Maths Unit Overview Year 12

Rationale for doing C1 first
Provides a more manageable step from GCSE for some – questions are slightly easier than in Pure 1 book – and ensure prior knowledge from GCSE is secure.
Builds some interleaved/spaced practice into the course by covering several key topics quickly in C1 and then revisiting them and building on them in Pure 1.
Good bank of past papers allows for reliable assessment early on – this has proved key for many students appreciating the need to 'step up'
For higher attainers extension links can be used to provide challenge if needed
Rationale for basing the scheme on the textbook
Book is well designed with chapters building on each other and covers the required content of the course
Provides an easy-to-follow structure for the students and staff
Can still be supplemented to provide a rich curriculum
Rationale for continuous teaching (not splitting the content between two teachers)
Previous results suggest this benefits lower-attaining students' outcomes
In student surveys almost all students (including higher-attainers) preferred it
Encourages teachers to work collaboratively and support each other
Extension links
UKMT senior challenge (https://www.ukmt.org.uk/competitions/solo/senior-mathematical-challenge)
MAT (https://www.maths.ox.ac.uk/study-here/undergraduate-study/maths-admissions-test)
STEP Foundation (https://maths.org/step/assignments)
(2.3) – numbers refer to specification (and OT – overarching themes where especially applicable) -
https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/mathematics-2017.html

No changes needed: recap of key GCSE skills (eg algebraic manipulation) incorporated by doing C1 in first half term. This might need to be done a bit slower than is usual, but the additional teaching time allows for this.

Maths – Year 12 Autumn 1				
What are we learning?	**What knowledge, understanding and skills will we gain?[1]**	**What does mastery look like?[2]**	**How does this build on prior learning?[3]**	**What additional resources are available?**
C1 – foundations of the A level: Ch1 – basic algebra and surds Ch2 – quadratics and the discriminant Ch3 – simultaneous equations, and inequalities Ch4 – graph sketching and transformations Ch5 – linear graphs Ch6 – arithmetic sequences Ch7 – basics of differentiation Ch8 – basics of integration	Knowledge: quadratic formula, cases of the discriminant, graphs shapes for reciprocal, linear, quadratic and cubic, apply transformations to graphs and use the correct language to describe them, y=mx+c, parallel and perpendicular lines, use of arithmetic sequence nth term and sum formulae, how to differentiate and integrate a polynomial Understanding: Understand and use the laws of indices for all rational exponents (2.1) Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y = f(x) at a general point (x, y) (7.1) Skills: Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation (2.4)	Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable (OT1.1) In particular students should: have clear presentation of work which show logical steps with correct use of = or implies between lines be able to confidently manipulate algebraic expressions involving indices and fractions be able to quickly factorise quadratics be able to confidently differentiate and integrate expressions, and know the difference between the two be able to comfortably pass a C1 exam	Much of Ch1-5 will be familiar to the majority of students from GCSE, however most students will still be developing mastery of them. Do be aware of the new or difficult content as below: Ch2 – use of discriminant Ch3 – dealing with quadratic inequalities Ch4 – explicit links to factorising/graph Ch6 builds on use of sequences and nth terms from GCSE but the use of the formulae and sigma notation is new Ch7-8 are new concepts but build on the ideas of gradient, and use a lot of the algebraic and index manipulations from GCSE and Ch1	C1 Textbooks SoL – guidance for each individual lesson Resources – outline Powerpoints with suggested examples and scaffolding activities Practice questions and assessments covering chapters suing previous exam questions C1 pastpapers For extension use: UKMT senior challenge, MAT and STEP Foundation materials

