CURIOSITY COMPASSION COURAGE

Curriculum Overview

Subject	Mathematics	Year group	13
Vision statement:	At Landau Forte our curriculum exists to ensure all students regardless of background and ability have the opportunity to unlock their potential. We are committed to students being challenged from their previous key stage learning experiences. Our broad and balanced curriculum is ambitious, coherently planned and sequenced, and will provide the platform for preparing students with the foundations for examination success. Our Curriculum Intent has been informed by a wide variety of researchers and is steeped in evidence based research. Christine Counsell summarises the aspiration of our curriculum to empower all learners creating a pathway to success in university, their career and life: *'A curriculum exists to change the pupil, to give the pupil new power. One acid test for a curriculum is whether it enables even lower attaining or disadvantaged pupils to clamber into the discourse and practices of educated people, so that they gain powers of the powerful.'* As well as excellent academic success we aim to ensure our students leave us as polite and well-rounded young adults. Our new core values of Compassion, Courage and Curiosity are currently being embedded throughout our curriculum offer to ensure we continue to meet our social, emotional, spiritual and moral obligations.		
Curriculum intent:	All students acquire the mathematical life skills necessary for the world of work, no matter what their starting point is, catering for all abilities and backgrounds. We have a strong belief that all students can achieve in Maths. Students will be taught to have a firm understanding of number bonds and be confident in using non-calculator strategies for solving problems. Students will be stretched and challenged through problem solving tasks to develop resilience. Students are encouraged to show **courage** through attempting questions in environment where other students show **compassion** through a culture of being non-judgmental when questions are answered incorrectly. Students are also encouraged to show **curiosity** through asking questions and taking a genuine interest in the real life applications of the Maths that they are learning. This will be achieved by staff working together in planning lessons that allow ALL students to achieve/ exceed their potential through: Common lesson planning formats; Expert knowledge of the subject; Differentiated material; Regular use of AfL to assess progress in a lesson; Regular use of formal marking and feedback; Regular summative assessments to ensure appropriate progress and intervention.		
Threshold Concepts (TCs):	TC1 Algebraic manipulation - This concept involves recognising mathematical properties and relationships using symbolic representation TC2 Number sense - This concept involves understanding the number system and how they are used in a wide variety of mathematical ways TC3 Shape facts - This concept involves recognising the names and properties of geometry shapes and angles. TC4 Multiplicative reasoning - This concept involves using ratio and proportion and understanding of reciprocals in real world applications TC5 Representing and interpreting data - This concept involves interpreting, manipulating and presenting data in various ways. TC6 Calculator skills - This concept involves fluent application of mathematical operations on a scientific calculator TC7 Understanding and calculating risk - This concept involves knowing the rules of probability in the correct context		

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KS4 National Curriculum summary:	The national curriculum for mathematics aims to ensure that all pupils: • become fluent in the fundamentals of mathematics, including through varied and frequent practice with increasingly complex problems over time, so that pupils develop conceptual understanding and the ability to recall and apply knowledge rapidly and accurately. • reason mathematically by following a line of enquiry, conjecturing relationships and generalisations, and developing an argument, justification or proof using mathematical language • can solve problems by applying their mathematics to a variety of routine and non-routine problems with increasing sophistication, including breaking down problems into a series of simpler steps and persevering in seeking solutions. Mathematics is an interconnected subject in which pupils need to be able to move fluently between representations of mathematical ideas. The programme of study for key stage 4 is organised into apparently distinct domains, but pupils should develop and consolidate connections across mathematical ideas. They should build on learning from key stage 3 to further develop fluency, mathematical reasoning and competence in solving increasingly sophisticated problems. They should also apply their mathematical knowledge wherever relevant in other subjects and in financial contexts.					
Learner skills:	Critical thinking CRITICAL THINKING	Organisation ORGANISATION	Collaboration COLLABORATION	Adaptability ADAPTABILITY	Oracy ORACY	Self-quizzing SELF QUIZZING
	Term 1 Aug-Oct	Term 2 Nov-Dec	Term 3 Jan-Feb	Term 4 Mar-Apr	Term 5 Apr-May	Term 6 Jun-Jul
Big picture questions:	**How else can we write complex numbers?** **What is De Moivre's Theorem?** **How do complex numbers relate to trigonometric identities?**	**How can we find volumes of revolution when curves are defined parametrically?** **Can we find volumes of revolution for more complex functions?**	**How do we solve first order differential equations?** **How do we solve second order differential equations?**	**How can we model situations using differential equations?** **What is harmonic motion?** **How can we solve linear programming problems**		

