Maths department

Programme of study for New GCSE—Year 7 (2020-2021)

Wk1 31-4 Sept	**Wk2 7-11 Sept**	**Wk3 14-18 Sept**	**Wk4 21-25 Sept**	**Wk5 28-2 Oct**	**Wk6 5-9 Oct**	**Wk7 12-16 Oct**	**Wk8 19-23 Oct**	**26-30 Oct**	**Wk 9 2-6 Nov**
Number Skills			Expressions and functions			Revision/Assessment		Half term	Analysing and
Wk10 9-13 Nov	**Wk11 16-20 Nov**	**Wk12 23-27 Nov**	**Wk13 30-4 Dec**	**Wk14 7-11 Dec**	**Wk15 14-18 Dec**	**21-25 Dec**	**28-1 Dec**	**Wk16 4-8 Jan**	**Wk17 11-15 Jan**
Displaying data	Decimals and measure			Revision/assessment		Christmas holiday		Fractions and percentages	
Wk18 18-22 Jan	**Wk19 25-29 Feb**	**Wk20 1-5 Feb**	**Wk21 8-12 Feb**	**15-19 Feb**	**Wk22 22-26 Feb**	**Wk23 1-5 Mar**	**Wk24 8-12 Mar**	**Wk25 15-19 Mar**	**Wk26 22-26 Mar**
Fractions and percentages	Probability		Revision/ assessment	Half term	Ratio and proportion			Lines and angles	
Wk27 29-1 Apr	**1-19 April**		**Wk28 19-23 Apr**	**Wk29 26-30 Apr**	**Wk30 3-7 May**	**Wk31 10-14 May**	**Wk32 17-21 May**	**Wk33 24-28 May**	**31-4 June**
Revision/ assessment	Easter holiday		Sequences and graphs			Transformations		Revision/ assessment	Half term
Wk34 7-11 Jun	**Wk35 14-18 Jun**	**Wk36 21-25 Jun**	**Wk37 28-2 Jul**	**Wk38 5-9 Jul**	**Wk39 12-16 Jul**	**Wk40 19-23 Jul**			
Data project	Reasoning		Revision/Assessment						

Term	Unit/lesson	Hours	GCSE spec	Support (Pi)	Core (Theta)	Depth (Delta)	Misconceptions
Autumn	**1 Number** **1.1 Mental maths**		N1-6, N13-16	1. Use multiplication facts and arithmetic laws to do mental division/multiplications 2. Multiply and divide by 10, 100 and 1000 3. Use the priority of operations	1. Know and use priority of operations 2. Recall multiplication facts and use laws of arithmetic to mentally multiply and divide 3. Multiply by multiples of 10, 100 and 1000	1. Understand how multiplying by 10, 100 and 1000 and how it relates to out place value system and why this means we have a decimal system	**Partitioning** splits the bigger number to make some easier multiplications. You must use the **priority of operations**. Use **BIDMAS**: - +/- work left to right
	1.2 Addition and subtraction			1. Use written methods to add and subtract whole numbers 2. Round to the nearest 10, 100 and 1000	1. Round whole numbers to nearest 10000, 100000, 1000000 2. Use estimation and inverse operation to check calculations 3. Add and subtract whole numbers using written method	1. Understand inverse operations	Students often read column calculations from left to right.
	1.3 Multiplication			1. Use a written method to multiply whole numbers	1. Multiply whole numbers using written method 2. Use estimation to check answers	1. Know what is is to multiply; grid method/long multiplication compared to illustrate same answer	Problems with place value can cause difficulties with written work.
	1.4 Division			1. Use written method to divide whole num-bers	1. Divide whole numbers using a written method 2. Use estimation to check answers	1. Know what it means if a division calculation has a remainder	1. Students often neglect to preserve place value in the answer 2. Students often fail to understand the process of
	1.6 Negative numbers			1. Order positive and negative numbers 2. Add and subtract positive and negative numbers	1. Order positive and negative numbers 2. Add and subtract positive and negative numbers 3. Multiply/divide with negatives	1. Understand what negative numbers are and how they behave	Students often assume the absolute value when comparing or ordering negative numbers.
	1.7 Factors, multiples and primes			1. Find multiples and LCM 2. Find factor pairs and HCF of two numbers 3. Recognise prime numbers	1. Find multiples and LCM 2. Find factor pairs and HCF of two numbers 3. Recognise prime numbers	1. Connect remainders to factors and multiples	1. Students often fail to find all the factors of a num-ber 2. Students often think that 1 is a prime number and that 2 is not.
	1.8 Square numbers			1. Recognise square numbers 2. Use calculator to find square numbers and roots 3. Use the priority of operations including powers	1. Recognise square numbers 2. Use calculator to find square numbers and roots 3. Use the priority of operations including powers + use index form	1. Some square roots give decimals—DON'T go into surds	1. Students often think that $\sqrt{n} = \frac{n}{2}$. 2. Students often make errors with the order of operations

