CURIOSITY COMPASSION COURAGE

Academic outline 2022-23

	A Level Mathematics					
	Term 1 Aug-Oct	Term 2 Nov-Dec	Term 3 Jan-Feb	Term 4 Mar-Apr	Term 5 Apr-May	Term 6 Jun-Jul
Year 12:	• Pure Chapter 1 – Algebraic Expressions • Pure Chapter 2 – Quadratic Functions • Pure Chapter 3 – Equations/Inequalities • Pure Chapter 4 – Graphs/Transformations • Pure Chapter 5 – Straight Line Graphs • Pure Chapter 6 - Circles	• Pure Chapter 9 – Trigonometric ratios and graphs • Pure Chapter 7 – Algebraic Fractions/Factor Theorem/Proof • Pure Chapter 11 - Vectors • Applied Chapter 1 – Statistical Sampling • Applied Chapter 2 – Data presentation and interpretation • Applied Chapter 8 – Quantities and units in mechanics • Applied Chapter 9 – Kinematics 1	• Pure Chapter 12 – Differentiation • Pure Chapter 10 – Trigonometric ratios and graphs • Pure Chapter 8 – Binomial Expansion • Applied Chapter 3 - Data presentation and interpretation	• Pure Chapter 13 - Integration • Pure Chapter 14 – Exponentials and Logarithms • Applied Chapter 10 – Forces and Newton's laws	• Revision for exams	

Year 13:	• Pure Chapter 1 – Algebraic Methods • Pure Chapter 2 – Functions and Graphs • Pure Chapter 3 – Series and Sequences • Pure Chapter 4 – the binomial theorem • Applied Chapter 1 – Regression and correlation • Applied Chapter 4 - Moments	• Pure Chapter 5 – Trigonometry (Radians and small angles) • Pure Chapter 9 – Differentiation • Pure Chapter 6 – Trigonometry (secant, cosecant and cotangent) • Pure Chapter 12 – Vectors (3D) • Applied Chapter 2 – Functions and Graphs • Applied Chapter 5 – Friction and forces	• Pure Chapter 7 – Trigonometry (Compound and double angle formulae) • Pure Chapter 8 – Parametric Equations • Pure Chapter 10 – Numerical methods • Pure Chapter 11 - Integration	• Applied Chapter 3 – The normal distribution • Applied Chapter 6 – Applications of kinematics (Projectiles) • Applied Chapter 7 – Applications of forces • Applied Chapter 8 – Further kinematics		[redacted]

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
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.

CURIOSITY COMPASSION COURAGE

Learner skills:	Critical thinking  	Organisation  	Collaboration  	Adaptability  	Oracy  	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
The Big Question						
Big picture questions:	**What is a partial fraction?** **How do I model with functions?** **What is a series?** **How can I apply the binomial theorem?** **How can I use hypothesis testing when the correlation is 0?** **What is meant by the centre of mass?**	**How can I apply trigonometry to more complex problems?** **How do I differentiate more complex functions?** **How do I use vectors in 3D?** **What is meant by conditional probability?** **How can I resolve forces when working with friction?**	**How can I apply trigonometry to more complex problems?** **What is meant by a parametric equation?** **What numerical methods can I use to solve problems?** **How do I apply integration?**	**How can I apply the normal distribution to problems?** **How do I apply kinematic knowledge to problems involving projectiles?** **How do I solve problems with particles?** **How can I use calculus to solve acceleration problems?**		