	How do we use the method of differences to find the sum of a finite series? **How do we write the Maclaurin series expansion of a function?** **What is an improper integral?** **How do we use trigonometric substitution to integrate rational functions?** **How do we use partial fractions to integrate functions?**	**What are polar coordinates?** **What are hyperbolic functions?**	**How do I use the vertex testing method to solve optimisation problems?** **How do I use the objective line method to solve optimisation problems?** **What is Newton's law of restitution?** **How do direct impacts and collisions work?**	**with more than 2 variables?** **What is oblique impact?**		
Content (Linked to TCs):	TC1 Algebraic manipulation TC2 Number sense TC3 Shape facts TC6 Calculator skills **Complex Numbers** Exponential form of complex numbers Multiplying and dividing complex numbers De Moivre's theorem Trigonometric identities Sums of series nth roots of a complex number Solving geometric problems	TC1 Algebraic manipulation TC2 Number sense TC3 Shape facts TC6 Calculator skills **Volumes of revolution** Volumes of revolution around the x-axis Volumes of revolution around the y-axis Volumes of revolution parametrically defined curves Modelling with volumes of revolution **Polar Coordinates**	TC1 Algebraic manipulation TC2 Number sense TC3 Shape facts TC5 Representing and interpreting data TC6 Calculator skills **Methods in Differential Equations** First-order differential equations Second-order homogenous differential equations	TC1 Algebraic manipulation TC2 Number sense TC3 Shape facts TC5 Representing and interpreting data TC6 Calculator skills **Modelling with Differential Equations** Modelling with first-order differential equations Simple harmonic motion Damped and forced harmonic motion		

	Series The method of differences Higher derivatives Maclaurin series Series expansions of compound functions **Methods in Calculus** Improper integrals The mean value of a function Differentiating inverse trigonometric functions Integrating using partial fractions	Polar coordinates and equations Sketching curves Area enclosed by a polar curve Tangents to polar curves **Hyperbolic Functions** Introduction to hyperbolic functions Inverse hyperbolic functions Identities and equations Differentiating hyperbolic functions Integrating hyperbolic functions	Second-order non-homogenous differential equations Using boundary conditions **Linear Programming** Linear programming problems Graphical methods Locating the optimal point Solutions with integer values **Elastic Collisions in One Dimension** Direct impact and Newton’s law of restitution Direct collision with a smooth plane Loss of kinetic energy Successive direct impacts	Coupled first-order simultaneous differential equations **Simplex Algorithm** Formulating linear programming problems The simplex method Problems requiring integer solutions Two-stage simplex method The Big-M method **Elastic Collisions in Two Dimensions** Oblique impact with a fixed surface Successive oblique impacts Oblique impact of smooth spheres.		
Key vocabulary:	**Complex Numbers** Imaginary number, complex number, exponential form, Euler’s relation, identity, Argand diagram, De Moivre’s theorem, trigonometric identities, series, nth roots, nth roots of unity, geometric problems. **Series**	**Volumes of Revolution** Integrate, volume of revolution, radians, function, parametric equations, modelling. **Polar Coordinates** Pole, initial line, trigonometry, polar coordinates, loops, polar curves, cardioid,	**Methods in Differential Equations** First order differential equation, separation of variables, general solution, integrating factor, second-order differential equations, homogeneous, auxiliary equation, non-homogeneous, particular	**Modelling with Differential Equations** Differential equations, first order differential equations, simple harmonic motion, acceleration, displacement, line of motion, centre of oscillation, damping force, damped harmonic motion, heavy damping,		

