Mathematics is the music of reason

Long Term Plan Year 10/11 Foundation Mathematics

Half Term	Unit Title	Key Knowledge/Content to learn and retain	Essential Skills to acquire (subject & generic)	Link to intent and ethos	Anticipated misconceptions	Links to previous KS	Link to future KS	Opportunity for stretch and high prior attainers	SMSC & British Values	Cultural Capital	Career Link
AUT 1	Developing Geometry	lArea of Trapezia	Calculate the area of a trapezium Calculate the perimeter and area of compound shapes	Ordering the right quantity of turf for a sports field, preparing detailed floor plans, and working out how much fertiliser is needed to treat a field crop all require knowledge and calculations of area	Students do not state the units when finding the length of an unknown. Students don't use the perpendicular height when calculating the area of a triangle or parallelogram; they use the length given for the sloped side. Students don't recognise right-angled trapezia as a trapezium, instead thinking that all trapezia have two sloping sides	The sum of the Units of measurement Perimeter of shapes Substitution	Intergrations	The formulae learned and used can be used to find the area of surfaces of a 3D shape			Farm manager Farmers and farm managers grow crops and raise farm animals for food production.
		Three – dimensional shapes	Surface area of cubes and cuboids Surface area of cubes and cuboids Volume of cubes and cuboids Volume of other 3-D Shapes	Freight costs are dependent upon the volume of material being transported. Freight rates are calculated using the container volume measured against the length of the container. The longer the container the higher the freight cosy	confusing the units for area and volume when calculating surface area For triangular prisms some students will still not use the perpendicular height of the face triangle to calculate the area of the cross-section (when given the slant height).	identify 3D objects calculate area and perimeter of 2D shapes definition and properties of 2D and 3D shapes	Intergration Volume of revolution Differentiation	You can use surface area and volume of solids to form a background for questions on ration and similarity		Things to Make and Do in the Fourth Dimension by Matt Parker	Retail buyer Wholesale buyer, food buyer, buyer for retail
Aut 2	Reasoning with Algebra and the coordinate grid	Straight line graph	Lines parallel to the axes, y=x and y=-x Using tables of values Compare gradients Compare intercepts Understand and use y=mx_c Write an equation in the form y=mx + c Find the equation of a line from a graph Interpret gradient and intercepts of real-life graphs	The curse and lines of buildings are designed using complex equations and their graphs. Architecture is just one of many progression in which people plot and use graphs in their work	Students sometimes think the constant (+c) tells them the step increase (gradient) when plotting coordinates Students occasionally think the '+c' tells them the starting point on the x-axis, rather than the y-axis When plotting lines, students often do not look at the big picture: if they have made a mistake in one of their y-value calculations, the line is no longer straight, but they will nonetheless plot their points regardless.	How to generate terms in a sequence from a given rule. How to identify coordinates of a given point. How to manipulate and solve equations. How to change the subject of a formula.	Linear programming Equations and tangents Tangents to circles Vectors	You can extend the work on straight-line graphs, considering exponential and trigonometric graphs. Problems involving direct proportion can be represented or solved using straight-line graphs			Architect Alternative titles for this job include Architects design new buildings and the spaces around them, and work on the restoration and conservation of existing buildings.

