Year 13 Mathematics Curriculum Rationale

In the pure strand of the curriculum students build upon their AS studies with a particular focus on calculus skills and techniques. Students are introduced to the normal distribution as a statistical model and learn more about hypothesis tests. In mechanics students solve kinematics problems in 2 dimensions and study friction, embedding their pure and mechanics skills to solve increasingly complex problems. All A level students are expected to practise, be resilient and persevere when approaching all areas of Mathematics.

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
Differentiation	Know the product rule and chain rule. Select the appropriate technique to differentiate a range of expressions. Identify points of inflection and know when a function is concave or convex. Use implicit differentiation to find the gradient of a function.	This unit builds on work studied in year 12 where students were introduced to differentiation. They build upon this knowledge and learn to differentiate a much wider range of expressions.	Integral online tests: D1, D2, D3, FD1, FD2, FD3 Topic Tests: Further Differentiation 1 and 2	Key vocabulary: points of inflection, concave and convex. How does the word "implicit" in this context fit with wider meaning of the word?	Hardworking – Practice Linking - Generalisation	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Partial Fractions	Students learn about how to write a single fraction in terms of 2 or 3 partial fractions.	This builds on algebra skills at GCSE, in particular manipulating algebraic fractions.	Integral online tests: A3 Topic Tests: Partial Fractions (Selected Questions)		Analysing - Precision	Review lesson notes Integral online tests / worksheets

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						Questions from the textbook Past exam questions
Integration	Students learn integration by parts, integration by substitution and other integration techniques. Students develop their ability to select the appropriate integration tool.	Students were introduced to basic integration techniques in Year 12. The unit develops this much further. Link to the differentiation unit studied earlier in the year with integration methods the reverse process of these.	Integral online tests: I1, I2, I3, I4 Topic Test: Further Integration 1, Further Integration 2		Hardworking – Practice Metathinking-Strategy Planning	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Vectors	Students are introduced to 3D vectors. Students use the constant acceleration equations in 2D situations.	This unit combines 2D vectors and kinematics in 1D studied in Year 12.	Integral online tests: V1 Topic Test: Trigonometry and Vectors in context, Kinematics 2		Metathinking- Strategy Planning	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Proof	Students learn the method of proof by contradiction.	Students are already familiar with proof by deduction, proof	Integral online tests: P1		Analysing – Precision	Review lesson notes

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	They are expected to use their proof and problem-solving skills in increasingly complex situations.	by exhaustion and proof by counter example.			Analysing- Critical and Logical Thinking	Integral online tests / worksheets Questions from the textbook Past exam questions
Series and Sequences	Students learn and apply formulae for terms of a sequence and series. They sum series and are required to make connections between different areas of mathematics.	Students have studied linear, quadratic, arithmetic and geometric sequences at GCSE. This unit builds on this and introduces the idea of series.	Integral online tests: S1, S2, S3 Topic Test: Series	Key Vocabulary: Arithmetic Geometric	Linking-Connection Finding Linking - Generalisation	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Trigonometry	Students solve equations involving radians. They derive and use the facts for arc length and area of a sector. They use small angle approximations.	Students have learnt to find an arc length and area of a sector at GCSE. In Year 12 students solved equations involving trigonometric functions in degrees. This unit builds on this.	Integral online tests: T1, T2 Topic Test: Trigonometry and Circular Measure 1		Analysing – Complex and Multistep problem solving. Creating- Intellectual playfulness	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Differential Equations	Students set up differential equations.	The differentiation and integration units studied earlier in the	Integral online tests: DE1		Hardworking- Perseverance	Review lesson notes

Unit	Core knowledge/skill development	Sequence	Assessment	Literacy, numeracy, PSHE, FBV, other links	ACP and VAA development	Home learning and enrichment
	They solve differential equations using the separation of variables method.	year form the foundations of this topic.	Topic Test: Differential Equations Topic Test		Creating- Originality	Integral online tests / worksheets Questions from the textbook Past exam questions
Functions	Use the language of functions correctly. Recognise and describe transformations of graphs. Find composite and inverse functions. Sketch graphs of the modulus of linear functions. Solve equations and inequalities with modulus functions.	Students are already familiar with simple cases of finding the inverse and composite functions at GCSE. They have developed their curve sketching skills in Year 12 and been introduced to simple transformations of graphs. This unit builds on this work, focusses on the language of functions and introduces the modulus of a function which is new to them.	Integral online tests: F1, F2, F3 Topic Test: Functions and Transformations	Key vocabulary: many-one one-one one-many domain range inverse	Linking-Big Picture Thinking Linking-Imagination	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions

