	**Representing Data**	**Tables and Probability**

Topic Overview: Tables and Probability

Building on from year 7 unit, this reminds students of the ideas of probability, in particular looking at sample spaces and the use of tables to represent these.

Lesson Sequence:

Construct sample spaces for 1 or more events
Building on year 7 knowledge of experiment, event and outcome, students consider sample spaces, listing all possible outcomes in an experiment. Emphasis is placed on a systematic approach to listing all possible outcomes.

Find probabilities from a sample space
Students build on knowledge and understanding of sample spaces to work out probabilities of events. The notation P (event) is introduced. Different ways probabilities can be represented and consideration of when events are and are not equally likely is emphasised.

Find probabilities from two-way tables
Students are guided on which total to use when answering questions and discussion is made around how probabilities can be represented and whether fractions need to be simplified.

Find probabilities from Venn Diagrams
Building on Year 7 work on drawing and interpreting Venn diagrams, students link them to finding probabilities.

Use product rule for finding the total number of possible outcomes
Students are introduced to product rule to find total arrangements. They need to consider whether repeats can be allowed. They will be given the opportunity to design their lists given the number of possible arrangements.

Sequence of Lessons:	
1	Construct sample spaces for 1 or more events
2	Find probabilities from a sample space
3	Find probabilities from two-way tables
4	Find probabilities from Venn Diagrams
5	Use product rule for finding the total number of possible outcomes

Topic Resources:	
Knowledge Map:	Statistics – ungrouped data
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
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	AQA Revision Guide

Scheme of Learning: Year 8 Spring Term

Topic Sequence: Algebraic Techniques

7	8	9
Brackets, Equations and Inequalities	**Sequences**	**Indices**

Topic Overview:

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 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.

Learning Sequence:

Form algebraic expressions This step revises the basic algebraic notation students have met in Year 7. Students may need reminding that × and ÷ signs should not appear in algebraic expressions, numbers are written before letters and that, for example aa is written a^2. Students could revisit the use of function machines and explore the use of algebraic expression within any other area that needs revising, for example probability.

Use directed number with algebra: This step revisits the use of directed number and substitution into algebraic expressions, both of which were covered in Year 7, in preparation for the more complex expressions coming up later in this block. Double-sided counters are very helpful to support understanding of the four operations with directed numbers. Entering negative numbers on a calculator in not always obvious and may need modelling by the teacher.

Multiply out a single bracket: It is useful to represent the expansion of brackets in many forms making links to number work in particular through the use of the area model. As well as including all combinations of **+** and **–** signs, examples should include those where the multiplier is a constant, for example just 5, a variable, for example just x or more complex, for example $3a$. Examples involving more than two terms inside the bracket are also useful to include.

Factorise into a single bracket; Students do not always link factorising expressions with looking for factors of numbers, so it is useful to be explicit about the similarities. This helps to reinforce the language of common factor and highest common factor, and these topics could be revisited during starters. When factorising into a single bracket, again using a variety of signs and types of terms (numerical, algebraic) is useful.

Expand multiple single brackeys and simplify: Students often only expand and simplify expressions of the form $3(x \pm 4) \pm 4(x \pm 5)$ and make errors with shorter expressions like $3 \pm 4(x \pm 5)$. Using concrete manipulatives to "build" the expressions is a useful way of developing understanding of the difference between similar looking expressions. Careful choice of numbers in examples and exercises, and varying numbers and signs is also helpful.

Solve equations, including with brackets: Solving one-step and two-step equations should be secure before moving on to working with equations with brackets. "Think of a number" problems are a good introduction, but students should also deal with equations with non-integer solutions (using a calculator when necessary) to avoid reliance on "spotting" solutions.

Form and solve equations with brackets: "Think of a number" problems and flowcharts are good models to support students to distinguish between, for example $2x + 3$ and $2(x + 3)$. It is worth investing class time developing students' skills in forming equations as the mechanics of solving can be more easily practised as homework. It is also useful to interleave other topics here, for example forming equations to find missing angles on a straight line, missing probabilities, etc.