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Autumn	**3 Expressions, functions and formulae** **3.1 Functions**		A1 - 4, A7	1. Find outputs of simple functions written in words and using symbols	1. Find outputs of simple functions written in words and using symbols 2. Describe simple functions in words	1. Understand that a function is a relationship that maps one set of numbers on to another, with each input mapping to exactly one output, and with the maths they know so far, it can use any of the four operations is important.	Students sometimes decide what an unknown function is based on only one set of input and output values
	3.2 Simplifying expressions			1. Simplify linear algebraic expressions by collecting lie terms	1. Simplify linear algebraic expressions by collecting lie terms 2. Use letters to represent unknowns in algebraic expressions	1. Know what an unknown is, how you can use any letter to represent an unknown number or quantity, and that as they represent numbers, you can add, subtract them in the same way as you do numbers	Students may write $5x - 4x = 1x$. Although it is not incorrect, explain to students that it is not necessary to write the 1.
	3.3 Simplifying expressions 2			1. Multiply and divide algebraic terms 2. Use brackets with numbers and letters	1. Use brackets with numbers and letters 2. Multiply and divide algebraic terms	1. Know what an unknown is, how you can use any letter to represent an unknown number or quantity, and that as they represent numbers, you can add, subtract them in the same way as you do numbers—including multiplying and dividing 2. Understand that algebra uses the same arithmetic rules as number	1. Students often combine unlike terms, e.g. $2p + 3r = 5pr$ 2. When expanding brackets, students often multiply only the first term in the bracket by the number outside the bracket, e.g. $4(x + 2) = 4x + 2$
	3.4 Writing expressions			1. Write expressions from word descriptions using addition, subtraction, multiplication and division 2. Write expressions to represent function machines	1. Write expressions from word descriptions using addition, subtraction, multiplication and division 2. Write expressions to represent function machines	1. Begin to understand that an algebraic expression can represent a rule, and that writing an algebraic expression may be easier than explaining a rule in words, and easier for the reader to understand	When writing expressions, students often write subtractions the wrong way round, e.g. writing 3 less than x as $3 - x$.
	3.5 Substituting into formulae			1. Substitute positive integers into simple formulae written in words 2. Substitute positive integers into formulae written in letters	1. Substitute positive integers into simple formulae written in words 2. Substitute positive integers into formulae written in letters	1. Understand that letters are called variables because they can change or vary, but the relationship between them given by the formulae will always remain the same	Students often substitute incorrectly into a formula. For example, $v = at$ when $a = 5$ and $t = 6$, simply writing $v = 56$.
	3.6 Writing formulae			1. Write simple formulae in words 2. Write simple formulae using letter symbols	1. Write simple formulae in words 2. Write simple formulae using letter symbols 3. Identify functions and formulae 4. Identify the unknowns in a formula and a function	1. Understand that a formula can be seen a s a rule that tells you how to do a calculation or how to work out the number of something, and writing it in algebra can save time	Students often do not write a formula in its simplest form, e.g. writing $p = 5 \times t$

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Autumn	**2 Analysing and displaying data** **2.1 Mode, median and range**		S2, S4	1. Find the mode of a data set, numerical and non-numerical 2. Find the median from an odd and even number of values 3. Find the range of a data set	1. Find the mode of a data set, numerical and non-numerical 2. Find the median from an odd and even number of values 3. Find the range of a data set	1. Understand what an average is a measure of and what it does/does not represent	1. Students forgetting to order data before finding median
	2.2 Displaying data			1. Read and draw pictograms/bar charts/ line graphs 2. Read and construct tally charts and frequency tables 3. Find mode and range from a chart or table	1. Read and draw pictograms/bar charts/ line graphs 2. Read and construct tally charts and frequency tables 3. Find mode and range from a chart or table	1. Understand how to chose the best representation for different data sets	1. Students often read frequencies as values and vice-versa in a table where 'frequency' is not labelled 2. Students often confuse frequency and mode, giving the frequency of the highest bar rather than the mode.
	2.3 Grouping data			1. Read and construct grouped tally charts and frequency tables 2. Read and construct grouped bar charts for discrete and continuous data 3. Find modal class from frequency table	1. Read and construct grouped tally charts and frequency tables 2. Read and construct grouped bar charts for discrete and continuous data 3. Find modal class from bar chart or frequency table	1. Understand different averages and what the represent	1. Students often do not understand they need to add individual frequencies to work out the number of people in a survey
	2.4 Averages and comparing data			1. Calculate mean, median, mode and range of a set of values 2. Compare two sets of data using an average or the range	1. Calculate mean, median, mode and range of a set of values 2. Compare two sets of data using an average or the range	1. Understand averages and what they represent 2. Understand how to use the range to compare data 3. Understand which average is most	1. Students often confuse the different types of average – mode, median and mean. 2. Students often do not understand the need to use context when comparing data sets.
	2.5 Line graphs and more bar charts			1. Read and draw a line graph 2. Read and draw a dual bar chart 3. Read and draw a compound bar chart	1. Read and draw a line graph 2. Read and draw a dual bar chart 3. Read and draw a compound bar chart	1. Understand how to chose the best representation for different types of data	1. Students often think that every value on a line in a line graph has meaning. 2. Students may use a dot rather than a cross to mark a point.

