Scheme of Work 2020-2021 Subject: Mathematics						
Year Group: Year 12 **Specification:** **A level**						
Lesson No	**Topic & Objectives**	**Key Activities & Specialist Terminology**	**Big Think Qs & Stretch**	**Assessment** **(Include relevant GCSE Q stem)**	**Home work**	**Lit** **Num** **SMSC Codes**
	Algebraic expressions: basic algebraic manipulation, indices and surds Objectives: • be able to perform essential algebraic manipulations, such as expanding brackets, collecting like terms, factorising etc; • understand and be able to use the laws of indices for all rational exponents;	1.Recap the skills taught at GCSE Higher Tier 2.Students should be exposed to lots of simplifying questions involving fractions as this is where most marks are lost in exams. 3.Recap the difference of two squares $(x + y)(x – y)$ and link this to $\left(\sqrt{x}+\sqrt{y}\right)\left(\sqrt{x}-\sqrt{y}\right)=x-y$, explaining the choice of term to rationalise the denominator**.** 4.Provide students with plenty of practice and ensure that they check their answers.	Include examples which involve calculating areas of shapes with side lengths expressed as surds. Exact solutions for Pythagoras questions is another place where surds occur naturally		Exam style questions from the book and from maths	

	be able to use and manipulate surds, including rationalising the denominator				genie. com	
	Quadratic functions: factorising, solving, graphs and discriminants Objectives • be able to work with quadratic functions and their graphs; • know and be able to use the discriminant of a quadratic function, including the conditions for real and repeated roots; • be able to complete the square. e.g. $ax^2 + bx + c = a\left(x + \frac{b}{2a}\right)^2 + \left(c - \frac{b^2}{4a}\right)$; • be able to solve quadratic equations, including in a function of the unknown.	1 Start by drawing $y = x^2$ and add different x terms followed by different constants in a systematic way. Then move on to expressions where the coefficient of x^2 is not 1.. 2.Lots of practice is needed as these algebraic skills are fundamental to all subsequent work. Students must become fluent, and continue to develop thinking skills such as choosing an appropriate method, and interpreting the language in a question. 3.Where examples are in a real-life contexts, students should check that solutions are appropriate and be aware that a negative solution may not be appropriate in some situations	The path of an object thrown can be modelled using quadratic graphs. Various questions can be posed about the path: • When is the object at a certain height? • What is the maximum height? • Will it clear a wall of a certain height, a certain distance away?			

	Equation and inequalities Objectives: • be able to solve linear simultaneous equations • be able to solve linear and quadratic inequalities; • know how to express solutions through correct use of ‘and’ and ‘or’ or through set notation; • be able to interpret linear and quadratic inequalities graphically; • be able to represent linear and quadratic inequalities graphically.	Simultaneous equations are important both in future pure topics but also for applied maths. Students will need to be confident solving simultaneous equations including those with non-integer coefficients of either or both variables. The quadratic may involve powers of 2 in one unknown or in both unknowns, e.g. Solve $y = 2x + 3$, $y = x^2 - 4x + 8$ or $2x - 3y = 6$, $x^2 - y^2 + 3x = 50$. Emphasise that simultaneous equations lead to a pair or pairs of solutions, and that both variables need to be found. Students must be able to express solutions using ‘and’ and ‘or’ appropriately, or by using set notation. So, for example: $x < a$ **or** $x > b$ is equivalent to $\{x: x < a\} \cup \{x: x > b\}$ and $\{x: c < x\} \cap \{x: x < d\}$ is equivalent to $x > c$ **and** $x < d$. Inequalities may contain brackets and fractions, but these will be reducible to linear or quadratic inequalities. For example, $\frac{a}{x} < b$ becomes $ax < bx^2$.	Students must be aware of the context and ensure that the solutions they give are appropriate to that context. Simultaneous equations will be drawn on heavily in curve sketching and coordinate geometry. Investigate when simultaneous equations cannot be solved or only give rise to one solution rather than two. Financial or material constraints within business contexts can provide situations for using inequalities in modelling. For those doing further maths this will link to linear programming. Inequalities can be linked to length, area and volume where side lengths are given as algebraic expressions and a maximum or minimum is given.			

