Mathematics: Year 10 overview

Assessment Opportunities	Literacy/Reading opportunities	CEIAG Links
The mathematics department operates a check in/ check out policy. Students "check in" to a topic by answering a series of questions totalling 20 marks. Class teachers analyse the answers given and plan the lessons according to the needs of their learners. Once the topic has been delivered, the check in assessment is handed back (unmarked) and the student completes the reverse "check out" side. Both sides are marked so students can instantly measure their progress and feedback given so students understand their next steps for improvement. Students in year 10 will complete 12 of these low stakes assessments throughout the year. Students are encouraged to use their books and knowledge organisers to help them answer the questions. Students also undertake two formal mathematics assessments at the end of the Autumn and Spring terms. These are completed in examination conditions and test all topics that have been covered during the term. These assessments total 40 marks and are reported home as a percentage. Year 10 also sit a formal set of GCSE mock examinations in the summer term.	**Autumn term:** Students will learn how to: Read scale factors to enlarge shapes. Read trigonometric graphs and ratios to find missing sides and angles. Read inequalities to plot graphical inequalities and identify regions. Read graphical simultaneous equations to find points of intersection. **Spring term:** Students will learn how to: Read a protractor to measure bearings. Read mathematical formulae to find the volume and surface area of cylinders, cones, spheres, and pyramids. Read Venn diagrams and frequency trees to find probabilities. **Summer term:** Students will learn how to read frequency polygons, two-way tables, pie charts, stem and leaf diagrams, scatter graphs, cumulative frequency graphs and histograms to interpret and manipulate data sets.	Our curriculum contributes towards helping students prepare themselves for the opportunities, responsibilities, and experiences of life beyond mathematics in school. Career opportunities are highlighted at the beginning of each new topic and students actively research careers during their weekly homework cycle, focusing on maths in the real world.

Curriculum vision:

"Our aim is to deliver a curriculum that is inclusive, relevant and progressive for all learners."

Bigger Picture Topic	Step	Learning Intention	Support	Interleaving Topics	Corbett Clip Number
Rationale: This block revises and extends knowledge from KS3 with a focus on building their experience of enlargement and similarity. This unit extends and looks more formally at dealing with topics such as similar triangles. Parallel line angle rules are revisited to support the establishment of similarity. Congruence is introduced through considering what information is needed to produce a unique triangle. **Learning Progression:** *topics students have seen that will play a vital role in understanding this block* Y7: Spring block 2 (areas of shapes) Y7: Summer block 1 (geometric notation and parallel and perpendicular lines) Y7: Summer block 2 (angles) Y8: Autumn block 2 (scale factors) Y8: Summer block 1 (angles in parallel lines) Y9: Spring block 4 (chains of reasoning to find angles) Y9: Autumn block 5 (explore congruency) **Key Vocabulary: Enlarge, scale factor, ratio, origin, object, image, reflection, centre of enlargement, similar, parallel, alternate**					
Careers Link: Construction-Structural geometry is a subject intertwined with building constructions and architecture. Determining the stability of structure and how to construct components requires a clear understanding of geometrics and the interaction and similarity between various shapes and weights. The design and construction of bridges are results of geometrical equations and the relationships between similar shapes. Geometry Integration Engineer- Jaguar Land Rover Viewing and manipulating geometric data to package components into a vehicle					
Block 1 Congruence, similarity & enlargement	Check in 1. Enlarge a shape by a positive integer scale factor	TBAT enlarge a shape by a positive integer scale factor	Useful to highlight the fact that angles do not change when enlarging shapes. This understanding will, in later steps, be built on	Coordinates Ratio	104
	2. Enlarge a shape by a fractional scale factor	TBAT enlarge a shape by a fractional scale factor	Pictorial representation is essential to support conceptual understanding Geoboard by The Math Learning Center	Fraction multiplication	107
	4. Identify similar shapes	TBAT identify similar shapes	It is helpful for students to understand ratio within this context as this will be useful later when introduced to trig	Ratio Proportion	291

	5. Work out missing sides and angles in a given pair of similar shapes	TBAT work out missing sides and angles in a pair of similar shapes	Students should see similar shapes in a range of orientations. Careful labelling will assist this	Compound shapes	292
	6. Use parallel line rules to work out missing angles	TBAT use parallel line rules to work out missing angles	Useful to distinguish between 'corresponding angles' and 'angles that correspond'		25
	7. Establish a pair of triangles that are similar	TBAT establish if a pair of triangles are similar	Students may need support to work out which vertex in one triangle corresponds to which in the other	Angles in parallel lines	
	12. Understand the difference between congruence and similarity	TBAT identify the differences between congruence and similarity	Students should bring together the ideas of similarity and congruence through categorising them	Ratio Area	66
	13. Understand and use conditions for congruent triangles	TBAT use conditions for congruent triangles	Students will have come across the language of SSS, ASA etc but will not have used them to SHOW the congruence of triangles	Constructions	67
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

Rationale: This block introduces trigonometry as a special case of similarity within right-angled triangles. Emphasis is placed throughout the steps on linking the trig functions to ratios, rather than just functions. This key topic is introduced early in year 10 to allow for regular revisiting e.g. when looking at bearings.

