Maths Unit Overview Year 13

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
- Helps teachers 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 modules (https://maths.org/step/assignments)

(2.3) – numbers refer to specification (and OT – overarching themes where especially relevant) - https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/mathematics-2017.html

Work will start with Pure 2 chapter 1 (chapters 1 and 2 are usually covered in Year 12) with the aim to use the additional teaching time to finish Pure 2 by Christmas as usual.
Statistics and Mechanics were covered sufficiently during lockdown with video lessons, and assessments used show at least a basic understanding from students. The Year 13 work builds directly upon the Y12 work so rather than spend time recapping Year 12, the additional teaching time in the spring term will be used to focus on the Y13 work, but going slower than usual as the foundations of the Y12 may be less secure than usual for some. Students who missed work will be directed to the lockdown lessons used to get a foundation before the topics are covered in class.
The usual chapter assessments will be used to check student progress throughout the course.

Maths – Year 13 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?**
Pure 2 Ch 1 – 6 Ch1 – Algebraic methods Ch2 – Functions and graphs Ch3 - Geometric sequences and series Ch4 - Binomial expansion with non-integer powers Ch5 – Radians Ch6 – Further trigonometric functions and identities	Knowledge: a geometric sequence has a common ratio between consecutive terms; formulae used with geometric sequences and series; definitions of convergent and divergent series; how to convert between degrees and radians; arc length and areas of sectors/segments; definitions of the reciprocal and inverse trigonometric functions. Understanding: prove formulae for geometric sequences and series; determine the range of values of *x* for which a binomial expansion is valid; apply knowledge of radians to trigonometric graphs and their transformations; how to derive the graphs of the reciprocal and inverse trigonometric functions; Skills: use general formulae for geometric sequences and series to solve problems; find and use binomial expansions with negative and fractional values of *n*; solve trigonometric equations in radians; use approximate trigonometric values with small angles; simplify expressions, prove identities and solve equations involving the reciprocal trigonometric functions.	Student can answer problem solving and exam style questions. Able to select the most efficient method to solve a problem (which may not be using a learnt formula) In particular, students should: Be able to model real-life situations with series Prove the formula for the first *n* terms of a geometric series Use partial fractions to simplify difficult binomial expansions Knows the trigonometric graphs in radians fluently and uses these to help solve trig equations Explain how to find the domain and range of reciprocal trigonometric functions	Ch3 builds on arithmetic sequences & series from C1 (Year 12 – Autumn 1) as well as sigma notation and recurrence relations. Ch4 builds on Pure 1 Ch8 (Year 12 Autumn 2 - where n was a positive integer) & Pure 2 Ch1 Partial fractions (which are used here to simplify expansions). Ch5 builds on trigonometry covered in GCSE & Pure 1 Ch10 (Year 12 Autumn 2), as well as calculating arc length and areas of sectors/segments from GCSE but using radians as the angle measure not degrees. Ch's 6 & 7 build on trigonometric functions taught in Pure 1 Ch10 (Year 12 Autumn 2), graph transformations from Pure 2 Ch2, and Pure 2 Ch5.	Pure 2 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 13 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 2 Ch 7 – 12 Ch7 – Further trigonometric formulae and solving; proving trigonometric identities. Ch8 - Parametric equations Ch9 - Further calculus techniques (using differentiation) Ch10 - Numerical methods Ch11 - Further calculus techniques (using integration); solving differential equations Ch 12 - 3D vectors	Knowledge: how to convert parametric equations into cartesian form; know the standard derivatives and integrals of trigonometric functions, exponentials and logarithms; definition of a continuous function; definitions of convergent and divergent iterations; the Newton-Raphson formula; unit and column vector notation for 3D vectors; definitions of coplanar and non-coplanar vectors. Understanding: use and sketch parametric equations of curves; why radians are used when differentiating and integrating; use the second derivative to determine whether a curve is concave or convex; graphical representations of iterations; use knowledge of derivatives to integrate familiar functions. Skills: use the chain rule, product rule and quotient rules; differentiate and integrate trigonometric functions; differentiate implicitly; use iterative techniques to find solutions of real-life situations; use the reverse chain rule, substitution, by parts, and partial fractions to integrate more complex functions; use the trapezium rule to find/approximate the area under a curve;solve simple differential equations; use vectors to solve geometric problems in 3D; model motion with vectors.	In particular, students should: use parametric equations to model real-life situations and in unusual contexts be able to correctly identify the rule/s needed to differentiate or integrate a given function accurately and fluently use all learnt techniques/methods to differentiate or integrate a given function find coordinates of points of inflection/stationary points choose a suitable interval when using an iterative process to locate roots use iterative processes to model real-life situations and in unusual contexts model real-life situations with differential equations to solve problems perform vector proofs in 3d plane	Ch8 builds on rearranging formulae and basic algebraic manipulation from GCSE, C1 and Pure 1 Ch's 1 & 14; circle geometry from Pure 1 Ch6; functions and mappings from Pure 2 Ch2; using the addition formulae from Pure 2 Ch7. Ch9 builds on differentiation techniques from C1 and Pure 1 Ch12; parametric equations from Pure 2 Ch8; trigonometric functions and identities from Pure 2 Ch's 6&7. Ch10 builds on iteration from GCSE; recurrence relations from C1 and Pure 2 Ch3; differentiation from year 12 and Pure 2 Ch9. Ch11 builds on estimating the area under a curve from GCSE; integration from C1 and Pure 1 Ch13; differentiation from Pure 2 Ch9; partial fractions from Pure 2 Ch1. Ch12 builds on 2D vectors knowledge from GCSE and Pure 1 Ch11.	Pure 2 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 13 Spring 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 2 Ch1 – 3 Ch1 - Regression, correlation and hypothesis testing Ch2 - Conditional probability Ch3 - Normal distribution	Knowledge: basic information about the large data set; how to use regression lines; rules of logs and indices; how to code data to obtain a linear relationship; probability formulae and key terminology; key facts and features of the normal distribution; how to code data so it can be modelled by the standard normal distribution. Understanding: exponential models in bivariate data; the product moment correlation coefficient (PMCC); when to use a one-tailed or two-tailed test; set notation; normal distribution and the characteristics of its curve; when to apply a continuity correction when calculating probabilities. Skills: carry out a hypothesis test for zero correlation (one-tailed and two-tailed) and for the mean of a normal distribution; calculate the PMCC on a calculator; draw a Venn diagram; use tree diagrams to represent and solve probability problems; calculate values on a standard normal curve; find unknown means and standard deviations for a normally distributed variable; approximate a binomial distribution using a normal distribution; select appropriate distributions and solve real-life problems in context; use a calculator to find probabilities from a normal distribution and inverse normal distribution.	Understand and use language and symbols associated with set theory, as set out in the content. Apply to solutions of inequalities and probability (OT1.3) Interpret the outputs of a mathematical model in the context of the original situation (for a given model or a model constructed or selected by the student) (OT3.3) Understand that a mathematical model can be refined by considering its outputs and simplifying assumptions; evaluate whether the model is appropriate (OT3.4) In particular, students should: be able to answer problem solving and exam style questions. be able to identify the correct hypothesis test to use for a given problem Explain why and how a normal distribution can be used	Ch1 builds on exponential functions and modelling from Pure 1 Ch14; correlation and regression from Stats 1 Ch4; hypothesis testing from Stats 1 Ch7. Ch2 builds on probability from GCSE and Stats 1 Ch5. Ch3 builds on probability distributions from Stats 1 Ch6	Stats and Mechanics 2 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. Large data set – investigations.