Content (Linked to TCs):	**Algebraic Methods** Proof: Examples including proof by deduction* and proof by contradiction Algebraic and partial fractions Simplifying algebraic fractions Partial fractions **Functions & Graphs** Modulus function Composite and inverse functions Transformations Modelling with functions* *examples may be Trigonometric, exponential, reciprocal etc. **Series and sequences** Arithmetic and geometric progressions (proofs of 'sum formulae') Sigma notation Recurrence and iterations **The binomial theorem**	**Trigonometry** Radians (exact values), arcs and sectors Small angles **Differentiation** Differentiating sin x and cos x from first principles Differentiating exponentials and logarithms Differentiating products, quotients, implicit and parametric functions. Second derivatives (rates of change of gradient, inflections) Rates of change problems* (including growth and kinematics) **Trigonometry** Secant, cosecant and cotangent (definitions, identities and graphs); Inverse trigonometrical functions; Inverse trigonometrical functions **Vectors (3D)** Use of vectors in three dimensions; knowledge of column vectors and i, j and k unit vectors **Probability** Using set notation for probability Conditional probability	**Trigonometry** Compound* and double (and half) angle formulae *geometric proofs expected R cos (x ± α) or R sin (x ± α) Proving trigonometric identities Solving problems in context (e.g. mechanics) **Parametric equations** Definition and converting between parametric and Cartesian forms Curve sketching and modelling **Numerical methods** Location of roots Solving by iterative methods (knowledge of 'staircase and cobweb' diagrams) Newton-Raphson method Problem solving **Integration** Integrating xn (including when n = –1), exponentials and trigonometric functions. Integrating functions defined parametrically. Using the reverse of differentiation, and using	**The Normal distribution** Understand and use the Normal distribution Use the Normal distribution as an approximation to the binomial distribution Selecting the appropriate distribution Statistical hypothesis testing for the mean of the Normal distribution **Applications of kinematics: Projectiles** Resolving horizontal and vertical components Solving problems invoving particles projected at an angle Derive formulae for time, flight, range and greatest height, and equation of path **Applications of forces** Equilibrium and statics of a particle (including ladder problems) Dynamics of a particle **Further kinematics** Constant acceleration (equations of motion in 2D; the i, j system) Variable acceleration (use of calculus and finding vectors	**Revision for exams**	[redacted]

	Expanding (a + bx)n for rational n; knowledge of range of validity Expansion of functions by first using partial fractions **Regression and correlation** Change of variable Correlation coefficients Statistical hypothesis testing for zero correlation **Moments** Moments: Forces' turning effect Forces at any angle Resolving forces Centre of mass	Questioning assumptions in probability **Friction and Forces** Friction forces (including coefficient of friction μ)	trigonometric identities to manipulate integrals Integration by substitution Integration by parts Use of partial fractions Areas under graphs or between two curves, including understanding the area is the limit of a sum (using sigma notation). Areas under curves expressed parametrically The trapezium rule Differential equations (including knowledge of the family of solution curves)		
Key vocabulary:	Proof, verify, deduction, contradict, rational, irrational, square, root, prime, infinity, square number, quadratic, expansion, trigonometry, Pythagoras. Function, mapping, domain, range, modulus, transformation, composite, inverse, one to one, many to one, mappings, reflect, translate, stretch.	Pythagoras, Pythagorean triple, right-angled triangle, opposite, adjacent, hypotenuse, trigonometry, sine, cosine, tangent, secant, cosecant, cotangent, SOHCAHTOA, exact, symmetry, periodicity, identity, equation, interval, quadrant, degree, radian, circular measure, infinity, asymptote, small angles, approximation, identity.	Pythagoras, Pythagorean triple, right-angled triangle, opposite, adjacent, hypotenuse, trigonometry, sine, cosine, tangent, secant, cosecant, cotangent, SOHCAHTOA, exact, symmetry, periodicity, identity, equation, interval, quadrant, degree, radian, circular measure, infinity, asymptote, small angles, approximation, identity.	Binomial, discrete distribution, discrete random variable, uniform, cumulative probabilities Normal, mean, variance, continuous distribution, histogram, inflection, appropriate probability distribution. Projectile, range, vertical, horizontal, component, acceleration, gravity, initial velocity, vector,	

