STUDENT FRIENDLY CHESTERTON MATHS CURRICULUM: KS5

Content at KS5 is split between two teachers: Teacher A focuses on Pure Maths (mostly relating to Calculus) and Mechanics Teacher B focuses on Pure Maths (mostly trigonometry and functions) and Statistics.

All topics constituting AS maths are taught in Year 12, but a few topics are taught quite late in the year. Some A2 content is taught in Year 12 to provide better sequencing to the learning

	Year 12		Year 13	
	A Pure + Mech	**B Pure + Stats**	**A Pure + Mech**	**B Pure + Stats**
Term 1a	Core Algebra: Indices, Surds and Rearranging. Simultaneous equation Concepts of Proof Coordinate geometry	Polynomials,Quadratics and Cubics Inequalities	Integration II Integration III	Algebraic Fractions Partial Fractions Discrete Random Variables Hypothesis Testing I
Term 1b	Binomial Expansions DifferentiationI	Functions TrigonometryI	Friction Statics	General Binomial Expansion Numerical Methods The Modulus Function
Term 2a	IntegrationI Kinematics and Motions	Radians Measure Graph Transformation	Parametric Equations Related Rates of Change Projectiles	Normal Distribution Hypothesis Testing II
Term 2b	Vectors Forcesand Equilibrium	Exponentials and Logarithms Sequences and Series	Differential Equations	Correlation Coefficient
Term 3a	Newton's 2nd Law Differentiation II	Trigonometry II Analysis of Data	Revision	Revision
Term 3b	Natural logarithms e^x Differentiation III	Probability		

Pure

Mechanics

Statistics

Key Maths Skills are taught intrinsically within all themes and are developed across the year groups

FLUENCY AND RECALL
REASONING AND PROOF
APPLICATION AND PROBLEM SOLVING
MATHEMATICAL COMMUNICATION

By the End of Year 9 all student will have covered the GCSE content to ***at least*** to Grade 4

Intent		What new knowledge/content do we introduce?			
By the end of KS5 students are able to…		**Year 12**	**Year 13**	**Choices and Rationale for Sequencing**	**How does this curriculum incorporate the National Curriculum and go beyond? How does going beyond the NC ensure challenge?**
Communicate using precise and consistently accurate mathematical language and notation. Solve complex multi-stage problems that draw on a variety of maths skills from across the syllabus. Use their calculators efficiently to solve problems and be able to recognise problems where a numerical approach is the best approach and when it is not. Analyse and interpret a data set using mathematical tools and spreadsheets to make inferences about populations by considering samples and probabilities. Model limited mechanical systems using mathematical equations and understand their limitations. Reason, argue and prove using mathematical arguments.	**Autumn**	Core algebraic skills from GCSE: Indices, Surds, rearranging complex algebraic formulae, polynomial multiplication and division, the factor theorem and solving linear, quadratic, cubic and simultaneous equations, solving linear and quadratic inequalities, understanding the equation of a straight line and the general equation of a circle, understanding the link between solving equations and their graphs including the discriminant for quadratics and tangents to curves. Mathematica notation and the concepts of direct proof, counter proof and proof by contradiction.	Algebraic fractions simplification and a arithmetic review extend to partial fractions with linear factors, repeated linear factors and irreducible quadratic factors Integration review as reverse of differentiation including polynomials: e, sin, cos. Extend to integrating more complex functions by inspection and then formalise to integrating by substitution. Integration by parts. Use of the double angle formula to integrate $\sin^2 x$ and the use of partial fractions to integrate complex fractions. Definition of a discrete random variable and the Binomial distribution. Hypothesis testing using the Binomial distribution.	The content of A level maths is defined as being the same across all exam boards. The style of the exam papers are different. We particularly like the OCR syllabus because of the long standing work done in developing A level maths and A level maths resources (such as the integral website) and because the optional content for Further Maths meshes better with our preferred arrangement for teaching Further Maths students in a separate group. The scheme of learning teaches the majority of AS in Year 12 and the majority of A2 in Year 13 but the sequencing has been adjusted for some topics to enable us to build subject knowledge around principles of understanding (for example in mechanics we have included force problems that require resolving in Year 12 rather than doing this work twice, once with unresolved forces in Year 12 and then again with resolved forces in Year 13). When designing the structure of the course, the content has been split between two teachers: one focusing on Mechanics and Calculus and the other on Statistics and the rest of the Pure content. Both teachers begin the year teaching pure content much of which is a revision of key concepts from GCSE. Challenge when reviewing and extending core GCSE content is provided: • By posing problems that require a greater understanding of the underlying principles I the mathematics. • Using examples that do not conform to the standard methods of solving and require alternative approaches • Looking at the validity of different approaches • Getting students to be rigorous in their mathematical communication and arguments/proving generalised results	The curriculum is designed to enable students to access top University courses in mathematics and related subjects. As such we routinely enter students for UKMT maths challenges at the Senior level and provide support in preparing for University entrance exams and interviews. To assist with this process the lessons and resources used to support the scheme of learning routinely have problems taken from UKMT challenges, AEA exams and Cambridge STEP papers. Where possible the mechanics and statistical parts of the syllabus have opportunities for students to take part in real life modelling (For example: checking the laws of kinematics, calculating the coefficient of friction by sliding down tables, looking to see if the number of chocolate chips in a chocolate chip cookie follows a Poisson distribution)
		Binomial expansions for positive integer powers and identifying specific terms, application to approximations. Differentiation of polynomials from first principles, gradient functions, finding equations of tangents and normal and applications to maxima and minima problems. Increasing and decreasing functions, second derivitives. Mappings and functions, the definition of a function, the domain, co-domain and range, compound functions and inverse functions. Definitions of sine, cosine, tangent and applications of the sine rule and cosine rule to geometry. Solving trig equations, definitions of sec, cosec and cot and the use of Pythagorean identities in solving trig equations.	Formal definition of Friction in mechanical systems. Friction as a limiting value. Using the proper definition of friction in all the cases studied so far: single and connected particles in equilibrium and on slopes, single and connected particles accelerating at a constant rate. Statics - Understand that for objects not modelled as a particle the position of the forces is important. Be able to calculate the moment of a force around a point. Understand that for a body to be in equilibrium there must be no resultant force and no resultant moment. Know that the moment generated by the weight acts at the centre of mass and be able to locate the centre of mass for uniform, symmetrical bodies. Be able to solve problems in equilibrium using moments General Binomial expansion and the validity range. Applications to approximations and involving partial fractions. Numerical methods - using a change of sign to locate an approximate solution to an equation. Use x = g(x) and direct iteration to solve an equation. Interpret with cobweb diagrams and recognise that rate of convergence is related to gradient. Apply Newton Raphson method for solving an equation Recognise and use the modulus function and its graph. Use a graphical and a squaring approach to solve equations using the modulus function.		
	Spring	Integration of polynomials as the reverse of differentiation and then as the limit of a sum to find the area underneath a curve or between two curves. Radians, definition and use in finding arc lengths and sector areas. Solving trig equations using radians and involving sine, cosine, tangent, sec, cosec and cot - link to identities from the Autumn term. Small angle facts and uses. Kinematics, distance, speed and acceleration time graphs and the relationship with displacement, velocity and acceleration time graphs as vector quantities. Suvat equations for problems involving constant acceleration. Differentiation and integration to solve problems involving non-constant acceleration	Understand what parametric equations are be able to plot them and differentiate the find the first derivative. Be able to convert between Cartesian and parametric equations and from parametric to Cartesian equations. Recognise and understand the properties of the normal distribution. Be able to model using the normal distribution to find related probabilities by standardising and using tables/calculator as appropriate. Use probabilities from a normal distribution to calculate a population mean and standard deviation. Understand that the sample mean distribution has a normal distribution if the underlying distribution is normal (or		