		Rotation and translation Enlargement and Similarity	Rotation (1) Rotation (2) Translations Compare rotation and reflections Series of transformations Positive integer scale factors Enlarge a shape from a point Positive fractional scale factor Negative scale factor Calculation in similar shapers	You can see examples of reflection, rotations, and translations all around you. Patterns in wallpaper and fabric are often translations, images reflected in water are reflection and the blade of a wind turbine are good examples or rotation When you enlarge a photo, project and image onto a screen or make scaled models youoare dealing with similarity. Many toys and other objects are scaled, but similar, versions of larger objects from real life	Confusing the directions clockwise and anticlockwise Assuming that a reflection (mirror) line cannot cover part of a shape Mixing up the x- and y-axes students are generally quite happy with the concept and application of simply enlarging by positive numbers greater than one. Issues arise when students are required to construct their enlargements from a centre of enlargement.	What angles of 90°, 180° and 270° look like. Which way a clockwise and which way an anticlockwise movement goes. How to fluently use the (x, y) coordinates in a 2D-plane . How to recognise numbers in equivalent ratios.	Matrices are the next level of transformations and appear at A level. Matrices can be used to describe all the transformations mentioned in this chapter and some further types of transformations studied in higher level mathematics The effect of increasing a length by a factor and how that changes the area and volume is studied in the topic of differentiation under rates of change. In addition to this, matrices can be used to describe enlargements of objects described in two and three dimensions.	This links closely with the idea of congruence.		Finding Moonshine: A Mathematician's Journey Through Symmetry by Marcus Du Sautoy	Software developer Software developers design, build and test computer programmes. Aerospace engineer Aerospace engineers design, build and maintain planes, spacecraft and satellites.
Spring	Proportional Reasoning	Ratio and Scale Rates	Compare quantities using a ration Share in a ration given total or one part Link ration of graphs Currency conversion Link ratios and scales Use interpret ratio of the form 1 : n and n : 1 Solve best buy problems Solve speed distance time problems without a calculator	Ration is used in many different real-life situations. Converting between different currencies, working out which packet of crisps is the best value for money, mixing large quantities of cement and scaling up a recipe to cater for more people all involve reasoning using ration Measurement has practical applications in many different job but is also important in every day activities. Being able to read	Students may fail to see a difference between the ratios m : n and n : m, not realising that the order in which the ratio is written affects how the quantities are shared Students sometimes think that m ÷ n is the same as m : n; Students perform calculations with values in different units Students treat time like they would the	How to divide quantities using efficient methods The multiplication tables and how to apply them. How to write one amount as a fraction of another. How to identify highest common factors. That multiplication is commutative. How to multiply and divide by powers of 10. Index notation	Trigonometry and sine rule. Constant of proportionality: integration and solving differential equations. In Mechanics, students continue to work with compound measures and build upon their knowledge of speed, and velocity.	Direct and inverse proportion Similarity and enlargement, Probability - combined events .Trigonometry and sine rule Irrational numbers and surds (from the golden ratio) Students will use what they have learnt about average speed		Mathematics for the Curious by Peter Higgins Flatterland by Ian Stewart	paint technician Paint sprayers apply coatings and protective finishes to cars, vans, motorbikes and other vehicles. Cartographer Cartographers collect information about the geography of an area to design and

		Percentage & Interest Multiplicative reasoning	Solve speed distance time problems with a calculator Use distance-time graphs Solve problems with density mass and volume Solve Flow problems and their graphs Rates of change and their units Calculate simple and compound interest Repeated percentage change Find the original value after a percentage change Solve problems involving growth and decay Understand direct proportion Calculate with pressure and density Understand inverse portion	and work with measurements is important when you make or alter clothes, work out what materials you need to build things and weight ingredients to make a recipe Many real-life situations involve growth increase or decay as time passes. Population numbers, growth of bacteria, disease infection rates, word temperature patters and value of money or possession might all increase or decrease over time Proportional reasoning is very common in daily life, you use proportional reasoning when you mix ingredients for a recipe, convert between units of measurement or work out costs per unit. It is an area of maths where you can use many different methods to solve problems	rest of the metric system and hence write 3.5 hours = 3 hours 50 mins or similarly 3 hours 30 mins as 3.3 hours. Some students find it hard to remember what these two types of interest are Confusion between the words ratio and proportion Rounding too early when using the unitary method	How to find the volume of a cuboid How to measure accurately using a ruler and protractor How to convert percentages to decimals. How to find a percentage of a quantity using multiplication. How to increase or decrease a quantity by a given percentage by multiplying by a suitable decimal. How to work with numbers including extensive fractions work. How to write ratios and interpret them. How many minutes there are in fractions of an hour.	Rate of change is the motivation behind differentiation and is used extensively at A level. In addition to this, exponential growth is studied in more detail and leads to the exponential function (based on Euler's number e). Students who go on to A level mathematics will encounter proportionality in the description of rates of change and thus in differential equations	direct and inverse proportion interpreting graphs			produce maps, charts and plans. . Investment analyst Investment analysts help stock market traders, stockbrokers and fund managers make decisions about investments Chef Chefs prepare, cook and present food in hotels, bars and restaurants.
Summer		Three Dimensional shapes	Know names of 2-d and 3-D shapes Recognise prisms including language of edge/vertices Plans and elevations Scale Drawings	Many people use geometry in their jobs and daily lives. Artists, crafts peole builders, designers, architects and engineers use shape and space in their jobs, but almost every uses lines, angles pattern and shapes in different ways everyday	Students sometimes muddle the meanings of face, edge and vertex. Ensure the correct definitions are given at the start of the topic, and reinforced whenever talking about 3D objects. The difference between a prism and a pyramid can be difficult to grasp. To tackle this, ask students to think what would happen if you cut slices of the shape? Would they all be identical (like a	How to identify common 3D objects. Basic properties of polygons and common 3D objects. How to accurately construct lines and angles using ruler and compasses	The volumes of solids of revolution are considered at A2. These are solids formed by rotating a curve around some straight line, for example the sorts of objects that might be produced on a lathe. Working with the three dimensional solid called a parallelepiped is a common source of problems when using vector Methods.	Students will need to use their skills in visualising in three dimensions to tackle problems that use Pythagoras' theorem in solids Considering the net of a solid is a key part of the process of calculating the surface area of a solid in		The Math Book by Clifford A Pickover	Civil engineer Civil engineers design and manage construction projects, from bridges and buildings to transport links and sports stadiums.