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Autumn	**4 Decimals and measures** **4.1 Decimals and rounding**		N1, N2, N13, N15, R1, R2, G14, G15, G16	1. Measure and draw lines to the nearest millimetre 2. Write decimals in order of size 3. Round decimals to the nearest whole number	1. Measure and draw lines to the nearest millimetre 2. Write decimals in order of size 3. Round decimals to the nearest whole number and to 1 decimal place 4. Round decimals to make estimates of calculations	1. Understand how to choose suitable numbers to round to when estimating an answer to a calculation (and this is not always rounding up or down to the nearest whole number)	1. Students often do not measure from 0 on a ruler. 2. Students often make errors with comparing and ordering numbers with different numbers of decimal places
	4.2 Length, mass and capacity			1. Multiply and divide by 10, 100 and 1000 2. Convert between metric units of length, mass and capacity	1. Multiply and divide by 10, 100 and 1000 2. Compare measurements by converting to the same units 3. Solve simple problems involving units of measure 4. Convert between metric units of length, mass and capacity	1.Understand how all units in the metric system are multiples/divisors of 'base' units and explore relationships 2. Understand how decimal parts relate to each other	Students often use the wrong operation (´10 instead of ÷10) when converting between units.
	4.3 Scales and measures			1. Read scales 2. Use scale diagrams	1. Use scale diagrams 2. Read scales on a range of measuring equipment 3. Write decimal measures as two related units of measures 4. Interpret metric measures displayed on a calculator	1. Understand how different scales enable different levels of accuracy 2. Understand why reading decimal fractions of metric measures on a calculator is easier than decimal fractions of measures of time	Students often misinterpret the divisions on a scale. Use a pictorial approach to address this.
	4.4 Working with decimals mentally			1. Multiply decimals by multiples of 10 and 100 2. Multiply decimals mentally 3. Understand where to position the decimal point by considering equivalent calculations	1. Multiply decimals by 10, 100 and 1000 2. Multiply decimals mentally 3. Check a result by considering whether it is of the right order of magnitude 4. Understand where to position the decimal point by considering equivalent calculations	1.Explore patterns in place value multiplication decimal calculations 2. Understand the inverse operations of multiplication and division in relation to place value decimal calculations	Students often make errors identifying the number of decimal places when multiplying. Encourage students to estimate calculations first.
	4.5 Working with decimals			1. Add and subtract decimals 2. Multiply and divide decimals	1. Add and subtract decimals 2. Multiply and divide decimals by single digit whole numbers 3. Divide numbers that give decimal answers	1. Understand when is the most appropriate time to use a written or a mental method of calculation	1. Students often fail to line up decimal points when adding or subtracting. 2. Students often do not use estimation to check the results of multiplication

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Autumn	**4.6 Perimeter**		N1, N2, N13, N15, R1, R2, G14, G15, G16	1. Work out perimeter of squares, rectangles and regular polygons 2. Calculate perimeter of shapes made from rectangles	1. Work out the perimeter of composite shapes and polygons 2. Solve perimeter problems	1. Understand how to deduce formulae for perimeters of different shapes	1. Students often use the wrong calculation for perimeter and area 2. Students often do not collect terms accurately when using algebraic expressions.
	4.7 Area			1. Find area of shapes by counting squares 2. Find the area of rectangles and squares 3. Calculate the area of shapes made from rectangles	1. Find area of irregular shapes by counting squares 2. Calculate the areas of shapes made from rectangles 3. Solve problems involving area	1. Understand that shapes can have the same area, but different perimeters; and shapes can have the same perimeter but different areas 2. Know why area is measured in square units, and length/perimeter is measured in linear units	1. Students sometimes multiply by 2 when squaring. 2. Students often do not know or recognise square roots of square numbers
	4.8 More units of measure			1. Choose suitable units to measure area 2. Use units of measure to solve problems 3. Use metric and imperial units	1. Choose suitable units to estimate length and area 2. Use units of measure to solve problems 3. Use metric and imperial units	1. Understand that to compare measures in different units, they must all be converted to the same unit 2. Understand how to make choices about which unit to convert measures to	Students often do not understand the relationship between metric and imperial units.

	1.5 Money and time			1. Round to the nearest pound or penny 2. Use calculator to solve problems about time/money	1. Round to nearest whole pound or penny 2. Interpret calculator display in different contexts 3. Solve problems involving money and time	1. Understand how multiplying by 10, 100 and 1000 and how it relates to out place value system and why this means we have a decimal system related to money	1. Students often interpret a calculator display incorrectly, either reading 3.5 as 'three pounds and five pence' 2. seeing 3.40 as 3 hours 40 minutes.

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Spring	**5 Fractions and percentages** **5.1** **Comparing fractions**	1	N2, N8, N10, N12, R3, R9	1. Use fraction notation to describe parts of a shape 2. Compare simple fractions	1. Use fraction notation to describe parts of a shape 2. Compare simple fractions 3. Use a diagram to compare two or more simple fractions 4. Order fractions	1. Know that, for unit fractions, the larger the denominator, the smaller the value of the fractions	1. When working out the fraction shaded, students often give an answer of number shaded (as the numerator) and number unshaded (as the denominator), 2. When comparing unit fractions, students assume that the fraction with the bigger denominator is the bigger fraction
	5.2 **Simplifying fractions**	1		1. Change an improper fraction to a mixed number 2. Identify equivalent fractions 3. Simplify fractions by dividing numerator and denominator by common factors	1. Change an improper fraction to a mixed number 2. Identify equivalent fractions 3. Simplify fractions by dividing numerator and denominator by common factors	1. Understand that simplifying fractions can make them easier to visualise	Students often write mixed numbers incorrectly. For example, writing $\frac{5}{3}$ as $1\frac{1}{2}$ (because 5 ÷ 3 = 1 r 2).
	5.3 **Working with fractions**	2		1. Add and subtract simple fractions 2. Calculate simple fractions of an amount	1. Add and subtract simple fractions 2. Calculate simple fractions of an amount	1. Understand inverse operations relating to fractions	When adding fractions, students often add the denominators as well as add the numerators
	5.4 **Fractions and decimals**	1		1. Work with equivalent fractions and decimals 2. Write one quantity as a fraction of another	1. Work with equivalent fractions and decimals 2. Write one quantity as a fraction of an-	1. Understand that all 1, 2 and 3place decimals are also fractions	Students often do not use the total as the denominator when writing one number as a fraction of another.
	5.5 **Understanding percentages**	1		1. Understand percentage as 'the number of parts per 100' 2. Convert a percentage to a fraction or a decimal	1. Understand percentage as 'the number of parts per 100' 2. Convert a percentage to a fraction or a decimal 3. Work with equivalent percentages,	1. Understand when it's easier to compare proportions using fractions, decimals or percentages	1. Students often write 0.8 as 8% or similar
	5.6 **Percentages of amounts**	1		1. Calculate percentages	1. Use different strategies to calculate with percentages 2. Express one quantity as a percentage of another	1. . Working with fractions and percentages that are >1 and what this means	Students think that, because you divide by 10 when finding 10%, therefore you divide by 20 when finding 20%.