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Summer block 1 (geometric notation)
Y8: Summer block 1 (geometric facts)
Y9: Spring block 6 (Pythagoras' theorem)
Y9: Summer block 1 (ratios in right angled triangles)
Y9 Spring block 6 (prove if a triangle is right angled)
Key Vocabulary: Enlarge, scale factor, ratio, adjacent, hypotenuse, opposite, right angle, tangent, cosine, sine, subject, angle, obtuse, acute, inverse

Careers Link: Trigonometry was first studied in the third century B.C as a way of applying geometry to astronomy. Early astronomers noted fixed relationships between the sides and angles of right-angled triangles. The trig functions are used in many fields, including electrical and mechanical engineering, acoustics, ecology, astronomy, physics and surveying. Even in smaller projects you'll find construction workers such as carpenters, landscapers and roofers relying on trigonometry to calculate the necessary angles and fittings to meet building code requirements efficiently and sufficiently.					
Block 2 Trigonometry	1. Explore ratio in similar right-angled triangles	TBAT explore ratio in similar right-angled triangles	Teachers will need to emphasise the generalisations been made. It may be appropriate to use opposite, adjacent and hypotenuse to discuss the given side lengths	Division of fractions Corresponding sides	
	2. Work fluently with the hypotenuse, opposite and adjacent sides	TBAT work fluently with the hypotenuse, opposite and adjacent sides	Labelling the hypotenuse first is a useful strategy. Provide opportunities to label sides in differently orientated right angled triangles		329
	3. Use the tangent ratio to find missing side lengths	TBAT use the tangent ratio to find missing side lengths	Teachers should start by modelling how to solve equations of the form $a = \frac{b}{c}$	Solving equations	330
	4. Use the sine and cosine ratio to find missing side lengths	TBAT use the sine and cosine ratio to find missing side lengths	Teachers should emphasise that choosing whether to use sine or cosine is dependent on which side lengths are involved in the question	Area of parallelograms	
	5. Use the sine, cosine and tangent ratio to find missing side lengths	TBAT use the sine, cosine and tangent ratio to find missing side lengths	Students now need opportunities to identify which trig ratio to use, particularly in problems that are less structured	Subject of formula	
	6. Use the sine, cosine and tangent to find missing angles	TBAT use the sine, cosine and tangent to find missing angles	When introducing the inverse, encourage students to practice using their calculators. Expose students to different notation such as angle ABC and angle y		331
	7. Calculate sides in right angled triangles using	TBAT calculate sides in right angled triangles using Pythagoras theorem	Here, the aim is to use unfamiliar contexts to test depth of understanding	Circles Area	257

	Pythagoras theorem				
	8. Select the appropriate method to solve right angled triangle problems	TBAT select the appropriate method to solve right angled triangle problems	Scaffolding to support students in making decision about when to use trig ratios / Pythagoras needs to be reduced as they become more confident	Area and perimeter of trapezia	
	9. Work with key angles in right angled triangles	TBAT work with key angles in right angled triangles	Students are to focus on finding the exact trig values. Modelling how to use this information to solve right-angled triangle problems without a calculator is key	Surds Simplifying fractions	341
	Check out Check in next block				
	Feedback lesson				

Rationale: Students will have covered both equations and inequalities at key stage 3 and this unit offers the opportunity to revisit and reinforce standard techniques and deepen their understanding. As well as solving equations, emphasis needs to be placed on forming equations from given information. This provides an excellent opportunity to revisit other topics in the curriculum such as angles on a straight line/in shapes/parallel lines, probability, area and perimeter etc.

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Spring block 4 (directed number)
Y7: Autumn block 4 (place value & comparing and ordering numbers
Y7: Autumn block 2 (function machines & substitution)
Y7: Autumn block 3 (form and solve one-step equations)
Y7: Spring block 4 (form and solve two-step equations)
Y8: Spring block 1 (expanding brackets & simplifying expressions)
Y8: Spring block 1 (form and solve equations with brackets)
Y8: Autumn block 4 (using coordinates & plotting graphs)
Y9: Summer block 5 (algebraic representation)
Y9: Autumn block 2 (revising and extending Y7 & Y8 coverage)
Y9: Summer block 5 (representing inequalities)

Key Vocabulary: Variables, solve, solution, equation, expression, inverse, inequality, greater than, less than, union, linear, plot, coordinate, y intercept, coordinate, intersect

Careers Link: Algebra possesses a powerful problem-solving tool used in fields ranging from engineering to business. Accountants need algebra to balance spreadsheet after spreadsheet of spending reports. Bankers use algebra to calculate interest and taxes. Computer programmers and support specialists must be able to use algebra to solve linear equations to troubleshoot many software and networking issues. Biologists all use the same linear equation format to solve problems such as determining ingredient portions, sizes of forests and atmospheric conditions. Engineering is one of the most well-known fields for using linear equations. Engineers include architects, surveyors, and a variety of engineers in fields such as biomedical, chemical, electrical, mechanical and nuclear. Linear equations are used to calculate measurements for both solids and liquids.

Hannah Fry- The Power of Algebra | STEM (short two-minute video)

Block 3 Representing solutions of equations & inequalities	1. Understand the meaning of a solution	TBAT find the meaning of a solution	Students are to consider whether a number is a solution or not by substitution.		
	2. Form and solve one-step and two-step equations	TBAT form and solve equations	Manipulatives such as cups and counters or algebra tiles could be useful to support students. Use this step to revisit other topics such as angle facts, probability etc.	Angle facts Probability Area of compound shapes	110
	3. Form and solve one-step and two-step inequalities	TBAT form and solve inequalities	Beware of students changing the inequality sign to an equals sign to 'make it easier' and also assuming an integer solution is needed.	Area Perimeter	
	4. Show solutions to inequalities on a number line	TBAT show solutions to inequalities on a number line	Encourage students to read the inequalities out loud to help them negotiate the meaning of the inequality symbols. Introduce the students to the conventions of this topic such as the meaning of the shading of the circle	Negative numbers	177
	5. Interpret representation on number lines as inequalities	TBAT interpret representation on number lines as inequalities	Again, the meaning of the shading of the circle, the direction of the line and how this relates to the inequality format needs discussion. It is worth revisiting this notation regularly to aid retention	Prime numbers Square numbers	177
	7. Draw straight line graphs	TBAT draw straight line graphs	Students should be encouraged to look for errors in their table of values if their points do not form the expected straight line		186
	8. Find solutions to equations using straight line graphs	TBAT find solutions to equations using graphs	It can be useful to draw attention to the fact that for a linear equation there will only be one point where the graphs meet and the x value corresponds to the solution of the equation		

	11. Form and solve equations with unknowns on both sides	TBAT form and solve equations with unknowns on both sides	As well as practicing solving, discussion on how to form the equations is key	Area Perimeter	
	12. Form and solve inequalities with unknowns on both sides	TBAT form and solve inequalities with unknowns on both sides	Teachers will need to be vigilant for students changing or omitting inequality signs	Properties of 2D shapes	113
	13. Form and solve more complex equations and inequalities	TBAT form and solve more complex equations and inequalities	The aim is to develop fluency within wider mathematics and not purely algebraic settings. Students should be exposed to different ways of answering the same questions, such as multiplying the brackets out first or dividing	Angles in a triangle Isosceles triangles	111a
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

Rationale: This block moves students on to the solution of simultaneous equations by both algebraic and graphical methods. The method of substitution will be dealt with before elimination, as this builds on students' prior knowledge from KS3. Links will be made to graphs to ensure students have a deep, conceptual understanding.