Understand and solve simple inequalities: Students will be familiar with the inequality signs from earlier work on comparison, but solving inequalities and the idea of a solution set (as opposed to a single value) will be new to most. It is worth discussing that, for example $x > 7$ and $7 < x$ mean the same; reading the inequalities aloud is helpful in determining meaning. Students sometimes replace the given sign with an equals sign; this is error-prone and should be discouraged.

Form and solve inequalities: Teacher modelling is again important here, as students often find forming equations/inequalities from given information difficult; class time can be spent just forming the inequalities with the solving left to later in the lesson and/or homework. Consideration needs to be given as to whether the full solution set or only particular integers are required. It is also worth discussing which values could be chosen to test whether the solution set is correct.

Identify and use formulae, expressions, identities and equations: In this step, students have the opportunity to practice distinguishing between expressions, equations, formulas (or formulae) and identities. It is particularly important that students know that an identity is true for all values of the variable(s) and includes the symbol ≡, whereas an equation can be solved to find particular values. A formula is distinguished from an equation as it can be used to find particular values of the subject.

Sequence of Learning:

1	Form algebraic expressions
2	Use directed number with algebra
3	Multiply out a single bracket
4	Factorise into a single bracket
5	Expand multiple single brackets and simplify
6	Solve equations, including with brackets
7	Form and solve equations with brackets
8	Understand and solve simple inequalities
9	Form and solve inequalities
10	Identify and use formulae, expressions, identities and equations

Topic Resources:

Knowledge Maps:	Notation and manipulation Inequalities Solving linear equations

Assessment:

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 8 Spring Term

Topic Sequence: Algebraic Techniques

7	8	9
Brackets, Equations and Inequalities	**Sequences**	Indices

Topic Overview:

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.

Learning Sequence:

Generate sequences given a rule in words

Building on from Year 7, students revisit the idea of forming a sequence given a rule in words. They should now be able to deal with more complex multi-step rules, and operations such as cubing and rooting. This step is a good chance to revisit the vocabulary of sequences, and students should also be able to use correct language to fully describe a given simple sequence. Exploring Fibonacci sequences is worthwhile.

Generate sequences given a simple algebraic rule

As well as providing practice in substitution, this step provides plenty of opportunity for students to develop their reasoning. They can observe the behaviour of the linear sequences in preparation for the later higher step of finding the rule, and solve equations to determine whether a number is a term in a sequence or not by considering if the solutions are integers. Similarly, they could also practice forming and solving inequalities.

Generate sequences given a complex algebraic rule

Students explored simple algebraic sequences in Year 7. They have since looked at more complex expressions involving squares, cubes and brackets in much more detail and so this step allows them to practice their substitution skills in the context of sequences; they may need reminders as to the behaviour of directed number.

Sequence of Learning:

1	Generate sequences given a rule in words
2	Generate sequences given a simple algebraic rule
3	Generate sequences given a complex algebraic rule

Topic Resources:

Knowledge Maps:	Sequences

Assessment:

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
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Scheme of Learning: Year 8 Spring Term

Topic Sequence: Algebraic Techniques

7	8	9
Brackets, Equations and Inequalities	**Sequences**	**Indices**

Topic Overview:

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, for example $3x^2y \times 5xy^3$. The higher strand also looks at finding powers of powers.

Learning Sequence:

Adding and subtracting expressions with indices
Students sometimes mix up adding and subtracting when dealing with expressions involving indices; this step is to clarify the need for like terms in order to be able to add and subtract terms. Students may need reminding of the word "coefficient" and the convention that we don't usually use 1 as a coefficient. Using manipulatives helps to explain why, for example $2x^2 + 3x^2 \equiv 5x^2$ rather than $5x^4$.

Simplifying algebraic expressions by multiplying indices
Students should already be aware of the conventions for simplifying expressions like $3 \times a$, $b \times 4$ and $c \times c$ from their work in Year 7; this step builds on this to include terms with more than one letter and several letters/numbers by considering the factors of each term. The formal rules of indices are dealt with later in this block, but within this step students should deal with squares, cubes and their products.