	Sequence, series, finite, infinite, summation notation, ∑∑(sigma), periodicity, convergent, divergent, natural numbers, arithmetic series, arithmetic progression (AP), common difference, geometric series, geometric progression (GP), common ratio, $n$nth term, sum to nn terms, sum to infinity (S∞)(S∞), limit. Binomial, expansion, theorem, integer, rational, power, index, coefficient, validity, modulus, factorial, nCrnCr, combinations, Pascal's triangle, partial fractions, approximation, converges, diverges, root. Hypotheses, significance level, one-tailed test, two-tailed test, test statistic, null hypothesis, alternative hypothesis, critical value, critical region, acceptance region, p-value, binomial model, correlation coefficients, product moment correlation coefficient, population	Derivative, tangent, normal, turning point, stationary point, maximum, minimum, inflexion, implicit, differential equation, rate of change, product, quotient, first derivative, second derivative, increasing function, decreasing function. Vector, scalar, column, 3D coordinates, vertices, Cartesian, i, j, k, magnitude, origin, distance, direction, angle, position vector, unit vector, vector addition/subtraction. Sample space, exclusive event, complementary event, discrete random variable, continuous random variable, mathematical modelling, independent, mutually exclusive, Venn diagram, tree diagram, set notation, conditional probability, two-way tables, critiquing assumptions. Force, weight, tension, thrust, friction, coefficient of friction, μ, limiting, reaction,	Parametric, Cartesian, convert, parameter t, identity, eliminate, substitute, circle, hyperbola, parabola, ellipse, domain, modelling, differential, integral, area. Roots, continuous, function, positive, negative, converge, diverge, interval, derivative, tangent, chord, iteration, Newton-Raphson, staircase, cobweb, trapezium rule. Integral, inverse, differential, coefficient, index, power, negative, reciprocal, natural logarithm, coefficient, exponential, identity, sin, cos, tan, sec, cosec, cot, parametric, definite integral, integrand, limit, indefinite integral, constant of integration, trapezium, substitution, by parts, area, differential equation, first order, separating variables, initial conditions, general solution.	angle of projection, position, trajectory, parabola. Force, resultant, component, resolving, plane, parallel, perpendicular, weight, tension, thrust, friction, air resistance, reaction, driving force, braking force, force diagram, equilibrium, inextensible, light, negligible, particle, rough, smooth, incline, uniform, friction, coefficient of friction, concurrent, coplanar. Distance, displacement, speed, velocity, constant acceleration, constant force, variable force, variable acceleration, retardation, deceleration, initial (tt = 0), stationary (speed = 0), at rest (speed = 0), instantaneously, differentiate, integrate, turning point.	

	coefficient, sample, inference, mean, normal distribution, variance, assumed variance, linear regression, interpolation, extrapolation, coded data Moment, turning effect, sense, newton metre (N m), equilibrium, reaction, tension, rod, uniform, non-uniform, centre of mass, resolve, tilting, 'on the point', concurrent.	resultant, magnitude, direction, bearing, force diagram, equilibrium, inextensible, light, negligible, particle, smooth, rough, uniform, perpendicular.			[redacted]
Assessment:	**Unit Assessments**	**Unit Assessments** **PPE 1**	**Unit Assessments**	**Unit Assessments** **PPE 2**	
Key/Historical misconceptions in this unit:	**Interchanging range with domain, 1 to 1 and 1 to many** **Geometric and arithmetic progression, negative ratios on geometry progression difference between geometric sequence and series, nth term formula and sum formula**	**Ensuring negatives in the correct place for sin and cos, chain rule, quotient rule and product rule** **Interchanging position vector with direction vectors,**	**Using radians for calculations, interchanging reciprocal graphs to inverse functions.**		
Sequencing:	**We have chosen to sequence the year 13 curriculum like this because it builds on the concepts learnt in year 12 and progresses forward to provide students with the skills for their next steps. The pure content is completed by the end of academy term 3 to allow for students to complete a number of past papers to best prepare them for their exams.**				

CURIOSITY COMPASSION COURAGE