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Autumn block 2 (function machines, representing functions graphically & substitution)
Y7: Autumn block 3 (solving equations)
Y7: Summer block 4 (algebraic expressions)
Y8: Spring block 1 (expanding brackets, simplifying expressions & solving equations)
Y8: Autumn block 4 (using coordinates and plotting graphs)
Y9: Autumn block 3 (change the subject of a formula)
Y9: Autumn block 2 (form and solve inequalities with unknowns on both sides)
Y9: Summer block 5 (interpreting graphs)

Key Vocabulary: Infinite, equations, finite, variable, solution, substitute, unknown, inverse, rearrange,

Careers Link:
Simultaneous equations are used in a wide range of careers. Systems of linear equations also come up a lot in the study of genes. If you want to find out what a particular gene does, you must see how it influences all the chemical processes in our body. There are hundreds of those going on in our bodies all the time, for example we produce sugars and proteins. The way these processes work, and how they influence each other, can be expressed by large systems of linear equations.

A biologist will use them to get an idea of how a population of animals might change over time. An economist or financial adviser will use them to predict the economy or the future profits of a company. An engineer will use them to work out the exact proportions of a building, like a bridge or a skyscraper, and how much and what kind of materials to use. In short, equations are a fact of life for many people, and to be able to work with them you need to start with the simplest ones – the linear equations.					
Block 4 Simultaneous Equations	1. Understand that equations can have more than one solution	TBAT show that equations can have more than one solution	Students should explore equations that have more than one possible solution. Use different types of numbers when finding these solutions, e.g., negatives, decimals, fractions. Building on this, get students to think about what else is needed to reduce to just one solution. This leads into the idea of requiring two equations and hence into the concept of simultaneous equations		
	2. Determine whether a given (x,y) is a solution to a pair of simultaneous equations	TBAT determine if (x,y) is a solution to a pair of simultaneous equations	Students are to substitute values into equations to work out whether or not they have a possible solution.	Area of a triangle	20
	3. Solve a pair of linear simultaneous equations by substituting a known variable	TBAT solve a pair of linear simultaneous equations by substituting a variable	Use bar models to begin with to support algebraic thinking.		296
	3. Solve a pair of linear simultaneous equations by substituting a known variable	TBAT solve a pair of linear simultaneous equations by substituting a variable	Extra lesson plotted in to ensure students become fluent on this step. Make use of diagnostic questions on mini whiteboards to check understanding at different points	Coordinates	296
	4. Solve a pair of linear simultaneous equations by substituting an expression	TBAT solve a pair of linear simultaneous equations by substituting an expression	Double sided counters could be used on the interactive board so students can visualise the substitution. At this stage, students are not rearranging to make the substitution		

	4. Solve a pair of linear simultaneous equations by substituting an expression	TBAT solve a pair of linear simultaneous equations by substituting an expression	Extra lesson plotted in to ensure students become fluent on this step.		
	5. Solve a pair of linear simultaneous equations using graphs	TBAT solve simultaneous equations using graphs	It is important that teachers emphasise that it is the value of x and y that give the solution, rather than the coordinate. Teachers could extend this by exploring why some pairs of linear equations do not have any solutions (parallel lines)	Parallel lines	297
	6. Solve a pair of linear simultaneous equations by subtracting equations	TBAT solve a pair of linear simultaneous equations by subtracting equations	Bar models to be used to clearly show the difference between two equations. Once students understand why subtracting eliminates a variable, they can attempt abstract simultaneous equations. Include answers which are zero, negative or non-integer		295
	7. Solve a pair of linear simultaneous equations by adding equations	TBAT solve a pair of linear simultaneous equations by adding equations	By considering the simplification of expressions, students need to understand how to make zero using addition. It is important to consider equations where it might be easier to rearrange before adding		
	8. Use a given equation to derive related facts	TBAT use a given equation to derive related facts	It is important to ensure that students understand that equivalent equations have the same solutions. This step relates closely to deriving related number facts e.g. working out 4 x 17 from doubling 2 x 17, and this makes a good introduction		
	9. Solve a pair of linear simultaneous equations by adjusting one equation	TBAT solve a pair of simultaneous equations by adjusting one equation	Bar models are a good way of demonstrating why equal coefficients of one of the variables is necessary when we are solving by elimination. It is useful to provide the abstract equation alongside each bar model to support conceptual understanding of the method.		298
	10. Solve a pair of linear simultaneous	TBAT solve a pair of linear simultaneous equations by adjusting both equations	Students may need guiding in choosing appropriate multipliers. Choosing whether to add or subtract should again be reinforced	LCM	

	equations by adjusting both equations				
	10. Solve a pair of linear simultaneous equations by adjusting both equations	TBAT solve a pair of linear simultaneous equations by adjusting both equations	Extra lesson plotted in to ensure students become fluent on this step.		
	11. Form a pair of linear simultaneous equations from given information	TBAT form a pair of linear simultaneous equations	Students often get confused about forming equations involving ‘more than’ or ‘doubling’, placing addition/ multiplication on the wrong side of the equation. This will need exploring by testing values. Students must give final answers in the context of the question		115
	12. Form and solve a pair of linear simultaneous equations from given information	TBAT solve and form a pair of linear equations	Students may need to be provided with scaffolding when first attempting to form and then solve two linear equations. This should be gradually removed	Area of rectangles and trapezia	115
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