Simplifying algebraic expressions by dividing indices
This step will reinforce students' understanding of algebraic notation, particularly the use of fractional form to represent division. This is helpful here as the fractional form can help students identify the common factors more easily, and links to writing fractions in simplest form. Students may need to be reminded that it is expected to give answers in the form, for example $\frac{y}{2}$ rather than involving decimals such as $0.5y$.

Using the addition law for indices
Through experimentation, students usually quickly see that multiplying terms of the form a^m and a^n gives the result a^{m+n}. Nonetheless, the sight of a multiplication sign often results in errors like $2^6 \times 2^2 = 2^{12}$ and it is helpful to include and discuss examples like this, and also noting the rule does not apply to different bases, for example $2^3 \times 3^4 \neq 6^7$. Likewise, the convention of writing x rather than x^1 can result in errors.

Using the addition and subtraction law for indices
This step develops from the last, illustrating that dividing expressions of the form a^m and a^n gives the result a^{m-n}. Common errors include not realising that a is the same as a^1 and mistakenly treating the exponent as a 0. It is worth noting the difference between writing, for example $6^5 \div 6^3$ as a single power and evaluating the result of $6^5 \div 6^3$. It is useful to mix up questions to include ×, ÷ and both operations.

Sequence of Learning:

1	Adding and subtracting expressions with indices
2	Simplifying algebraic expressions by multiplying indices
3	Simplifying algebraic expressions by dividing indices
4	Using the addition law for indices
5	Using the addition and subtraction law for indices

Topic Resources:

Knowledge Maps:	Index numbers Surds Algebraic Notation and manipulation

Assessment:

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
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Scheme of Learning: Year 8 Spring Term

Topic Sequence: Developing Number

10	11	12
Fractions and Percentages	**Standard Index Form**	**Number Sense**

Topic Overview: 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.

Lesson Sequence:

Convert fluently between key fractions, decimals and percentages
This revises year 7 work on mental conversion of key fractions, decimals and percentages. Use of diagrams such as the 100 square, and number lines to compare these will help to secure understanding. Students should be confident in articulating their methods and using them to compare different forms **Calculate key fractions, decimals and percentages of an amount without a calculator**
Students will have visited finding fractions and percentages of amounts during year 7. This step will provide a further opportunity to consolidate their understanding and revisit key ideas and supporting diagrams such as the bar model. Decimal multiplication can sometimes cause confusion, but using their knowledge of conversions and starting with 0.1 × ⋯ = ⋯ ÷ 10 and building from this is helpful.
Calculate fractions, decimals and percentages of an amount using calculator methods
Teachers model the use of calculators so students gain awareness of efficient methods and using estimation before calculating. When solving problems, students will have access to a calculator but may still need access to supporting tools, such as the bar model, to complement their understanding.
Convert between decimals and percentages greater than 100%
Students should already be fluent in converting between decimals and percentages up to 100% and now explore the equivalence of percentages above 100%. This will support later use of multipliers for percentage increase.
Percentage decrease with a multiplier
For percentage decrease, students will need to understand that they are subtracting the given percentage from 100%. This concept will be represented using bar models and number lines to help reinforce how to find the correct multiplier.
Calculate percentage increase and decrease using a multiplier
Students build on the last two steps using multipliers above one to increase an amount by a given percentage. Similarities and differences between percentage increase and decrease will be discussed and mixed questions will be given so that students are thinking carefully rather than just using a procedure.
Express one number as a fraction or a percentage of another without a calculator
As a first step on the way to expressing one number as a percentage of another, students will firstly explore writing one number as a fraction of another. In this step, the focus will be to support students to express fractions as percentages where the fraction denominators are factors or multiples of 100. Links will be made to probability and simple conversions.
Express one number as a fraction or a percentage of another using calculator
Building on from the previous step, students are asked to consider a number as a percentage of another both from fractions that can be converted mentally and those that are best converted using a calculator.
Work with percentage change
Students continue to express one number as a percentage of another, this time in the context of change. Good contexts to consider include percentage profit and loss and interest to remind students of these words. Students will look at situations that can be worked out using both calculator and non-calculator methods allowing them to choose the most appropriate method.
Choose appropriate methods to solve percentage problems
Skills gained from the previous lessons will be applied to various percentage problems. Students will analyse and discuss what questions are being asked and how to choose methods.
Find the original amount given the percentage less than 100% (H)
Bar models are a useful model as they show both the reduction and the remainder providing a strong visual clue as to how to find the original.
Find the original amount given the percentage greater than 100% (H)
Emphasis will be placed on adding the percentage increase to 100%. This will enable students to understand what percentage the value they are given represents.
Choose appropriate methods to solve complex percentage problems (H)
A variety of situations including the 'reverse' percentage questions just studied mixed with percentage increase, decrease, finding a percentage and expressing as a percentage.