Maths - Year 13 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?**
Mechanics 2 Ch4 – 8 Ch4 – Moments Ch5 – Forces and friction Ch6 – Projectiles Ch7 – Applications of forces Ch8 – Further kinematics	Knowledge: definition of a moment and formulae for calculating; definition of equilibrium; how to resolve a force into components; formula for the maximum (limiting value) of the friction between two surfaces; how to derive key formulae for projectiles; SUVAT equations; how to solve problems involving static particles; notation for differentiation with respect to time. Understanding: using a force diagram; friction and the coefficient of friction; solve problems involving uniform rods in equilibrium; solve problems involving non-uniform rods; which suvat equation to use for a given problem; use the equations of motion for constant acceleration to write velocity and displacement as functions of time. Skills: calculate the moment of a force and resultant moments of a set of forces; solve problems involving rods in equilibrium and on the point of tilting; solve problems involving smooth or rough inclined planes; solve problems involving the coefficient of friction; model motion under gravity for an object projected horizontally; solve statics problems involving weight, tension and pulleys; analyse projectile motion in a vertical plane with constant acceleration; differentiate and integrate a vector with respect to time.	In particular, students should: be able to answer problem solving and exam style questions in a range of familiar and non-familiar contexts answer 'show that' questions critically evaluate modelling assumptions represent a problem with an accurate and detailed force diagram solve problems involving uniform rods in equilibrium, non-uniform rods, rods on the point of tilting write an equation of motion for a particle and solve derive formulae for time of flight, time to reach greatest height, range on horizontal plane, equation of trajectory for a particle, and use to solve problems. Expertise to select the correct/most appropriate formulae to solve a problem, drawing on knowledge from the entire 2-year course (including Pure content)	Ch's 4 & 5 build on trigonometry from GCSE and year 12; forces & force diagrams from Mechanics 1 Ch10. Ch6 builds on trigonometry from GCSE; SUVAT equations from Mechanics 1 Ch9; solving trigonometric equations from Pure 1 Ch10. Ch7 reviews and consolidates Mechanics 2 Ch's 4&5 Ch 8 builds on vectors from Pure 1 Ch11; SUVAT equations from Mechanics 1 Ch9; calculus from Pure 2 Ch's 9&11	Stats and Mechanics 2 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.
Maths - Year 13 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?
Structured revision and use of past papers (often there will be 1-2 weeks of catch up from previous content as well)	Knowledge: revisiting and reconsolidating all knowledge from the 2 year course Understanding: building a deeper understanding of the course through regular review and practice Skills: a particular focus on ensuring exam technique is secure	Students can confidently tackle questions on a range of topics. Work is presented clearly in logical steps When faced with an unusual or difficult context students are not afraid to try several approaches to find a correct solution	This is all about consolidating and applying prior learning.	Specimen papers Mock papers Past papers Bank of 'starter' questions (past exam questions on variety of topics – 1 easier and 1 more challenging) Revision PowerPoints and questions banks to help revise specific topics External online resources (such as crashmaths for exam style practice or TLMaths for revision videos)

Maths - Year 13 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?**
Structured revision and use of past papers	Knowledge: revisiting and reconsolidating all knowledge from the 2 year course Understanding: building a deeper understanding of the course through regular review and practice Skills: a particular focus on ensuring exam technique is secure	Students can confidently tackle questions on a range of topics. Work is presented clearly in logical steps When faced with an unusual or difficult context students are not afraid to try several approaches to find a correct solution	This is all about consolidating and applying prior learning.	Specimen papers Mock papers Past papers Bank of 'starter' questions (past exam questions on variety of topics – 1 easier and 1 more challenging) Revision PowerPoints and questions banks to help revise specific topics External online resources (such as crashmaths for exam style practice or TLMaths for revision videos)