Rationale: This block provides a great opportunity to revisit other materials and make links across the mathematics curriculum. Topics such as accurate drawings, use of scales and angles in parallel lines, which have been taught at KS3, will be revisited in this block. Students will also reinforce their understanding of trigonometry and Pythagoras from earlier in the year, applying their skills in another context as well as using maths to model real life situations

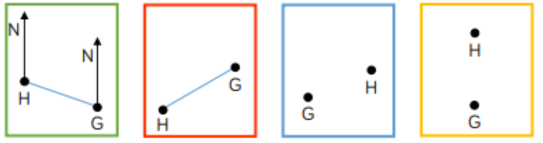
Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Summer block 1 (draw lines, angles and similar shapes)
Y7: Summer block 2 (angle rules)
Y8: Autumn block 2 (work with scale factors)
Y8: Summer block 1 (angles in parallel lines)
Y9: Autumn block 5 (standard ruler and compass constructions)
Y9: Spring block 6 (understand and use Pythagoras’ theorem)

Y9: Autumn block 5 (revisit scale drawings)

Key Vocabulary: Compass, point, angle, turn, three letter notation, enlarge, protractor, convert, similar, three-figure, north line, clockwise, bearing, scale, construct, parallel, co-interior, corresponding

Careers Link: Three figure bearings are used to map out directions and distances. They are essential to many professions such as coast guards, sailors, pilots and air traffic control. Bearings can also be used to measure the dimensions of a floor plan, which is shown and discussed in the video below. Filmed in Durham Cathedral, it investigates the mathematics used by master masons and the links with classical architecture.

The floor plan of Durham Cathedral using bearings and scale drawings-| STEM (short two-minute video)

Block 5 Angles & Bearings	1. Use cardinal directions and related angles 2. Draw and interpret scale diagrams	TBAT use cardinal directions and draw and interpret scale diagrams	Students will revisit their prior work on angles and should be comfortable with both measuring and drawing angles using three letter notation. Students should also be able to interpret scales as well as make scale drawings. Use both formats when exploring different scales 1cm=500m and 1:50000	Ratio 1:n Metric conversions	283
	3. Understand and represent bearings	TBAT represent bearings	The wording 'of A from B' can often confuse students and is worth addressing as a class, identifying a wide variety of start and end points.		26
	4. Measure and read bearings	TBAT measure and read bearings	Students need plenty of practice with the skill, like in the exemplar questions below Draw the points G and H in each of the relative positions shown, including North lines for each point.  Measure the bearing of G from H and their bearing of H from G for each of your diagrams. Compare your answers with a partner's.		
	5. Make scale drawings using bearings	TBAT make scale drawings using bearings	When students are confident with the measuring and direction of bearings, they can be moved on to more complex problems requiring them to draw scale diagrams. It is a good idea to use plain paper instead of squared paper, to promote accurate use of a protractor		869
	6. Calculate bearings using angle rules	TBAT calculate bearings using angle rules	Encourage students to read the question carefully, in particular noting where to measure the bearing from		27

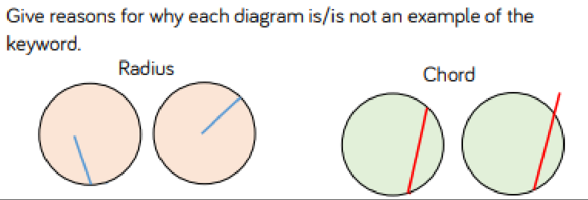
	7. Solve bearings problems using Pythagoras and trigonometry	TBAT solve bearings problems using Pythag and trig	This is a good opportunity to revisit the use of trigonometry and Pythagoras. Drawing the north line is especially revealing in these questions as it introduces right angles. Students will need scaffolded support initially, to form diagrams from worded questions		
	Autumn Assessment				
	Autumn Assessment Reflection				
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

Rationale: This block also introduces new content whilst making use of and extending prior learning. The formula for arc length and sector area are built up from students understanding of fractions. They are also introduced to the formulae for surface area and volume of spheres and cones.

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Spring block 2 (areas of shapes)
Y7: Summer block 1 (geometric notation)
Y8: Autumn block 1 (circumference of a circle)
Y8: Summer block 2 (area of a circle)
Y8: Autumn block 3 (multiply and divide fractions)
Y9: Autumn block 4 (surface area and volume)

Key Vocabulary: Radius, diameter, chord centre, tangent, arc, sector, segment, circumference, area, fraction, proportion, cylinder, cone, perpendicular height, base, sphere, area,

Careers Link: Surface area is one of the most practical math concepts used in everyday jobs. Painters use surface area to determine how much paint they will need for a project. The surface area of an element is an important consideration for chemists because the greater the surface area of a substance, the quicker it reacts. Dentists use surface area to determine the size of dental restorations, such as bridges and dental implants. Dentists follow Ante's Law, which states the surface area of the replacement must be equal to or greater than the surface area of the original tooth.