	Method of differences, series, sigma, derivatives, Maclaurin series, valid series, expansion, compound functions. **Methods in Calculus** Improper integrals, infinite, convergent, divergent, limits, mean value, inverse trigonometric functions, partial fractions,	tangents, parallel, perpendicular, **Hyperbolic Functions** Hyperbolic sine, hyperbolic cosine, hyperbolic tangent, inverse hyperbolic functions, domain, range, restricted domain, identities, equations, Osborn's rule,	integral, boundary conditions. **Linear Programming** Decision variables, objective function, constraints, inequalities, feasible solution, optimal solution, maximisation, minimisation, non-negativity, graphical method, objective line, vertex testing, integer solution. **Elastic Collisions in One Dimension** Direct impact, Newton's law of restitution, separation of particles, coefficient of restitution, coalesce, perfect elastic collision, totally inelastic collision, conservation of linear momentum, smooth plane, speed of rebound, speed of approach, kinetic energy.	critical damping, light damping, equilibrium position, forced harmonic motion, coupled first-order linear differential equations. **Simplex Method** Decision variables, objective, constraints, slack variables, simplex method, simplex tableau, basic variable, basic feasible solution, pivot, two-stage simplex method, surplus variable, non-basic variable, artificial variable, big-M method. **Elastic Collision in Two Dimensions** Oblique impact, change in momentum, velocity, Newton's law of restitution, angle of deflection, lines of centres.		
Assessment:	**Unit Assessments**	**Unit Assessments** **PPE 1**	**Unit Assessments**	**Unit Assessments** **PPE 2**	**Final Exam**	
Key/Historical misconceptions in this unit:	**Complex Numbers** • Assuming laws of indices work the same way with complex	**Volumes of Revolution** • Mixing up volumes of revolution when rotating around	**Methods in Differential Equations** • Using the wrong method eg integrating	**Modelling with Differential Equations** • Using the wrong form of	•	•

	numbers as real numbers. • Using De Moivre's theorem for complex numbers in exponential form. • Not choosing consecutive values when getting distinct roots in the nth roots of unity. **Series** • Not writing enough terms in the method of differences to see which terms cancel. • Writing a Maclaurin series when the series does not converge. • Using degrees instead of radians in expansions of trigonometric functions. **Methods in Calculus** • Not writing the correct limiting	the x-axis or y-axis. • Not rewriting the limits in terms of t when using parametric equations. **Polar Coordinates** • Not drawing a diagram to see which quadrant the pole lies in. • Not measuring the polar angle from the positive x-axis. **Hyperbolic Functions** • Thinking sinh is an even function. • Thinking cosh is an odd function. • That the derivative of cosh is –sinh not sinh. •	factor instead of separating the variables. • Trying to find a particular solution to a second-order differential equation without knowing two boundary conditions. • Using the wrong form of particular integral. **Linear Programming** • Incorrectly writing some constraints. • Shading the wrong side of the inequality constraints. • Not realising a problem requires integer solutions. **Elastic Collisions in One Dimension** • Using the wrong speeds and signs for speed of approach and separation.	harmonic motion. **Simplex Method** • Making numerical errors with pivots in the simplex tableau. • Incorrectly altering all constraints including non-negativity constraint when using slack variables. **Elastic Collisions in Two Dimension** • Using the wrong speeds and signs for speed of approach and separation.		

	process in working. • Not splitting the integral into the sum of two improper integrals when both limits of an integral are infinite.					
Sequencing:	**We have chosen to sequence the further maths curriculum in this way for a number of reasons. A lot of topics build on each other, for example Argand diagrams can only be learnt once complex numbers have been completed, the same for matrices and linear transformations. Some topics have been moved, such as volumes of revolution, to allow for the pre-requisite knowledge to be taught in A Level Maths first. Some Year 13 A Level knowledge is incorporated into the Year 12 Further Maths curriculum to allow for students to have the pre-requisite knowledge for some of the first Year 13 topics.**					