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Spring	**6. Probability** **6.1 The language of probability**	1	P2, P3, P4	1. Use the language of probability 2. Use a probability scale with words 3. Understand the probability scale from 0 to 1	1. Use the language of probability 2. Use a probability scale with words 3. Understand the probability scale from 0 to 1	1. 'Unlikely' and 'likely' have precise meetings in probability than everyday language 2. Assigning numerical values to probabilities can help us compare them more accurately	Students may confuse equally likely with even chance.
	6.2 Calculating probability	1		1. Identify outcomes of an event 2. Calculate probabilities	1. Identify outcomes of an event 2. Calculate probability based on equally likely outcomes 3. Use probability scale from 0 to 1	1. Know that probability can be represented as a fraction, decimal or a percentage (and how you choose which to use for a given question) 2. There may be n outcomes, but the probability of each is only 1/n if the outcomes are equally likely	1. Students may not include outcomes that appear identical. 2. Students may not understand the difference between an event and an outcome. 3. Students may calculate probability using outcomes that are not equally likely.
	6.3 More probability calculations	1		1. Use probability notation 2. Calculate the probability of an event not happening	1. Calculate more complex probabilities 2. Calculate the probability of an event not happening	1. Understand that when there are outcomes A, B and C, P(A or B) = P(A) + P(B), and that P(A) + P(B) + P© = 1	When answering Depth questions students may count the same outcome twice.
	6.4 Experimental probability	2		1. Estimate probability based on experimental data	1. Record date from a simple experiment 2. Estimate probability based on experimental data 3. Make conclusions based on the results of an experiment	1. Understand that experimental probability is always an estimate , and for some contexts you can only use experimental probability as it is not possible to calculate a theoretical probability 2. Understand why more trials lead to better estimate of probability	Students may feel that estimated/ experimental probability is inferior to 'exact' or theoretical probability based on equally likely outcomes.
	6.5 Expected outcomes	1		1. Use probability to estimate the expected number of outcomes 2. Apply probabilities from simple experimental data in simple situations	1. Use probability to estimate the expected number of outcomes 2. Apply probabilities from simple experimental data in simple situations	1. Understand that if an event has the probability 1/3 then we expect it to happen 1 in 3 times, but that doesn't mean that it will definitely happen 1 in 3 times	When playing a game, students may forget to subtract the entrance fee from the prize. Point out the difference between 'prize' and

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Spring	**7. Ratio and proportion** **7.1 Direct proportion**	2	R3, R4, R5, R7, R8	1. Use direct proportion in simple contexts 2. Solve simple problems involving direct proportion	1. Use direct proportion in simple contexts 2. Solve simple problems involving direct proportion 3. Use the unitary method to solve simple word problems involving direct proportion	1. Understand when scaling/doubling/ halving may be more or less efficient than the unitary method, to solve direct proportion problems 2. Understand that when two quantities are in direct proportion, when one increase the other increases at the same rate	Students sometimes do not find the value of one item first when answering a question that requires the use of the unitary method.
	7.2 Writing ratios	1		1. Use ratio notation 2. Reduce a ratio to its simplest form	1. Use ratio notation 2. Reduce a ratio to its simplest form 3. Reduce a three part ratio to its simplest form by cancelling	1. Understand how to use ratios to make comparisons	1. Students sometimes write a ratio in the wrong order. 2. Students sometimes fail to write a ratio in its simplest form.
	7.3 Using ratios	2		1. Find equivalent ratios 2. Divide a quantity into two parts in a given ratio 3. Solve word problems involving ratios	1. Find equivalent ratios 2. Divide a quantity into two parts in a given ratio 3. Solve word problems involving ratios 4. Use ratios and measures	1. Understand the multiplicative nature of ratio 2. Know the relationship between units of capacity, length and weight	1. When dividing an amount in a ratio, e.g. £12 in the ratio 2 : 3, students sometimes work out 12 ÷ 2 and 12 ÷ 3. 2. Students sometimes assume that questions which involve using a ratio to find one part when the other is known are 'share in a given ratio' questions 3. Students sometimes do not know whether to multiply or divide when converting units.
	7.4 Ratios, proportion and fractions	1		1. Use fractions to describe proportions 2. Understand relationship between ratios and proportions	1. Use fractions to describe proportions 2. Understand and use the relationship between fractions, ratio and proportion	1. Understand the relationship between ratio and proportion 2. Understand that ratio is another way of comparing parts 3.. Understand how this relates to comparing parts when written in fraction form	When changing a ratio to a fraction, students sometimes do not write the total as the denominator, e.g. when given a ratio of boys : girls = 2 : 3, they write $\frac{2}{3}$ are boys.
	7.5 Proportions and percentages	1		1. Use percentages to describe proportions 2. Use percentages to compare simple proportions 3. Understand the relationship between ratio and proportion	1. Use percentages to describe proportions 2. Use percentages to compare simple proportions 3. Understand the relationship between percentages, ratio and proportion	1. Understand that ratio is simply another way of comparing parts, and how this relates to comparing parts in percentage form 2. Understand how to decide when it is better/more efficient to use ratios or proportion to make comparisons	When changing a ratio to a percentage, sometimes students do not write the total as the denominator of the initial fraction.