Maths - Year 12 Autumn 2				
What are we learning?	**What knowledge, understanding and skills will we gain?[1]**	**What does mastery look like?[2]**	**How does this build on prior learning?[3]**	**What additional resources are available?**
Pure 1 – Ch1-10 Ch1-5 revisits work from C1 and builds on it with: Ch1 some harder algebra manipulation Ch2 – function notation and language Ch3 graphing regions for inequalities Ch4 – quartic graphs Ch5 – straight lines graphs used to model direct proportion. Additionally the next chapters provide newer content: Ch6 – equations of circles Ch7 – the Factor Theorem, and proofs Ch8 – Binomial expansion Ch9 and 10– Trigonometry, including identities and equations	Knowledge: Function notation and language. Be able to sketch quartic graphs. Equation of a circle. The Factor Theorem. Binomial expansion formulae. Trigonometry ratios, graphs, basic identities. Understanding: Graphing regions for inequalities. Using the correct language and techniques for proving and disproving mathematical statements. Apply the binomial expansion formula in different cases. Skills: Further confidence in manipulating algebra and surds. Modelling real-life situations using straight line graphs and quadratics.	Comprehend and critique mathematical arguments, proofs and justifications of methods and formulae, including those relating to applications of mathematics. (OT1.5) Construct extended arguments to solve problems presented in an unstructured form, including problems in context. (OT2.2) In particular students should: Use the equation of a circle to help solve geometrical problems Be able to factorise degree 3 and above polynomials using Factor Theorem Be able to prove and disprove mathematical statements, including the clear setting out of trig identity proof Apply their knowledge to simple context (eg modelling exercises in Ch2 and Ch5)	Ch1-5 directly revisit and build on work from Autumn1 as noted in the first column. Basic circles centred on the origin are seen at GCSE but Ch6 extends this to any circle The Factor Theorem (Ch7) links to current ideas about factorisation Proofs (Ch7) are used at GCSE but this will formalise the ideas of deduction, exhaustion and using counter-examples For Binomial expansion, students who studied Stats GCSE will have seen Pascal's triangle, but all will be familiar with the idea of expanding brackets which this generalises Trigonometry (Ch9-10) directly revisits concepts used at GCSE and builds them into using trigonometric identities to solve equations	Pure 1 Textbooks SoL – guidance for each individual lesson Resources – outline Powerpoints with suggested examples and scaffolding activities Practice questions and assessments covering chapters using previous exam questions For extension use: UKMT senior challenge, MAT and STEP Foundation materials
Maths - Year 12 Spring 1				

What are we learning?	What knowledge, understanding and skills will we gain?	What does mastery look like?	How does this build on prior learning?	What additional resources are available?
Pure 1 – Ch11-14 Chapter 11 2D vectors Chapter 12 differentiation (builds on C1 and includes stationary points) Chapter 13 integration (builds on C1 and includes areas) Chapter 14 exponentials and logarithms	Knowledge: Vectors – representation, magnitude, position and direction, problem solving and modelling. Differentiation. Integration. Exponentials, logarithms, the natural logarithm, nonlinear data. Understanding: To understand column vectors and unit vectors i and j. Using vectors to find velocity, displacement, and force. Increasing and decreasing functions, stationary points and second derivatives. Differentiation from first principles. Definite integrals, area under a curve, area between curve and straight lines. $y=e^{x,}$ the law of logarithms. Logarithms as inverse of exponential. **Skills:** Using Pythagoras and trigonometry to find magnitude and direction form. Manipulating functions and sketching gradient functions, applying knowledge to problems, recognise how to solve the area under graphs and between curves and straight lines. Solving equations using logs, plotting graphs using logs.	In particular students should: Construct and present mathematical arguments through appropriate use of diagrams; sketching graphs; logical deduction; precise statements involving correct use of symbols and connecting language, including: constant, coefficient, expression, equation, function, identity, index, term, variable. Construct and extend knowledge to modelling and using practical real-life models and graphs to come to outcomes.	Vectors builds upon knowledge from GCSE Higher Differentiation and integration both build directly on from C1. Exponential continue work from GCSE and also the use of manipulating indices in C1	Pure 1 Textbooks SoL – guidance for each individual lesson Resources – outline Powerpoints with suggested examples and scaffolding activities Practice questions and assessments covering chapters suing previous exam questions For extension use: UKMT senior challenge, MAT and STEP Foundation materials

Maths - Year 12 Spring 2

What are we learning?	What knowledge, understanding and skills will we gain?[1]	What does mastery look like?[2]	How does this build on prior learning?[3]	What additional resources are available?
Stats and Mechanics 1 Ch1-7 (Stats) Data collection and representation, measures of location and spread, correlation, probability, distributions (binomial), hypothesis testing, the large data set	Knowledge: Language relating to data collection, types of sampling, existence of large data set, percentiles, deciles, variance, standard deviation, coding, outlier calculations, equation of a regression line, determining if events are independent, discrete probability distributions, the binomial distribution, the language and concept of hypothesis testing Understanding: understand the large data set and how to collect data from it, interpret measures of central tendency, location and spread, understand when you can use regression lines to make predictions, interpret their coefficients, utilise different methods to calculate probabilities, comment on the appropriateness of the use of binomial distributions, calculate individual and cumulative probabilities for the binomial distribution, find critical values of a binomial distribution. **Skills:** compare data sets, carry out and interpret one- and two-tailed tests	Comprehend and critique statistical methods for interpreting data sets and performing hypothesis testing. Conduct investigations into statistical data that is appropriate for the context. In particular, students should be able to: Accurately utilise and interpret statistical language and representations Use the binomial distribution to perform well-constructed hypothesis testing Confidently critique/justify methods use to analyse elements of the large data set	Recaps Statistics GCSE (if taken) and builds upon topics from this. Builds on GCSE maths topics: mean, median, mode, range, quartiles, box plots, cumulative frequency, histograms, correlation, probability, Venn diagrams, tree diagrams.	Statistics and Mechanics 1 Textbook SoL – guidance for each individual lesson Resources – outline Powerpoints with suggested examples and scaffolding activities Practice questions and assessments covering chapters suing previous exam questions Large Data Set folder with guided questions on both staff and student shared areas
Maths - Year 12 Summer 1				