	Graphs and transformations Objectives: • understand and use graphs of functions; • be able to sketch curves defined by simple equations including polynomials; • be able to use intersection points of graphs to solve equations.	1.Cubic and quartic equations given at this point should either already be factorised or be easily simplified (e.g. $y = x^3 + 4x^2 + 3x$) as students will not yet have encountered algebraic division. 2.Transformations to be covered are: $y = a\mathrm{f}(x)$, $y = \mathrm{f}(x) + a$, $y = \mathrm{f}(x + a)$ and $y = \mathrm{f}(ax)$. 3.Links can be made with sketching specific curves. Students should be able to sketch curves like $y = (x - 3)^2 + 2$ and $y = \frac{2}{x-3} + 2$	Students should be able to justify the number of solutions to simultaneous equations using the intersections of two curves. Examples can be used in which the graph is transformed by an unknown constant and students encouraged to think about the effects this will have			
	Straight-line graphs, parallel/perpendicular, length and area problems Objectives: • understand and use the equation of a straight line; • know and be able to apply the gradient conditions for two straight lines to be parallel or perpendicular; • be able to find lengths and areas using equations of straight lines;	Equations can be given or asked for in the forms $y = mx + c$ and $ax + by + c = 0$ where a, b and c are integers Students should be able to find the equation of a line given the gradient and a point, either the formula $y - y_1 = m(x - x_1)$ can be used or the values substituted into $y = mx + c$. The length of a line segment is found by using Pythagoras' theorem, which can be written as the formula $d = \sqrt{(x - x_1)^2 + (y_2 - y_1)^2}$	To help students see how much information is given in the equation of a line, a good activity is to give an equation and ask students to find everything they know about that line, e.g. the intercepts, a point on the line, the gradient, a sketch, a parallel line, etc. Modelling with straight-line graphs gives the opportunity to collect data that can then be plotted and a line of best fit used to find an equation			

	• be able to use straight-line graphs in modelling.					
October Half Term						
	Circles: equation of a circle, geometric problems on a grid Objectives: • be able to find the midpoint of a line segment; • understand and use the equation of a circle; • be able to find points of intersection between a circle and a line; • know and be able to use the properties of chords and tangents.	1. Circle theorems from GCSE (9-1) Mathematics can be used in questions so a quick recap could be useful and then they should be incorporated into questions. 2. Drawing sketches or annotating given diagrams 3. Simultaneous equations can be used to find the points of intersection between a circle and a straight line 4. The equation of the circle $(x-a)^2 + (y-b)^2 = r^2$ can be derived from Pythagoras' theorem, giving students the opportunity to look at proof.	The conditions in which a circle and a line intersect can be investigated, with students justifying which will and will not intersect. Investigate finding the equation of a circle given 3 points on its circumference.			
	Algebraic division, factor theorem and proof Objectives • be able to use algebraic division;	Equations in which the coefficient of x or x^2 is 0 for example $x^3 + 3x^2 - 4$ or $2x^3 + 5x - 20$ will need additional explanation and practice. Find a given that $(x-2)$ is a factor of $x^3 + ax^2 - 4x + 6$. Two conditions can also be given in order to form simultaneous equations to solve.	The factor theorem can be introduced through investigation by substituting different values and checking against division to look for patterns.			

	• know and be able to apply the factor theorem; • be able to fully factorise a cubic expression; • understand and be able to use the structure of mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion; • be able to use methods of proof, including proof by deduction, proof by exhaustion and disproof by counter-example.		Students should be familiar with basic proofs from GCSE (9-1) Mathematics this knowledge can be built upon to look at the different types of proof. Students will need to understand how to set out each type of proof; the correct conventions in language and layout should be encouraged			
	The binomial expansion Objectives • understand and be able to use the binomial expansion of $(a + bx)^n$ for positive integer n; • be able to find an unknown coefficient of a binomial expansion.	Students should initially be introduced to Pascal's triangle, which can be used to expand simple brackets. Students will need to be familiar with factorials and the ${}_nC_r$ notation. Students should practice finding the coefficient of a single term, they should also be able to deal with setting up simple algebraic equations to find unknown constants	Use of the binomial expansion can be linked to basic probability and approximations. Be aware of an alternative notation such as $\binom{n}{r}$ and ${}^nC_r$.			

	Trigonometric ratios and graphs Objectives • understand and be able to use the definitions of sine, cosine and tangent for all arguments; • understand and be able to use the sine and cosine rules; • understand and be able to use the area of a triangle in the form $\frac{1}{2}ab\sin C$; • understand and be able to use the sine, cosine and tangent functions; their graphs, symmetries and periodicity.	Use of trigonometric ratios will have been covered at GCSE (9-1) Mathematics; questions should now be focused more on multi-step problems and questions set in context. The unit circle can again be used to show how the trigonometric graphs are formed. Characteristics such as the period and amplitude should be discussed. Knowledge of graphs of curves with equations such as $y = \sin x$, $y = \cos(x + 30)$, $y = \tan 2x$ is expected so this is a good opportunity to recap transformations	Use of the graphs can be linked to modelling situations such as yearly temperatures, wave lengths and tidal patterns. Proof of the sine and cosine rules.			
Christmas Holidays						