Term	Unit/lesson 8 Lines and Angles	Hours	GCSE spec	Support (Pi)	Core (Theta)	Depth (Delta)	Misconceptions
Summer	**8.1 Measuring and drawing angles**	2	G1, G3, G4, G15	1. Use a protractor to measure and draw angles	1. Use a protractor to measure and draw angles 2. Recognise acute, reflex and obtuse angles	1. When do you need to measure and when can you just estimate angles 2. Understand the possible types of angles on a straight line, round a poin t, and in shapes 3. Know and understand why a protractor has two scales, and which to use to measure a given angle	1. Students sometimes do not see angle as a measure of turn. 2. Students fail to measure angles correctly with a protractor.
	8.2 Lines, angles and triangles	1		1. Name and label lines, angles and triangles 2. Estimate the size of angles	1. Estimate the size of angles 2. Describe and label the lines, angles and triangles 3. Identify angle and side properties of triangles	1. Understand how to draw a diagram from written instructions 2. Classify triangles using more than one name	1. Students sometimes do not use a protractor incorrectly. 2. Students sometimes assume that all triangles have 3 lines of symmetry.
	8.3 Drawing triangles accurately	2		1. Use a ruler and protractor to draw triangles accurately	1. Use a ruler and protractor to draw triangles accurately	1. Understand you can draw more than one triangle with the same angles and different side lengths (leads into enlargement) 2. Given one side and two angles, understand you can only draw one triangle	Some students are unable to draw accurately.
	8.4 Calculating angles	1		1. Find missing angles on a straight line and around a point 2. Use vertically opposite angles	1. Use rules for angles on a straight line, around a point and vertically opposite angles 2. Solve problems involving angles	1. Understand relationship between angles on a straight line and angles around a point 2. Understand there is no limit to the amount of angles around a point	Students sometimes make simple errors when calculating.
	8.5 Angles in a triangle	1		1. Work out the size of unknown angles in triangles	1. Use the rule for sum of angles in triangles 2. Calculate interior and exterior angles 3. Solve angle problems involving triangles	1. Use angles in triangles to solve problems involving other shapes made up of triangles . 2. Explore the relationship between exterior and interior angles of a triangle	1. Sometimes students do not extend a side to form the exterior angle. 2. Students often do not subtract correctly from 180°.
	8.6 Quadrilaterals	1		1. Identify and name types of quadrilaterals 2. Use the rule for the sum of angles in a quadrilateral 3. Solve angle problems involving quadrilaterals	1. Identify and name types of quadrilaterals 2. Use the rule for the sum of angles in a quadrilateral 3. Solve angle problems involving quadrilaterals	1. Know that the order in which you find angles can make solving a problem more or less efficient 2. Use angles in quadrilaterals to solve problems involving other shapes made up of quadrilaterals	1. Students often to not calculate correctly. 2. Students often fail to remember the names of shapes.

Term	Unit/lesson 9 Sequences and graphs	Hours	GCSE spec	Support (Pi)	Core (Theta)	Depth (Delta)	Misconceptions
Summer	**9.1 Sequences**	1	A8, A9, A23, A24, A25	1. Recognise, describe and continue number sequences 2. Generate terms of a sequence using a one-step term-to-term rule 3. Find missing terms in a sequence	1. Recognise, describe and continue number sequences 2. Generate terms of a sequence using a one-step term-to-term rule 3. Find missing terms in a sequence	1. know that the first term and term-to-term rule together define a sequence. With just one of these, there is an infinite number of sequences that could be generated 2. Understand that an infinite sequence doesn't necessarily tend to +/- infinity. E.g. 1/2, 1/4, 1/8	Sometimes students make basic mistakes when adding and subtracting negative numbers and/or decimals.
	9.2 Pattern sequences	1		1. Find patterns and rules in sequences 2. Describe how a pattern sequence grows	1. Find patterns and rules in sequences 2. Describe how a pattern sequence grows 3. Find the midpoint of a line segment	1. Understand that the first pattern gives the first term, and what is added each time is the term to term rule	Students often do not relate the 'pattern number' to the term number, instead thinking they are the same, or confusing them.
	9.3 Coordinates and midpoints	1		1. Read and plot coordinates 2. Generate and plot coordinates from a rule 3. Find the midpoint of a line segment	1. Generate and plot coordinates from a rule 2. Solve problems and spot patterns in coordinates 3. Find the midpoint of a line segment	1. Recognise that the negative coordinate axes are extensions of the number line in two directions 2. Know and understand that the midpoint is : (the mean of x coordinates , the mean of the y coordinates), just as midpoint of two numbers is the mean of the two numbers	1. Some students confuse *x*- and *y*-coordinates (especially when one or the other is 0). 2. Some students confuse positive and negative coordinates
	9.4 Extending sequences	1		1. Use the term-to-term rule to work out terms in a sequence. 2. Recognise and arithmetic sequence 3. Recognise a geometric sequence	1. Continue and describe special sequences 2. Use the term-to-term rule to work out more terms in the sequence 3. Recognise an arithmetic sequence and a	1. Understand that when you plot an arithmetic sequence, it will always give a straight line. Relate this to 'going up or down in equal size steps' - and this is why we sometimes call them linear sequences	Students sometimes think that any sequence that follows a rule is arithmetic e.g. 2, 4, 8, 16, …
	9.5 Straight-line graphs	2		1. Recognise, name and plot graphs parallel to the axes 2. Recognise, name and plot the graph of y=x 3. Plot straight lines using table of values	1. Recognise, name and plot straight line graphs parallel to the x– or y– axis 2. Recognise, name and plot the graphs of y=x and y=-x 3. Plot straight lines using table of values 4. Draw graphs to represent relationships	1. Understand that the equation of a straight line is a function that generates a y value for every x value, and when you input x = 1, 2, 3, into the function, the y values from an arithmetic sequence	1. Some students think that the graph of $y = a$ is parallel to the *y*-axis, and that $x = b$ is parallel to the *x*-axis. 2. Students sometimes think that when $n = 4$, $3n = 34$. 3. Students don't always draw graphs to the edges of the grid.
	9.6 Position-to-term rules	1		1. Generate terms of a sequence using a position-to-term rule	1. Generate terms of a sequence using position-to-term rule	1. Understand the connection between : nth term, term-to-term rule or common difference and first term (arithmetic sequences only)	Some students confuse position-to-term rule and term-to-term rule, as the same operation could be used in both, e.g. a position-to-term rule could be $5n$ and a 'similar' term-to-term rule could be ´5.