Block 6 Working with Circles	1. Recognise and label parts of a circle	TBAT recognise and label parts of a circle	Showing pupils non examples that are close in nature to the word in question will help to refine their definitions and understanding  		
	2. Calculate fractional parts of a circle	TBAT calculate fractional parts of a circle	Looking at familiar fractions of circles such as quarters and eights is a useful lead in to the coming steps involving working out arc lengths and areas using formulae		
	3. Calculate the length of an arc	TBAT calculate the length of an arc	Students may need to revisit the formula of the circumference of a circle. Angles below and above 180 degrees should be explored and both exact and rounded answers should be considered	Perimeter	58
	4. Calculate the area of a sector	TBAT calculate the area of a sector	Links should be made with the previous step, establishing that the proportion of a full turn taken up by the sector is identical to its proportion of the area of the circle, leading to the formula		46
	9. Understand and use the volume of a cylinder and cone	TBAT calculate the volume of a cylinder and cone	Good to point out that a cone is a type of pyramid with a circular base. Students do not need to learn these formulae, but should be fluent in their use	Pythagoras	357 359
	10. Understand and use the volume of a sphere	TBAT calculate the volume of a sphere	Students need to be careful using this formula as both the fraction and the cubing can cause problems. The use of a calculator could be modelled and compared with non-calc methods		361
	11. Understand and use the surface area of a sphere	TBAT calculate the surface area of a sphere	This is another given formula and it would be useful to look at this in conjunction with either the next or previous step so that students experience making the right choice of formula to use.		588
	12. Understand and use the surface area of	TBAT calculate the surface area of a cylinder and cone	Pythagoras' theorem may be needed to calculate the slant height of perpendicular height. Allowing students to see the links between the areas by making or deconstructing cylinders and cones is highly effective		314 315

	a cylinder and cone				
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

Rationale: This block revisits the vectors used to describe translations from KS3. This block looks at vectors more formally, discovering the meaning of -a compared to a to make sense of operations such as addition, subtraction and multiplication of vectors.

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Spring block 4 (use the four operations with directed number)
Y7: Summer block 1 (geometric notation)
Y9: Spring block 5 (translate shapes and describe translations)

Key Vocabulary: Column vector, direction, scalar, magnitude, size, column vector, direction, parallel, multiplier, addition, negative

Careers Link: People whose profession involves the movement of things usually depend on vectors to help them organise their thoughts. Examples are airline pilots, sea captains, doctors tracking the progress of an epidemic, meteorologists tracking weather systems and engineers dealing with forces and motion. Health diagnosing and treating occupations also use vectors in their everyday work as chiropractors when treating patients.

Block 7 Vectors	1. Understand and represent vectors	TBAT represent vectors	A key learning point is that a vector shows both direction and magnitude. It is also important to emphasise the role of the arrow so that students get the idea of starting and end points and hence direction. Comparing vectors with the same magnitude, but different directions is very useful	Coordinates	353
	2. Use and read vector notation	TBAT use and read vector notation	We can now introduce the formal notation for labelling vectors. Students develop a deeper understanding of a vector representing movement from one point to another and can start comparing different representations		353a
	3. Draw and understand vectors multiplied by a scalar	TBAT draw and understand vectors multiplied by a scalar	Students should understand that when vectors are parallel, one is a multiple of the other and the multiplier is called a scalar. Students will need support in identifying negative multipliers where vectors are parallel, but in opposite directions.	Multiplication Negative numbers	

	4. Draw and understand addition of vectors	TBAT draw and calculate the addition of vectors	A common misconception is thinking that the resultant vector follows on from the direction of the other vectors. To avoid this, students may need lots of practice in drawing out vector representations of addition. This can be extended to more than two vectors		
	5. Draw and understand addition and subtraction of vectors	TBAT draw and calculate the addition and subtraction of vectors	Students should also be exposed to the pictorial form of adding and subtracting vectors. Developing reasoning is key here, so activities such as 'true/false' or 'always, sometimes, never' are useful		
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

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

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Autumn block 5 (interchanging between fractions and decimals)
Y7: Summer block 3 (use multiplicative relationships between known facts)
Y8: Autumn block 2 (currency conversions)
Y8: Autumn block 1 (divide in a ratio)
Y8: Spring block 4 (express one number as a fraction of another)
Y9: Autumn block 5 (scale drawings)
Y9: Summer block 2 (conversion graphs)

Key Vocabulary: Ratio, unit, equivalent, convert, simplest form, share, part, whole, proportion, gradient, origin, exchange rate, bearing

Careers Link: Many professional titles such as computer programmer, statistician, actuary, quantitative analyst, scientist, economist, urban planner, lawyer and judge, all require at least some knowledge or use of fractions. Other job categories that commonly require the use of fractions include business, sales, architecture, scientific fields, art and design and the financial sector. Stock analysts evaluate publicly traded companies and make recommendations to investors and brokers based on their analysis. Ratios are widely used to analyse the health and value of companies. An example of a common ratio used by stock analysts is the "Quick Ratio". The Quick Ratio analyses the near-term cash flow position of the company.

Block 8 Ratios & Fractions	1. Compare quantities using a ratio	TBAT compare quantities and link ratios to fractions	A recap of unit conversions could be useful here. Pictorial representations help to unpick any misconceptions as fractional relationships are clearly highlighted.		269a

	2. Link ratios and fractions				
	3. Share in a ratio	TBAT share in a ratio	Students should be familiar with this step from KS3. Encouraging the use of bar models and emphasising the importance of labelling them helps students to understand the structure of ratio problems		270
	4. Use ratios and fractions to make comparisons	TBAT use ratios and fractions to make comparisons	Students might need to review comparing fractions before ratios. Students should be encouraged to draw bar models and to write parts of a ratio as a fraction of the whole, to support their comparisons.		
	5. Link ratios and graphs	TBAT link ratios and graphs	Students can revisit the notion of gradient and see how this links to the ratio of the pairs of values $\frac{y}{x}$		
	6. Solve problems with currency conversions	TBAT solve problems with currency conversions	Double number lines are particularly helpful in aiding students to build up to higher quantities using multiplicative reasoning and to think about how they can use what they know to find other values, linking this to their knowledge of ratio.		214a
	7. Link ratios and scales	TBAT link ratios and scales	Students may need reminding about unit conversions as a precursor to this step. It is good practice to use full size maps rather than just extracts normally seen in examination and textbook questions. Using applications like Google maps to extend students' experience of different scales may also be useful. This is also a good opportunity to revisit/reinforce drawing and reading bearings.		
	8. Use and interpret ratios of the form 1:n and n:1	TBAT use and interpret ratios of the form 1:n and n:1	Students sometimes find this tricky as answers do not always conform to the usual simplifying of ratios where both parts are integers. Students may need some guidance on deciding which has the highest proportion or whether a criteria is met and using stem sentences, such as 'for every 1 red, there are _____ green' can be a helpful way for students to interpret the information a bit more easily	Metric conversions	271c
	9. Solve best buy problems	TBAT solve best buy problems	Students will have different methods for comparing and it is useful to share these as a group. Use of double		210