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Further Algebra	Find and use the binomial expansion for values of n that are rational. Simplifying algebraic expressions using long division where appropriate.	Year 12 has introduced the binomial expansion with a positive integer power. There is added complexity to the work on rational functions and polynomials studied at GCSE and in Year 12.	Integral online tests: A1, A2 Topic Test: Binomial Expansion		Linking-Connection Finding	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Trigonometric Functions	Understand and use the inverse and reciprocal trigonometric functions. Solve equations involving identities. Sketch the graphs of inverse and reciprocal functions.	This builds on both the Year 12 Trigonometry unit and the radians work studied earlier in Year 13.	Integral online tests: TF1 Topic Test: Trigonometry and Circular Measure 2		Metathinking-Metacognition Hardworking-practice	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Trigonometric Identities	Understand and use the compound angle identities. Know and use the double angle identities. Use these to write expressions as a	This builds on the Year 12 trigonometry unit.	Integral online tests: TI1, TI2 Topic Test: Trigonometry		Realising – Automaticity Agile-Enquiring	Review lesson notes Integral online tests / worksheets Questions from the textbook

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	single trigonometric function.					Past exam questions
Forces and Motion	Students use the constant acceleration equations to model motion in 1 and 2 dimensions. Students study forces and motion on a slope.	Students have used the constant acceleration equations in 1D in year 12 and here they extend this to 2D. In Year 12 students have used Newton's Laws to study motion on a horizontal surface and these techniques are extended to a slope here.	Integral online tests: F1, F2 Topic Test: Forces (A level), Kinematics 2		Metathinking- Metacognition Analysing- Precision	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Probability	Conditional probability is studied, and students develop their problem-solving skills in a probability context.	Conditional probability was studied informally at GCSE and some formal definitions are used here. The complexity of the probability problems has increased from Year 12.	Integral online tests: P1 Topic Test: Probability (A level)		Analysing - Complex and Multistep problem solving Agile - Creative and Enterprising.	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions

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Statistical Distributions	The normal distribution is introduced as a model. Students find probabilities of events occurring in the normal distribution.	In Year 12 students use the binomial distribution for discrete distributions. Some similar ideas are studied here but for a continuous model, the normal distribution.	Integral online tests: D1 Topic Test: Normal and Approximating	Link to real world applications in the sciences.	Linking - Big picture thinking. (The normal distribution is used in the real world for modelling many scenarios)	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Hypothesis Testing	Students carry out a hypothesis test for the mean of a normal distribution. Students carry out a hypothesis test for correlation.	Prior learning includes both Year 12 hypothesis testing with a binomial model and also the previous Year 13 unit on the normal distribution. In Year 12, students can interpret values of the PMCC.	Integral online tests: H1, H2 Topic Test: Hypothesis Testing (A level)		Analysing - Critical and Logical Thinking. Deduce, hypothesise, reason and seek supporting evidence by conducting the hypothesis test.	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Moments	Calculate the moment of a force about a point or axis. Solve problems involving equilibrium of a rigid body.		Integral online tests: M1 Topic Test:		Creating-Originality	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions

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Friction	Draw force diagrams including the friction force. Find and use the coefficient of friction. Use Newton's Laws of motion to solve friction problems.		Integral online tests: FR1 Topic Test: Friction and Moments		Analysing-Complex and Multistep problem solving. Hardworking-practice	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Parametric Equations	Understand what is meant by a parameter and by parametric equations. Convert between Cartesian and parametric form. Use parametric differentiation accurately to find the gradient at a point on the curve.		Integral online tests: PE1, PE2 Topic Test: Parametric Equations		Analysing-Precision Creating-Originality	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions
Projectiles	Formulate equations of motion for projectiles and use		Integral online tests: P1, P2		Creating-Evolutionary and Revolutionary Thinking	Review lesson notes Integral online tests / worksheets

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	these to find position and velocity.		Topic Test: Kinematics 1, 3		Hardworking-Resilience	Questions from the textbook Past exam questions
Numerical Methods	Use change of sign methods to show there is a root in a given interval. Solve equations numerically using fixed point iteration and demonstrate convergence on suitable diagrams. Use the Newton-Raphson method correctly. Use the trapezium rule accurately. Know the limitations of numerical methods.		Integral online tests: N1, N2 Topic Test: Numerical Methods		Realising-Speed and Accuracy	Review lesson notes Integral online tests / worksheets Questions from the textbook Past exam questions