Term	Unit/lesson 10 Transformations	Hours	GCSE spec	Support (Pi)	Core (Theta)	Depth (Delta)	Misconceptions
Spring	**10.1 Congruency and enlargements**	2	G5, G7, G8	1. Identify congruent shapes 2. Enlarge shapes using a given scale factor 3. Work out the scale factor given an object and its image	1. Identify congruent shapes 2. Use the language of enlargement 3. Enlarge shapes using given scale factors 4. Work out the scale factor given to an object and its image	1. Understand the language of 'scale factor' - scale relating to scaling up/ down and multiplicativity; factor relating to one measure being divisible by another (also about multiplicativity) 2. Understand how ratio and enlargements relate to each other (inc side lengths, perimeter and area) 3. Know that enlargements, angles in shapes remain unchanged	1. Some students confuse congruence and similarity or think they are the same. 2. Sometimes students do not understand enlargement as a multiplicative relationship.
	10.2 Symmetry	1		1. Recognise line and rotational symmetry in 2D shapes 2. Identify all the symmetries of 2D shapes 3. Identify reflection symmetry in 3D shapes	1. Recognise line and rotational symmetry in 2D shapes 2. Identify all the symmetries of 2D shapes 3. Identify reflection symmetry in 3D shapes 4. Solve problems using line of symmetry	1. Understand the symmetries of 3D solids and the shapes of their planes of symmetry 2. Understand the relationship between rotational and line symmetry in regular polygons	1. Some students wrongly mark diagonals as lines of symmetry. 2. Some students forget that every shape has rotational symmetry of at least order 1. 3. Students need to be clear about the difference between line of symmetry (reflection symmetry), rotational symmetry, order of rotational symmetry and plane of symmetry.
	10.3 Reflection	2		1. Recognise and carry out reflections in a mirror line 2. Reflect a shape on a co-ordinates grid 3. Find the mirror line for a reflection on a co ordinate grid	1. Recognise and carry out reflections in a mirror line 2. Reflect a shape on a co-ordinates grid 3. Describe a reflection on a co ordinate grid	1. Identify patterns or rules in co ordinates of vertices when a shape is reflected in different straight lines on a coordinate grid	Common misconceptions around reflecting in the line $x = y$ can be addressed by using tracing paper.
	10.4 Rotation	1		1. Draw and describe rotations	1. Describe and carry out rotations on a co ordinate grid	1. Identify patterns/rules in co ordinates of vertices when a shape is rotated by different angles and in different directions on a co ordinate grid	1. Some students neglect to rotate every part of the shape. 2. Sometimes students do not maintain the distance to the centre of rotation.
	10.5 Translations and combined transformations	2		1. Translate 2D shapes 2. Transform 2D shapes by combinations of rotations, reflections and translations	1. Translate 2D shapes 2. Transform 2D shapes by combinations of translations	1. Know that in translation, rotation, reflection, the image is congruent to the object 2. Understand that combined transformations can be equivalent to a single transformation	1. Translation errors usually involve incorrect use of negative numbers or travelling vertically first. 2. Some students think that shapes are only congruent if they have been translated, and not if they have been rotated or reflected.

REFERENCE	STATEMENT FROM EDEXCEL SPECIFICATION FOR GCSE (9-1) MATHEMATICS
Higher tier students will be assessed on all content. Foundation tier students will be assessed on content identified by the standard and underlined type.	
N1	order positive and negative integers, decimals and fractions; use the symbols =, ≠, <, > , ≤, ≥
N2	apply the four operations, including formal written methods, to integers, decimals and simple fractions (proper and improper), and mixed numbers – all both positive and negative; understand and use place value (e.g. when working with very large or very small numbers, and when calculating with decimals)
N3	recognise and use relationships between operations, including inverse operations (e.g. cancellation to simplify calculations and expressions); use conventional notation for priority of operations, including brackets, powers, roots and reciprocals
N4	use the concepts and vocabulary of prime numbers, factors (divisors), multiples, common factors, common multiples, highest common factor, lowest common multiple, prime factorisation, including using product notation and the unique factorisation theorem
N5	apply systematic listing strategies, **including use of the product rule for counting (i.e. if there are m ways of doing one task and for each of these, there are n ways of doing another task, then the total number of ways the two tasks can be done is m × n ways)**
N6	use positive integer powers and associated real roots (square, cube and higher), recognise powers of 2, 3, 4, 5**; estimate powers and roots of any given positive number**
N7	calculate with roots, and with integer **and fractional** indices
N8	calculate exactly with fractions, **surds** and multiples of π; **simplify surd expressions involving squares (e.g. √12 = √(4 × 3) = √4 × √3 = 2√3) and rationalise denominators**
N9	calculate with and interpret standard form $A \times 10^n$, where $1 \leq A < 10$ and n is an integer
N10	work interchangeably with terminating decimals and their corresponding fractions (such as 3.5 and 7/2 or 0.375 or 3/8); **change recurring decimals into their corresponding fractions and vice versa**
N11	identify and work with fractions in ratio problems
N12	interpret fractions and percentages as operators
N13	use standard units of mass, length, time, money and other measures (including standard compound measures) using decimal quantities where appropriate
N14	estimate answers; check calculations using approximation and estimation, including answers obtained using technology
N15	round numbers and measures to an appropriate degree of accuracy (e.g. to a specified number of decimal places or significant figures); use inequality notation to specify simple error intervals due to truncation or rounding