Sequence of Lessons:

1	Convert fluently between key fractions, decimals and percentages
2	Calculate key fractions, decimals and percentages of an amount without a calculator
3	Calculate fractions, decimals and percentages of an amount using calculator methods
4	Convert between decimals and percentages greater than 100%
5	Percentage decrease with a multiplier
6	Calculate percentage increase and decrease using a multiplier
7	Express one number as a fraction or a percentage of another without a calculator
8	Express one number as a fraction or a percentage of another using calculator method
9	Work with percentage change
10	Choose appropriate methods to solve percentage problems
11	Find the original amount given the percentage less than 100% (H)
12	Find the original amount given the percentage greater than 100% (H)
13	Choose appropriate methods to solve complex percentage problems (H)

Topic Resources:

Knowledge Map:	Fractions Percentages FDP conversion

Assessment:

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 8 Spring Term

Topic Sequence: Developing Number

10	11	12
Fractions and Percentages	**Standard Index Form**	Number Sense

Topic Overview: Standard Index Form

Students have already briefly looks at standard form in Year 7 and now this knowledge is introduced in more detail, 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

Lesson Sequence:

Investigate positive powers of 10
Using experimentation students will explore powers of ten. This recaps and builds on students' understanding from the indices unit and work from year 7.

Work with numbers greater than 1 in standard form
Students will now write large numbers in standard form. Students should be exposed to correct examples in the form $A \times 10^n$ where A is a number between 1 and 10 and n is an integer. It is important to look at how standard form works rather than just counting zeros.

Investigate negative powers of 10
During this step students will look at decreasing powers of ten then investigate what happens if you get to 1 and below. Time should be spent discussing and also investigating 10^0 and explore misconceptions such as $10^0 = 0$ and $10^{-2} = -100$ .Students should also be confident working between standard form, decimals and fraction equivalences.

Work with numbers between 0 and 1 in standard form
Once negative powers are understood, students can explore the patterns and connections between decimal numbers and standard form.

Compare and order numbers in standard form
Students will order numbers given in words, standard form and ordinary form. Strategies for comparing numbers, such as considering the exponent of 10 as an initial check should be discussed.

Mentally calculate with numbers in standard form
Using simple numbers, students will complete mental calculations where one number in standard form is multiplied or divided by an integer. The result may no longer be in standard form.

Add and subtract numbers in standard form
Students will compare strategies for addition and subtraction without a calculator. There is a risk of just adding the numbers and adding the powers separately and students may prefer to always convert to ordinary numbers.

Multiply and divide numbers in standard form
Students will explore the use of commutativity to multiply and divide numbers given in standard form. Their earlier work on indices and dealing with answers like 30×10^7 should have prepared them for this step.

Use a calculator to work with numbers in standard form
All four operations will be explored, and students can further their knowledge of calculators to use the memory and exponent functions. Alternative methods to the answer to the same question could be shown on the calculator, such as using the fraction button for division.

Understand and use negative indices
Students will build on their understanding of negative powers of 10 to explore negative indices generally.

Understand and use fractional indices
Here students will begin working with fractional indices, finding the square roots and the cube roots of numbers.