What are we learning?	What knowledge, understanding and skills will we gain?[1]	What does mastery look like?[2]	How does this build on prior learning?[3]	What additional resources are available?
Stats and Mechanics 1 Ch8-11 (Mechanics) Modelling, constant accelerations, forces and motion, variable acceleration	Knowledge: Know SI units for quantities and derived quantities used in mechanics. Be able to derive the constant acceleration formulae. Be able to calculate resultant forces by adding vectors Know calculus can be used to solve kinematics problems, to solve problems involving maxima and minima and to derive constant acceleration formulae. Understanding: How the concept of mathematical modelling applies to mechanics and be able to apply some of the common assumptions used in mechanical models. Interpret displacement-time and velocity-time graphs. Apply Newton's first, second and third laws to solve problems. Solve problems involving connected particles Skills: Draw force diagrams and calculate resultant forces. Use the constant acceleration formulae to solve problems involving vertical motion under gravity.	Understand, interpret and extract information from diagrams and construct mathematical diagrams to solve problems, including in mechanics (OT2.7) Translate a situation in context into a mathematical model, making simplifying assumptions (OT3.1) In particular, students should: be able to answer problem solving and exam style questions in a range of familiar and non-familiar contexts critically evaluate modelling assumptions represent a problem with an accurate and detailed force diagram write an equation of motion for a particle and solve Select appropriate calculus techniques to solve problems involving variable acceleration	Much of this builds on work in both GCSE Maths and Science/Physics. Students are usually familiar with measures, units, forces, and -time graphs. Students studying A level Physics will be very familiar with the ideas in Ch9 and 10, but need to be aware that g=9.8 in maths, and there is no need to rearrange formulae before substituting values.	Statistics and Mechanics 1 Textbook SoL – guidance for each individual lesson Resources – outline Powerpoints with suggested examples and scaffolding activities Practice questions and assessments covering chapters suing previous exam questions
Maths - Year 12 Summer 2				

What are we learning?	What knowledge, understanding and skills will we gain?	What does mastery look like?	How does this build on prior learning?	What additional resources are available?
Pure 2 – Ch1-2 Proof by contradiction, partial fractions, the modulus function	Knowledge: How to manipulate algebraic fractions including, adding, subtracting, multiplying, dividing, and using factorisation to simplify them. Know the format of a partial fractions for linear and repeated factors. Know how to divide with algebra. The modulus function and its notation. Formal definition of a function (one-to-one and many-to-one). Composite and inverse functions. Domain and range of a function. Understanding: Using proof by contradiction and a powerful tool to prove mathematical statements. Link the process of partial fractions to reversing the process of adding fractions. Link between domain and range of a function and it's inverse. Link between the graphs of a function and its inverse. Skills: Be able to select the appropriate method for proving a statement**.** Be able to manipulate algebraic fractions, including splitting them into partial fractions. Be able to sketch the graphs of functions involving modulus.	Understand and use mathematical language and syntax as set out in the content (OT1.2) Understand and use the definition of a function; domain and range of functions (OT1.4) In particular, students should: Construct and present mathematical arguments accurately and clearly. Correct use of = and ≡ Correct use of set notation when describing domain and range Be able to select appropriate methods to work out the domain and range of a functions using its graph or knowledge of its inverse	Proof by contradiction is a 'tool' that can be added to the proofs used in Pure 1 Ch7 (Autumn 2) and it is good to start with a revision of these first (deduction, exhaustion, disproof by counterexample). The work on fractions and algebra dividing is also first covered in Pure 1 Ch7 (Autumn 2) but the partial fractions work is new and builds on this. The modulus work is new but this builds on previous work on graphs and transforming them in Ch4-5 (Autumn 2). Functions are used informally throughout the course (and at GCSE) but this is usually the first formal definition. Students studying Further Maths may already be familiar with modulus in the context of complex numbers (Further Maths – Year 12 Autumn 1 – Core 1)	Pure 2 Textbook SoL – guidance for each individual lesson Resources – outline Powerpoints with suggested examples and scaffolding activities Practice questions and assessments covering chapters suing previous exam questions