N16	apply and interpret limits of accuracy, **including upper and lower bounds**
A1	use and interpret algebraic manipulation, including: ● ab in place of a × b ● 3y in place of y + y + y and 3 × y ● a^2 in place of a × a, a^3 in place of a × a × a, a^2b in place of a × a × b ● a/b in place of a ÷ b ● coefficients written as fractions rather than as decimals ● brackets
A2	substitute numerical values into formulae and expressions, including scientific formulae
A3	understand and use the concepts and vocabulary of expressions, equations, formulae, identities, inequalities, terms and factors
A4	simplify and manipulate algebraic expressions (including those involving surds **and algebraic fractions**) by: ● collecting like terms ● multiplying a single term over a bracket ● taking out common factors ● expanding products of two **or more** binomials ● factorising quadratic expressions of the form $x^2 + bx + c$, including the difference of two squares; **factorising quadratic expressions of the form $ax^2 + bx + c$** ● simplifying expressions involving sums, products and powers, including the laws of indices
A5	understand and use standard mathematical formulae; rearrange formulae to change the subject
A6	know the difference between an equation and an identity; argue mathematically to show algebraic expressions are equivalent, and use algebra to support and construct arguments **and proofs**
A7	where appropriate, interpret simple expressions as functions with inputs and outputs; ; **interpret the reverse process as the 'inverse function'; interpret the succession of two functions as a 'composite function' (the use of formal function notation is expected)**
A8	work with coordinates in all four quadrants

A9	plot graphs of equations that correspond to straight-line graphs in the coordinate plane; use the form y = mx + c to identify parallel **and perpendicular** lines; find the equation of the line through two given points or through one point with a given gradient
A10	identify and interpret gradients and intercepts of linear functions graphically and algebraically
A11	identify and interpret roots, intercepts, turning points of quadratic functions graphically; deduce roots algebraically **and turning points by completing the square**
A12	recognise, sketch and interpret graphs of linear functions, quadratic functions, simple cubic functions, the reciprocal function $y = 1/x$ with $x \neq 0$, **exponential functions $y = k^x$ for positive values of k, and the trigonometric functions (with arguments in degrees) y = sin x, y = cos x and y = tan x for angles of any size**
A13	**sketch translations and reflections of a given function**
A14	plot and interpret graphs (including reciprocal graphs **and exponential graphs**) and graphs of non-standard functions in real contexts to find approximate solutions to problems such as simple kinematic problems involving distance, speed and acceleration
A15	**calculate or estimate gradients of graphs and areas under graphs (including quadratic and other non-linear graphs), and interpret results in cases such as distance-time graphs, velocity-time graphs and graphs in financial contexts (this does not include calculus)**
A16	**recognise and use the equation of a circle with centre at the origin; find the equation of a tangent to a circle at a given point**
A17	solve linear equations in one unknown algebraically (including those with the unknown on both sides of the equation); find approximate solutions using a graph
A18	solve quadratic equations (**including those that require rearrangement**) algebraically by factorising, **by completing the square and by using the quadratic formula**; find approximate solutions using a graph
A19	solve two simultaneous equations in two variables (linear/linear **or linear/quadratic)** algebraically; find approximate solutions using a graph
A20	**find approximate solutions to equations numerically using iteration**
A21	translate simple situations or procedures into algebraic expressions or formulae; derive an equation (or two simultaneous equations), solve the equation(s) and interpret the solution

A22	solve linear inequalities in one **or two** variable**(s), and quadratic inequalities in one variable;** represent the solution set on a number line, **using set notation and on a graph**
A23	generate terms of a sequence from either a term-to-term or a position-to-term rule
A24	recognise and use sequences of triangular, square and cube numbers, simple arithmetic progressions, Fibonacci type sequences, quadratic sequences, and simple geometric progressions (r^n where n is an integer, and r is a rational number > 0 **or a surd**) **and other sequences**
A25	deduce expressions to calculate the nth term of linear **and quadratic** sequences
R1	change freely between related standard units (e.g. time, length, area, volume/capacity, mass) and compound units (e.g. speed, rates of pay, prices, density, pressure) in numerical and algebraic contexts
R2	use scale factors, scale diagrams and maps
R3	express one quantity as a fraction of another, where the fraction is less than 1 or greater than 1
R4	use ratio notation, including reduction to simplest form
R5	divide a given quantity into two parts in a given part:part or part:whole ratio; express the division of a quantity into two parts as a ratio; apply ratio to real contexts and problems (such as those involving conversion, comparison, scaling, mixing, concentrations)
R6	express a multiplicative relationship betweeb two quantities as a ratio or a fraction
R7	understand and use proportion as equality of ratios
R8	relate ratios to fractions and to linear functions
R9	define percentage as `number of parts per hundred¿; interpret percentages and percentage changes as a fraction or a decimal, and interpret these multiplicatively; express one quantity as a percentage of another; compare two quantities using percentages; work with percentages greater than 100%; solve problems involving percentage change, including percentage increase/decrease and original value problems, and simple interest including in financial mathematics
R10	solve problems involving direct and inverse proportion, including graphical and algebraic representations
R11	use compound units such as speed, rates of pay, unit pricing, density and pressure
R12	compare lengths, areas and volumes using ratio notation; make links to similarity (including trigonometric ratios) and scale factors