			number lines or ratio tables can be useful for structuring mathematical thinking.		
	10. Combine a set of ratios	TBAT combine a set of ratios	In order to combine ratios, students need to be secure in finding the lowest common multiple and in working with equivalent ratios. Pictorial methods are very helpful here and students could draw the objects (as in the sweets example), or use bar models to represent the number of parts. "Scaling up" the ratios until a common multiple is found is another very useful strategy.	LCM	
	11. Link ratio and algebra	TBAT link ratio and algebra	This step explores the use of algebraic notation within ratios and the linking of ratio questions to problems that need to be tackled through e.g. forming and solving equations.	Solving eqautions	
	14. Mixed ratio problems	TBAT solve mixed ratio problems	It is very useful for students to be able to reflect on a variety of topics covered rather than just see them discretely, so the purpose of this step is to provide opportunities to look again at various aspects of this unit to reinforce understanding.	Angles Fractions	271e
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

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

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Spring block 1 & 2 (use a calculator)
Y7: Autumn block 5 (interchange between fdp)
Y7: Spring block 3 (find percentage of amounts)
Y8: Spring block 4 (explore calculator and non-calculator methods)
Y8: Spring block 4 (using multipliers)
Y9: Spring block 3 (revisit and extend Y7/8 work in the context of financial mathematics)
Y9: Spring block 2 & 3 (Reverse percentages)

Key Vocabulary: Fraction, decimal, percentage, convert, equivalent, multiplier, increase, decrease, interest, express, simple, compound, change

Careers Link: A wide range of careers use percentages such as in the design of the traffic light labels on most food packets in the UK. These include a percentage of the 'reference intake' which is an important piece of information that all people need to be able to interpret. On a typical cream donut, it might say 43% under saturated fat meaning that it contains 43% of the maximum amount of saturated fat an adult should eat in a day.
Percentages are everywhere in biology. One example is calculating percentage mass change in the process of 'Osmosis' where water diffuses across a membrane. This is a key concept which is used daily by many practising biologists.
Careers in football technology use percentages to work out the ball possession among teams. Ball possession used to be calculated by relying on someone starting a stopping a manual timer, whereas nowadays it is measured using video-based data and expressed as a percentage.

Block 9 Percentages & Interest	1. Convert and compare fdp 2. Work out percentages of amount	TBAT convert fdp and work out percentages of amounts	Useful to show students how to perform conversions on their calculators as well as through mental and written methods. Finding percentages greater than 100% is a useful lead in to reviewing percentage increase in the next step		121 - 130
	3. Increase and decrease by a given percentage	TBAT increase and decrease by a given percentage	Some students get confused when reducing by a given percentage and use the wrong multiplier; the use of estimation is a good strategy here.	Estimation	238
	4. Express one number as a percentage of another	TBAT express one number as a percentage of another	Encouraging students to express as a fraction first and then considering how to convert is also useful	Probability	237
	5. Calculate simple and compound interest	TBAT calculate simple and compound interest	A useful strategy for helping students to distinguish and remember the difference between simple and compound interest is to compare them alongside each other rather than just looking at them independently.	Indices	236a 236
	6. Repeated percentage change	TBAT calculate repeated percentage change	This builds on the previous step, generalising the method for compound interest to any repeated percentage change situation, including repeated reduction. Students may not be aware of the term "depreciation"	Surface area	91 92
	7. Find the original value after a percentage change	TBAT find the original value after a percentage change	It is worth looking at multiple methods such as finding 10% or 1% from the given value or using equations of the form "Original x multiplier = final value"	Volume	
	8. Solve problems involving	TBAT solve problems involving growth and decay	There are no new techniques but students may need to be directed to the links with compound interest and depreciation using the vocabulary or "growth" and "decay"		

	growth and decay				
	10. Solve problems involving percentages, ratios and fractions	TBAT solve problems involving percentages, ratios and fractions	This step provides a nice link with the previous block of learning and can be used to explore examination-style questions that feature a combination of FDP as well as ratio. Bar models and tables are key ways to represent problems to enable students to access the questions which may at first appear overwhelming		271e
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

Rationale: This block builds on KS3 and builds a good context in which to revisit fraction arithmetic and conversion between fraction arithmetic and conversion between fractions, decimals, and percentages. Tables and Venn diagrams are revisited and understanding, and use of tree diagrams is developed at both tiers.

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Spring block 5 (add and subtract fractions including mixed numbers)
Y7: Autumn block 5 (interchange between fractions and decimals below 1)
Y7: Summer block 4 (use the language of probability)
Y8: Autumn block 6 (use tables and Venn diagrams to find probabilities)
Y9: Summer block 3 (compare experimental and theoretical probability)

Key Vocabulary: Numerator, denominator, outcome, event, intersect, union, relative frequency, estimate, universal set, Venn diagram, frequency trees, sample space, product,

Careers Link: The world of finance is essentially a world of uncertainty. Therefore, a wide variety of financial professionals, such as portfolio analysts, traders and financial strategists rely on probabilistic models. Financial officers and loan officers rely on probability analysis to estimate payments, defaults and the resulting financial condition of the company in the future.