					stereotypical loaf of bread)? If so, the shape is a prism. A pyramid can be identified because it has an apex (point) where all but one of the sides (the base)						
		Constructions & congruency	Locus of a distance from a point Locus of a distance from a straight line/shape Locus equidistant from two points Construct a perpendicular bisector Construct a perpendicular from a point Construct a perpendicular to a point Locus of a distance from two lines Construct and angle bisector Construct triangles	Draughts people and architect need to draw accurate scaled diagrams of the building and other structures they are working on. Although the drawings are complicated, they still use ordinary mathematical instruments link pencils and runners and a pair of compasses to draw them	Students struggle with formal language and notations in geometry. For example when a vertex is labelled B, students refer to the angle as B forgetting that there are two possible angles this could be, one less than 180° and the other greater than 180° as a minimum. Having starters based on notation, and highlighting angles and lines given their label, can help identify and recognise these errors at the beginning. Students' work may not be not accurate enough. It could be that they are struggling to work with their pair of compasses and pencil. Having a set of Christmas cracker screwdrivers to hand for loose compasses and reminding students to sharpen their pencils helps with this. Students who struggle to use their pair of compasses because they put too much pressure on it may find it better to spin the paper not the pair of compasse	Properties of angles. Properties of shapes and associated language, including circles. Read and write angles and lines using formal notation conventions. Measure and construct angles using a protractor. Notation conventions including: ⊥ for perpendicular to and || for parallel to. Knowledge of basic ratio and scale.	Parametric equations, which are covered in the second year of A level, give a loci of points on the plane given a parameter. Students will also learn about cycloid curves, similar to the lines formed in the problems related to rolling shapes.	This topic requires accurate use and care of equipment. The development of neatness with drawing is useful for accurate drawing of straight lines (Chapter 23F / 24H Straight-line graphs). Generally, the accuracy developed should improve the quality of sketches.		Excursions in Geometry by C. Stanley Ogilvy	Draughtsperson Draughtspersons prepare technical drawings and plans fiven to them by an architect.
		Pythagoras' Theorem	Identify the hypotenuse of a right-angle triangle Determine whether a triangle is right angles Calculate the hypotenuse of a right angle triangles	Builders, carpenters, garden designers and navigators all use Pythagoras theorem in their jobs. It is a method based on right-angles triangles that helps them to work out unknown lengths	Identifying the hypotenuse incorrectly by mistaking the length that is the longest (often due to the orientation of the triangle). . Misunderstanding that the theorem connects the squares of the side lengths	Understand how to correctly use labels in geometry particularly those that are unique to a triangle, e.g. vertices (A, B …), sides (AB or, for triangles only, lowercase c as it is opposite vertex C), symbol for a right angle.	At A level, Pythagoras' theorem will be employed in many different ways. The most obvious of those is in coordinate geometry where pupils will use Pythagoras' theorem to find the length of line segments in 2D and 3D as well as finding	Trigonometry, will increase students' knowledge of right-angled triangles and opportunities for pupils to solve problems that involve both trigonometry and/or Pythagoras' theorem will be presented. For many students this		Mathematics: A Very Short Introduction by Timothy Gowers	