R13	understand that X is inversely proportional to Y is equivalent to X is proportional to 1/Y; **construct and** interpret equations that describe direct and inverse proportion
R14	interpret the gradient of a straight line graph as a rate of change; recognise and interpret graphs that illustrate direct and inverse proportion
R15	**interpret the gradient at a point on a curve as the instantaneous rate of change; apply the concepts of average and instantaneous rate of change (gradients of chords and tangents) in numerical, algebraic and graphical contexts (this does not include calculus)**
R16	set up, solve and interpret the answers in growth and decay problems, including compound interest **and work with general iterative processes**
G1	use conventional terms and notation: points, lines, vertices, edges, planes, parallel lines, perpendicular lines, right angles, polygons, regular polygons and polygons with reflection and/or rotation symmetries; use the standard conventions for labelling and referring to the sides and angles of triangles; draw diagrams from written description
G2	use the standard ruler and compass constructions (perpendicular bisector of a line segment, constructing a perpendicular to a given line from/at a given point, bisecting a given angle); use these to construct given figures and solve loci problems; know that the perpendicular distance from a point to a line is the shortest distance to the line
G3	apply the properties of angles at a point, angles at a point on a straight line, vertically opposite angles; understand and use alternate and corresponding angles on parallel lines; derive and use the sum of angles in a triangle (e.g. to deduce and use the angle sum in any polygon, and to derive properties of regular polygons)
G4	derive and apply the properties and definitions of special types of quadrilaterals, including square, rectangle, parallelogram, trapezium, kite and rhombus; and triangles and other plane figures using appropriate language
G5	use the basic congruence criteria for triangles (SSS, SAS, ASA, RHS)
G6	apply angle facts, triangle congruence, similarity and properties of quadrilaterals to conjecture and derive results about angles and sides, including Pythagoras' theorem and the fact that the base angles of an isosceles triangle are equal, and use known results to obtain simple proofs
G7	identify, describe and construct congruent and similar shapes, including on coordinate axes, by considering rotation, reflection, translation and enlargement (including fractional **and negative** scale factors)

G8	**describe the changes and invariance achieved by combinations of rotations, reflections and translations**
G9	identify and apply circle definitions and properties, including: centre, radius, chord, diameter, circumference, tangent, arc, sector and segment
G10	**apply and prove the standard circle theorems concerning angles, radii, tangents and chords, and use them to prove related results**
G11	solve geometrical problems on coordinate axes
G12	identify properties of the faces, surfaces, edges and vertices of: cubes, cuboids, prisms, cylinders, pyramids, cones and spheres
G13	construct and interpret plans and elevations of 3D shapes
G14	use standard units of measure and related concepts (length, area, volume/capacity, mass, time, money, etc.)
G15	measure line segments and angles in geometric figures, including interpreting maps and scale drawings and use of bearings
G16	know and apply formulae to calculate: area of triangles, parallelograms, trapezia; volume of cuboids and other right prisms (including cylinders)
G17	know the formulae: circumference of a circle = $2\pi r = \pi d$, area of a circle = πr^2; calculate: perimeters of 2D shapes, including circles; areas of circles and composite shapes; surface area and volume of spheres, pyramids, cones and composite solids
G18	calculate arc lengths, angles and areas of sectors of circles
G19	apply the concepts of congruence and similarity, including the relationships between lengths, **areas and volumes** in similar figures
G20	know the formulae for: Pythagoras' theorem $a^2 + b^2 = c^2$, and the trigonometric ratios, $\sin\theta$ = opposite/hypotenuse, $\cos\theta$ = adjacent/hypotenuse and $\tan\theta$ = opposite/adjacent apply them to find angles and lengths in right-angled triangles **and, where possible, general triangles** in two **and three** dimensional figures
G21	know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0°, 30°, 45°, 60°$ and $90°$; know the exact value of $\tan\theta$ for $\theta = 0°, 30°, 45°$ and $60°$
G22	**know and apply the sine rule $a/\sin A = b/\sin B = c/\sin C$, and cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$, to find unknown lengths and angles**

G23	**know and apply Area = 1/2 ab sin C to calculate the area, sides or angles of any triangle**
G24	describe translations as 2D vectors
G25	apply addition and subtraction of vectors, multiplication of vectors by a scalar, and diagrammatic and column representations of vectors; **use vectors to construct geometric arguments and proofs**
P1	record, describe and analyse the frequency of outcomes of probability experiments using tables and frequency trees
P2	apply ideas of randomness, fairness and equally likely events to calculate expected outcomes of multiple future experiments
P3	relate relative expected frequencies to theoretical probability, using appropriate language and the 0-1 probability scale
P4	apply the property that the probabilities of an exhaustive set of outcomes sum to one; apply the property that the probabilities of an exhaustive set of mutually exclusive events sum to one
P5	understand that empirical unbiased samples tend towards theoretical probability distributions, with increasing sample size
P6	enumerate sets and combinations of sets systematically, using tables, grids, Venn diagrams and tree diagrams
P7	construct theoretical possibility spaces for single and combined experiments with equally likely outcomes and use these to calculate theoretical probabilities
P8	calculate the probability of independent and ependent combined events, including using tree diagrams and other representations, and know the underlying assumptions
P9	**calculate and interpret conditional probabilities through representation using expected frequencies with two-way tables, tree diagrams and Venn diagrams**
S1	infer properties of populations or distributions from a sample, while knowing the limitations of sampling
S2	interpret and construct tables, charts and diagrams, including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data, tables and line graphs for time series data and know their appropriate use
S3	**construct and interpret diagrams for grouped discrete data and continuous data, i.e. histograms with equal and unequal class intervals and cumulative frequency graphs, and know their appropriate use**

S4	interpret, analyse and compare the distributions of data sets from univariate empirical distributions through: ● appropriate graphical representation involving discrete, continuous and grouped data, **including box plots** ● appropriate measures of central tendency (median, mean, mode and modal class) and spread (range, including consideration of outliers, **quartiles and inter-quartile range**)
S5	apply statistics to describe a population
S6	use and interpret scatter graphs of bivariate data; recognise correlation and know that it does not indicate causation; draw estimated lines of best fit; make predictions; interpolate and extrapolate apparent trends while knowing the dangers of so doing