Sequence of Lessons:	
1	Investigate positive powers of 10
2	Work with numbers greater than 1 in standard form
3	Investigate negative powers of 10
4	Work with numbers between 0 and 1 in standard form
5	Compare and order numbers in standard form
6	Mentally calculate with numbers in standard form
7	Add and subtract numbers in standard form
8	Multiply and divide numbers in standard form
9	Use a calculator to work with numbers in standard form
10	Understand and use negative indices
11	Understand and use fractional indices

Topic Resources:	
Knowledge Map:	Index Numbers Standard Form
Assessment:	
Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment
Supportive Reading:	
Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide

Scheme of Learning: Year 8 Spring Term

Topic Sequence: Developing Number

10	11	12
Fractions and Percentages	Standard Index Form	Number Sense

Topic Overview: Number Sense

Estimation is a key focus here 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 1 000 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.

Lesson Sequence:

Round numbers to powers of 10, and 1 significant figure.
This is revision of KS2 and Year 7 content. Use of number lines and discussion of degree accuracy will take place.

Round numbers to a given number of decimal places
Students may need reminding of the similarities and differences between rounding to decimal places and rounding to significant figures.

Estimate the answer to a calculation
Students will learn to find the estimate to a calculation by rounding the numbers to 1 significant figure and performing the calculation on the simpler numbers obtained..

Understand and use error interval notation (H)
This Higher strand step builds on the inequality notation covered earlier in the year to formally represent the upper and lower bounds of a single number that has been rounded to a given degree of accuracy.

Calculate using the order of operations
KS2 and Year 7 content is built on to look at the order of operations in increasingly complex situations. It is useful to include formats involving fraction lines to represent division. Examples including roots as well as powers may be included. Comparing answers with those obtained from calculators is useful for both developing use of calculator skills as well as checking.

Calculate with money
This step provides a good opportunity to revisit other topics such as percentages, fractions and ratio in the context of money, and to maintain fluency with non-calculator methods as dependent on the needs of the class. Interpreting calculator displays will also be checked. It is a good opportunity to remind students of the vocabulary of financial mathematics

Convert metric measures of length
This small step reviews and extends Year 7 content to look at more complex conversions. It provides a good context in which to revisit area formulae to help cement these in students' minds, and to look again at multiplication and division by powers of ten. It is useful to make connections with the prefixes kilo, milli etc. also used in the next step.

Convert metric units of weight and capacity
This step emphasises the connections between conversions of all the metric units to establish the consistency of meaning of milli- kilo- etc. As well as performing the calculations, there is opportunity to discuss which unit is suitable to measure which item as many students may not be aware of this and see the activity as purely abstract.

Convert metric units of area (H)
It is worth explicitly challenging the misconception that as 1 cm = 10 mm then 1 cm^2 = 10 mm^2 .

Convert metric units of volume (H)
Volume has not yet been explicitly covered in KS3, but students following the Higher strand should be familiar with units of volume from KS2 and should also be confident in finding the volume of a cuboid. The large numbers created by volume conversion are a useful context on which to revisit numbers expressed in standard form.

Solve problems involving time and the calendar
This topic is often regarded as 'common knowledge' but without explicit teaching/reminding, students are often prone to errors. The use of an 'empty number line' to model calculating time differences is very helpful, emphasising that time is not a decimal quantity.

Sequence of Lessons:

1	Round numbers to powers of 10, and 1 significant figure
2	Round numbers to a given number of decimal places
3	Estimate the answer to a calculation
4	Understand and use error interval notation (H)
5	Calculate using the order of operations
6	Calculate with money
7	Convert metric measures of length
8	Convert metric units of weight and capacity
9	Convert metric units of area
10	Convert metric units of volume (H)
11	Solve problems involving time and the calendar (H)

Topic Resources:

Knowledge Map:	The Knowledge Map title should be here	**Any other Resources:**	Any other resources needed should be here

Assessment:

Knowledge:	End of Topic test
Application of Knowledge:	Termly mixed topic assessment

Supportive Reading:

Any supported reading listed here	Sparx Maths www.sparxmaths.co.uk
	Corbett Maths : www.corbettmaths.com
	AQA Revision Guide