Probability | Maths - Real Life Maths - YouTube 4 minute video on probability been used in weather reporting jobs and real life

Block 10 Probability	1. Know how to add, subtract and multiply fractions	TBAT know how to add, subtract and multiply fractions	Students need a conceptual understanding of adding, subtracting and multiplying fractions before exploring probability. Returning to pictorial representations may be necessary. There is then an opportunity to interleave many previously taught topics.	Order of operations Area of polygon Volume	132 133
	2. Find probabilities	TBAT find probabilities using equally likely outcomes	This step supports students to become conceptually fluent in using equally likely outcomes to find probabilities. Misconceptions should be highlighted		245

	using equally likely outcomes		here, particularly considering factors such as 'size' of spinner and whether this impacts on probability of outcomes. Reminding students that they can write probability as a fraction, decimal or percentage is also useful.		
	3. Use the property that probabilities sum to 1	TBAT use the property that probabilities sum to 1	Students should have opportunities to work with percentages, fractions and decimals when finding probabilities. This step is also an opportunity to revisit Venn diagrams, set notation and forming/solving linear equations	Solving linear equations	250
	SPRING ASSESSMENT				
	SPRING ASSESSMENT REFLECTION				
	4. Using experimental data to estimate probabilities	TBAT use experimental data to estimate probabilities	Students could be supported to find experimental probabilities from a variety of sources.		248
	5. Find probabilities from tables, venn diagrams and frequency trees	TBAT find probabilities from tables, venn diagrams and frequency trees	This is an opportunity for students to revise key ways of representing information. When working with Venn diagrams, students might need reminding that P(A) includes P($A \cap B$). When working with two-way tables, students might need support in choosing the correct cell value for the denominator.	Ratio	
	6. Construct and interpret sample spaces for more than one event	TBAT construct and interpret sample spaces for more than one event	Discuss how to be systematic and the different ways of being systematic. A misconception is to add the total number of possible outcomes from each event and use this as the denominator when calculating probabilities (e.g. thinking the total number of possible outcomes when rolling two dice must be 12).		246
	7. Calculate probability with independent events	TBAT calculate probability with independent events	Before working with tree diagrams, students need to understand that for independent events, P(A and B) = P(A) × P(B). They also need to be clear that the outcome of one event has no bearing on the outcome of the other. This can be demonstrated using sample		249

			spaces. Examples and non-examples of independent events supports understanding of this term		
	8. Use tree diagrams for independent events	TBAT use tree diagrams for independent events	Sample spaces alongside the tree diagram can provide a helpful transitionary step. Initially scaffolding by providing students with the tree diagrams to enable all to access this concept. Teachers might include tree diagrams where there are more than two outcomes in each trial. Students may need support in identifying 'pathways' and what final outcome each shows.	Fraction, decimal and percentage conversion	252
	9. Use tree diagrams for dependant events	TBAT use tree diagrams for dependent events	It is useful to generate examples of dependent events with students, to ensure that they understand what these are. Again, scaffolding by providing incomplete information on a tree diagram or in a method provides a starting point. Working with probability in percentages, decimals and fractions and then discussing which is easier to calculate with can also be helpful	Multiplying and adding fractions	
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

Rationale: This block builds on KS3 work on the collection, representation, and use of summary statistics to describe data. Much of the content is familiar, both from previous study within and beyond Mathematics (Science and Geography) and from everyday life. The steps have been chosen and sequenced the way they are to balance consolidation of existing knowledge with extending and deepening, particularly in terms of interpretation of results and evaluating and criticising statistical methods and diagrams.

Learning Progression: *topics students have seen that will play a vital role in understanding this block*

Y7: Spring blocks 1 & 2 (use four operations)
Y7: Autumn block 5 (interchange between fractions and decimals)
Y7: Spring block 1 (solve problems with line charts and bar charts)
Y7: Summer block 1 (construct and interpret pie charts)
Y7: Autumn block 4 (find the median and the range)
Y8: Autumn block 5 (different types of data and construct & interpreting frequency tables and two-way tables)
Y8: Summer block 4 (collecting data)
Y8: Summer block 5 (identify outliers, find the mode, and compare distributions)

Key Vocabulary: Population, sample, biased, random, primary/secondary data, midpoint, class, interval, frequency, composite, angle, sector, radius, misleading, frequency density, mean, median, mode, outlier, average, modal class

Careers Link: There are a wide range of jobs that need to interpret graphs in their everyday practice. Jobs such as project managing, stockbroking and an epidemiologist. Also, an atmospheric scientist / meteorologist use data. They analyse meteorological data, atmospheric scientists, or meteorologists, can measure, and provide predictions for weather events and anomalies. Computer programs can be written to support weather models, and meteorologists can also use this data to provide warnings about severe weather. Measured data is crucial in understanding weather-related information relevant to air pollution, droughts, and long-term changes in regional climates. Working as a meteorologist requires a bachelor's degree in atmospheric science; those who wish to pursue research as an atmospheric scientist will need a minimum of a master's if not a Ph.D. Jobs that use graphs - BBC Bitesize 5 minute video on jobs that use data / graphs					
Block 11 Collecting, representing & interpreting data	1. Understand populations and samples 3. Primary and secondary data	TBAT use samples, primary and secondary data	There is often confusion caused by the colloquial use of the word 'random' to mean haphazard or unexpected, rather than the statistical meaning that each member of the population has an equal chance of being selected. It is useful to discuss the pros and cons of each type of data e.g. secondary is much cheaper, but may not be as reliable. The internet is a great source of secondary data which could be useful to exploit to generate the charts and diagrams in the forthcoming steps		343a
	4. Construct and interpret frequency tables and frequency polygons	TBAT construct and interpret frequency tables and polygons	Students are familiar with frequency tables for grouped data from KS3, and may recall the idea of the midpoint as used to find the estimate of the mean	Ratio Probability	51
	5. Construct and interpret two-way tables	TBAT construct and interpret two-way tables	Students have worked with two-way tables throughout KS3, so this review step is an opportunity to revisit both extracting and completing information as well as designing tables, looking at more complex tables if appropriate. There are ample opportunities to link to other areas of the curriculum that need revising, including fractions, decimals, percentages, ratios and probability	Fractions Decimals Percentages	147 148
	6. Construct and interpret line and bar charts	TBAT construct and interpret line and bar charts	Students should experience them in a variety of forms – vertical, horizontal, lines instead of bars etc. They should also explore multiple and composite bar charts, as in the two exemplar questions, focusing on interpretation and what types of information it is easier to read from one type than the other		