			Use Pythagoras theorem on coordinates axes Explore proof of Pythagoras' theorem		and forgetting to find the square root. Struggling to rearrange the formula to find a side other than the hypotenuse. Applying (incorrectly) the theorem to non-right-angled triangles	How to use a calculator to find squares and square roots. How to round to a given accuracy (either significant figures or decimal places). . The properties and categories of triangles How to substitute into and rearrange formulae including squares and square roots.	the radius of a circle given the centre and a point on the curve and deducing the equation of the circle. Less direct is its application to deriving trigonometric identities, notably: sin θ / cos θ = Tan θ and its use in deriving the compound angle formulae. It will also be used to calculate the magnitude of vectors in 2D and 3D, and hence many other values associated with compound measures.	will present additional challenge as they will have to select the most efficient method without direction. Pythagoras'			Merchant Navy deck officer Merchant Navy deck officers look after the day-to-day running and navigation of ships, and take care of passengers and cargo.
		Trigonometry	Explore ratio in similar right-angled triangles Work fluently with the hypotenuse, opposite and adjacent sides Use the tangent ratio to find missing side lengths Use sine, cosine and tangent to sing missing side lengths Use sine cosine and tangent to find missing angles	Trigonometry means triangle measurements and is very useful for finding the lengths of sides and sizes of angles in navigation, surveying, astronomy, engineering, construction and even in the placements of satellites and satellites receivers.	Students struggle to identify and label the adjacent and opposite sides because they don't realise it depends on where the given angle is. Students confuse the ratios and struggle to identify which function should be used. Students work with the wrong mode for angle inputs on their calculator. students struggle to rearrange the trig formulae. Students struggle to remember exact values for certain trig ratio	Properties of triangles including notation conventions for angles and sides. How to round to a given accuracy and recognise the effect of rounding. What it means for triangles to be similar and how to use scale factors to calculate side lengths. How to identify and apply knowledge of alternate angles in parallel lines. How to apply Pythagoras' theorem to calculate unknown lengths.	Trigonometry forms a large part of the A level syllabus. Alongside the 2D and 3D problem-solving applications, students will explore the domain and range of each function in detail considering the features of each one. Students will learn to solve more complicated equations involving trigonometric functions and list all solutions in a possible domain. Knowledge of identities will be used to manipulate expressions and reciprocal functions will be used to extend these Ideas.				Geoscientist Geoscientists study the Earth's structure and formation, and analyse rocks to explore its natural mineral and energy resources.
		Angles and bearings	Select the appropriate method to solve right-angle triangle problems work with key angles in right-angled triangles Understand & represent bearings Measure and read bearings Scale Drawings Using Bearings	Measurement has practical applications in many different job but is also important in every day activities. Being able to read and work with measurements is important when you make or alter clothes, work out what materials you need to build things and weight ingredients to make a recipe	Students confuse multiplication and division of the scale factor when working with scale drawings. Students forget what a bearing is and how it compares to a given angle	How to measure accurately using a ruler and protractor	There are few direct links to this topic in the core part of the A level course.	Another personalised way for students to work with scale drawings is to supply them with a series of maps of their local area with different scales. They can then compare the scales given for an area they know and gain an understanding of why scale drawings are needed			

			Bearing with angles rules Bearings & Right angles geometry								Cartographer Cartographers collect information about the geography of an area to design and produce maps, charts and plans.