		Graph sketching - Basic graph types and sketching from using all four transformations and reflections in both axes combined.	suitably large) and calculate probabilities for the sample mean. Understand the link between the Binomial and Normal distributions. Projectiles. Revise suvat equations in 1d and extend to 2d. Model a particle under constant acceleration, understanding the limitations of the model. Solve problems involving finding the velocity, maximum height and range. Derive and use a trajectory equation in Cartesian form to model a projectile Related rates of change. Understand the relationship between dy/dx and dx/dy. Use rates of change to solve problems involving related variables.	As the year progresses the courses is designed so that students are generally studying some pure content with one of their teachers, whilst studying applied content with the other. To assess progress we use a variety of core assessments: • Half termly assessments (exam conditions) • Written assessments using exam standard questions (2-3 per half term) based on a cross-section of recently taught topics • These assessments are kept in student feedback folders We also set: • 100 mins of homework each week to improve fluency in core skills and to provide exposure to exam style questions • Independent-learning tasks once per half term where students work through a series of guided tasks to investigate and a topic before being formally taught the topic in class	
		Logarithms and power equations, log rules fo algebra and linearising graphs. Arithmetic and geometric sequences and series including summation notation and the sum to infinity of a GP. Definition of a vector and vector notation, modulus and 'argument'. Problems involving vector geometry in 2d including kinematics problems involving constant acceleration. Forces: Types of forces. Forces in equilibrium and resolving forces. Forces in equilibrium on a slope and involving connected particles. Friction: Problems in equilibrium involving friction	Differential equations - what are they and how to form them. Include cases involving related rates of change. Be able to solve a differential equation by separating the variables and be able to interpret the results Hypothesis testing with the normal distribution. Conduct Hypothesis testing for the mean of a distribution and the sample mean of a distribution. Understand that Persons Correlation Coefficient can be used to calculate how close bi-variate data lies to a perfect correlation (a line). Perform a test for Pearsons Correlation Coefficient.		
	Summer	Newton's second law and RF= ma, solving problems involving forces on one particle or connected particles including slopes. The chain rule, product rule and quotient rule for differentiation and applications to maxima and minima problems Data analysis - collecting data and sampling, measures of location and measures of spread including the mean and standard deviation, representations of data using histograms, box plots, scatter graphs and cumulative frequency curves. Trigonometry - the compound angle formulae, double angles and their identities. Applications of the compound angle formulae to maxima/minima and solving equations, Proving trig identities using all the common A level identities and applications of the double angle formulae to solving trig equations.	Revision		
		Definition of e^x and ln x. ln and e algebra. Properties of their graphs, differentiation of e^x and ln x and applications. Differentiation of sinx, cosx, tanx and applications, including the use of chain, product and quotient rule. Implicit differentiation. Probability notation, single event probability, combined event probability, conditional probability, venn diagrams and tree diagrams, Bayes' theorem and probability distribution tables			

	How does the KS5 Curriculum build on previous learning at KS4?	Students are expected to be at grade 7 and fluent in maths to join the maths course. The first terms work largely overlaps with GCSE skills from the Higher syllabus and we ensure that all students get exposure to these to iron out inconsistencies and to enable us to identify any gaps in knowledge that need to be filled quickly. Students who have sat Additional Maths or Further Maths as an FSMQ alongside GCSE maths still cover these topics but extensive use is made of UKMT maths challenge, AEA and Step standard questions to ensure deeper thinking and understanding. This is particularly important provision for students studying both A level Maths and Further Maths.		