	7. Construct and interpret pie charts	TBAT construct and interpret pie charts	It is useful to look at the proportions in the chart as fractions of 360, as well as percentages and as fractions of the 'whole' that is being represented	Angles	163 164
	8. Criticise charts and graphs	TBAT criticise charts and graphs	Students need to look beyond the superficial criticisms of neatness, labelling of axes and titles to consider the mathematical flaws that charts or graphs may have. Changes in scale, starting the axes from inappropriate points or misuse of scaling may exaggerate or minimise differences. Encourage students to find real-life examples of this – there are plenty available!		
	11. Find and interpret averages from a list	TBAT find and interpret averages from a list	Students will have met mean, median and mode several times and at this stage they need to be considering when each one is and isn't appropriate e.g., only the mode is possible with categorical data	Algebraic expressions	50 53 56
	12. Find and interpret averages from a table	TBAT find and interpret averages from a table	It is useful for students to look at tables presented both horizontally and vertically when revising this KS3 topic, and then decide which is the best way to set the tables out to find averages. The term 'modal class' will need revisiting, emphasising its relationship to the mode		51 54 55
	13. Construct and interpret time series graphs	TBAT construct and interpret time series graphs	It is worth discussing seasonal trends and cases where there is no apparent trend		382
	14. Construct and interpret stem and leaf diagrams	TBAT construct and interpret stem and leaf diagrams	As with most of the diagrams in the block, interpretation is just as important as construction. When drawing stem and leaf diagrams, students need to take care to keep numbers in line so that the relative lengths of each line are meaningful. Compare stem and leaf diagrams to horizontal bar charts where all the data is visible, and revisit averages and the range. Include examples with decimal values e.g. 7|3 means 7.3		169 170
	18. Compare distributions using charts and measures	TBAT compare distributions using charts and measures	When comparing distributions, students should look at one of the averages and measure of spread; at Foundation level this will always be the range. The average is used as an indicator of overall performance and the range is used to describe the consistency. Students often only look at the average, so looking at		150

			data sets where the averages are equal but the ranges differ can be useful		
	20. Construct and interpret scatter graphs	TBAT construct and interpret scatter graphs	Students will be familiar with correlation from KS3, but this review step is useful to remind them of the vocabulary and to practice choice of scale when plotting points. Where to start and finish axes are also good points for discussion. It is also worth reinforcing that correlation does not imply causality, and that absence of linear relationship does not necessarily mean that the variables are unconnected		165 166
	21. Draw and use a line of best fit 22. Understand extrapolation	TBAT use a line of best fit and extrapolation	When using lines of best fits to make estimates, students should draw lines from/to the axes to make their intention clear and to improve accuracy. Extrapolation can be demonstrated by looking at examples that give e.g., negative, or other impractical answers. Links could be made to science e.g., considering when relationships may work for certain intervals but not others e.g., length of an extended spring		167
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			

Rationale: This block again mainly revises KS3 content, reviewing prime factorisation and associated number content such as HCF and LCM. After consolidating the content, this block explores triangular and Fibonacci type sequences.

Learning Progression: *topics students have seen that will play a vital role in understanding this block*
Y7: Spring block 2 (use multiples)
Y7: Summer block 5 (prime factorisation, HCF and LCM)
Y7: Autumn block 2 (function machines)
Y7: Autumn block 1 (recognise linear and non-linear sequences)
Y7: Autumn block 2 (generate sequences from an algebraic rule)
Y8: Spring block 2 (revise and extend Y7 coverage on sequences to include some more complex rules)
Y9: Spring block 1 (HCF and LCM)
Y9: Summer block 6 (prime factorisation)
Y9: Autumn block 3 (testing conjectures about sequences)

Key Vocabulary: Integer, factor, multiple, prime, index form, product, arithmetic, geometric, nth term, Fibonacci, square, cube, triangular, linear, non-linear, coefficient

Careers Link: Lighting designers use the lowest common multiple quite often, to plan and set lights to flash at different times. The highest common factor is often used in the textile industry when working out minimum and maximum quantities of stock that is to be produced. Additionally, the lowest common multiple concepts is important to solve problems related to racetracks, traffic lights and to predict when an event occurs again over a same period of time.

Block 13 Types of number & sequences	1. Understand the difference between factors and multiples	TBAT identify the difference between factors and multiples	The main emphasis of this step is to review the difference between a factor and a multiple. The are model is useful in considering factors and links well to factors of algebraic terms. Ensure that students are exposed to non-examples and examples		216 220
	2. Understand primes and express a number as a product of its prime factors	TBAT identify primes and express a number as a product of its prime factors	The language of 'express' and 'product' requires emphasis. Students should use their reasoning skills to make connections between the prime factor decomposition of related numbers		223
	3. Find the HCF and LCM of a set of numbers	TBAT find the HCF and LCM of a set of numbers	Students need to be careful to use prime factors when completing the Venn diagram, rather than just factors		224
	4. Describe and continue arithmetic and geometric sequences	TBAT describe and continue sequences	Students can have the misconception that a common ratio of a geometric sequence has to be a positive integer and so should work with examples of fractions, decimal and negatives	Compound interest Negative numbers	374 375
	5. Explore other sequences	TBAT explore other sequences	Square number and cube number sequences could be included but will be looked at again in the next block so could be omitted if time is short		
	7. Find the rule for the nth term of a linear sequence	TBAT find the nth term of a linear sequence	This step reviews prior learning. Consider using sequences with decimal / fractional differences to extend this. Use of descending sequences can also be used to prompt discussion about the multiplier		228
	Check out Check in next block	TBAT complete check out			
	Feedback lesson	TBAT respond to feedback			
	Summer Assessment				

	Summer Assessment Reflection				