Year 13: Curriculum Implementation Plan

| Knowledge and Skills – Students will be taught to… | Reading, Oracy, Literacy | Formative Assessment | Summative Assessment |
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| Please see individual units below. | • Reading worded questions to understand the context and decide how to approach a problem<br>• Paired/collaborative discussion of problems<br>• Writing responses to worded questions such as “Explain why…”<br>• Expanding vocabulary of key mathematical terms<br>• Giving verbal responses in class question-and-answer | • Questioning in class<br>• Self-assessment<br>• Peer-assessment<br>• Starter and homework questions<br>• Weekly revision sheets, including practice exam questions<br>• Regular mini-assessments<br>• Show of hands and other forms of whole-class feedback<br>• Review of student work during lessons<br>• Practice exam papers and exam-style questions | Regular assessment of progress against exam-style questions, in line with the school assessment calendar |

| Mathematics – Pure Unit 1 – Algebraic Methods | |
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| Unit content: | By the end of the sub-unit, students should: |
| 1.1 Proof by contradiction<br>1.2 Algebraic fractions<br>1.3 Partial fractions<br>1.4 Repeated factors<br>1.5 Algebraic Division | • understand that various types of proof can be used to give confirmation that previously learnt formulae are true, and have a sound mathematical basis;<br>• understand that there are different types of proof and disproof (e.g. deduction and contradiction), and know when it is appropriate to use which particular method;<br>• be able to use an appropriate proof within other areas of the specification later in the course;<br>• be able to add, subtract, multiply and divide algebraic fractions;<br>• know how to use the factor theorem to shown a linear expression of the form $(a+bx)$ is a factor of a polynomial;<br>• know how to use the factor theorem for divisors of the form $(a+bx)$;<br>• be able to simplify algebraic fractions by fully factorising polynomials up to cubic;<br>• be able to split a proper fraction into partial fractions;<br>• be able to split an improper fraction into partial fractions, dividing the numerator by the denominator (by polynomial long division or by inspection). |

| Mathematics – Pure Unit 2 – Functions and Graphs | |
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| Unit content: | By the end of the sub-unit, students should: |
| 2.1 The modulus function<br>2.2 Functions & Mappings<br>2.3 Composite functions<br>2.4 Inverse functions<br>2.5 y=\|f(x)\|and y=f(\|x\|)<br>2.6 Combining functions<br>2.7 Solving modulus problems | • understand what is meant by a modulus of a linear function;<br>• be able to sketch graphs of functions involving modulus functions;<br>• be able to solve equations and inequalities involving modulus functions;<br>• be able to work out the domain and range of functions;<br>• know the definition of a one-one and a many-one mappings;<br>• be able to work out the composition of two functions;<br>• be able to work out the inverse of a function and sketch its graph;<br>• understand the condition for an inverse function to exist;<br>• understand the effect of simple transformations on the graph of $y=\mathrm{f}(x)$ including sketching associated graphs and *combinations* of the transformations:<br>$y=a\mathrm{f}(x)$, $y=\mathrm{f}(x)+a$, $y=\mathrm{f}(x+a)$, $y=\mathrm{f}(ax)$<br>• be able to transform graphs to produce other graphs;<br>• understand the effect of composite transformations on equations of curves and be able to describe them geometrically;<br>• Use of trigonometric functions for modelling tides, hours of sunlight, etc.;<br>• Use of exponential functions for growth and decay Use of reciprocal function for inverse proportion (e.g. Pressure and volume). |

| Mathematics – Pure Unit 3 – Sequences and Series | |
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| Unit content: | By the end of the sub-unit, students should: |
| 3.1 Arithmetic sequences<br>3.2 Arithmetic series<br>3.3 Geometric sequences<br>3.4 Geometric series<br>3.5 Sum to infinity<br>3.6 Sigma notation<br>3.7 Recurrence relations<br>3.8 Modelling with series | • know what a sequence of numbers is and the meaning of finite and infinite sequences;<br>• know what a series is;<br>• know the difference between convergent and divergent sequences;<br>• know what is meant by arithmetic series and sequences;<br>• be able to use the standard formulae associated with arithmetic series and sequences;<br>• know what is meant by geometric series and sequences;<br>• be able to use the standard formulae associated with geometric series and sequences;<br>• know the condition for a geometric series to be convergent and be able to find its sum to infinity;<br>• be able to solve problems involving arithmetic and geometric series and sequences;<br>• know the proofs and derivations of the sum formulae (for both AP and GP);<br>• be familiar with $\sum$ notation and how it can be used to generate a sequence and series;<br>• know how this notation will lead to an AP or GP and its sum;<br>  • know that $\sum_{1}^{n} 1 = n$<br>• know that a sequence can be generated using a formula for the $n$th term or a recurrence relation of the form $x_{n+1} = f(x_n)$;<br>• know the difference between increasing, decreasing and periodic sequences;<br>• understand how a recurrence relation of the form $U_n = f(U_{n-1})$ can generate a sequence;<br>• be able to describe increasing, decreasing and periodic sequences. |

| Mathematics – Pure Unit 4 – Binomial Expansion | |
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| Unit content: | By the end of the sub-unit, students should: |
| 4.1 Expanding $(1+x)^n$<br>4.2 Expanding $(a+bx)^n$<br>4.3 Using partial fractions | • be able to find the binomial expansion of $(1 \pm x)^n$ for rational values of $n$ and $\lvert x \rvert<1$;<br>• be able to find the binomial expansion of $(1 \pm bx)^n$ for rational values of $n$ and $\lvert x \rvert<1\lvert b \rvert$;<br>• be able to find the binomial expansion of $(a \pm x)^n$ for rational values of $n$ and $\lvert x \rvert<a$;<br>• be able to find the binomial expansion of $(a \pm bx)^n$ for rational values of $n$ and $\lvert bxa \rvert<1$;<br>• know how to use the binomial theorem to find approximations (including roots);<br>• be able to use partial fractions to write a rational function as a series expansion. |

| Mathematics – Pure Unit 5 - Radians | |
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| Unit content: | By the end of the sub-unit, students should: |
| 5.1 Radian measure<br>5.2 Arc length<br>5.3 Areas of sectors and segments<br>5.4 Solving trigonometric equations<br>5.5 Small angle approximations | • understand the definition of a radian and be able to convert between radians and degrees;<br>• know and be able to use exact values of sin, cos and tan;<br>• be able to derive and use the formulae for arc length and area of sector;<br>• understand and be able to use the standard small angle approximations for sine, cosine and tangent; |

| Mathematics – Pure Unit 6 – Trigonometric Functions | |
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| Unit content: | By the end of the sub-unit, students should: |
| 6.1 Secant, cosecant and cotangent<br>6.2 Graphs of sec x, cosec x & cot x<br>6.3 Using sec x, cosec x & cot x<br>6.4 Trigonometric identities<br>6.5 Inverse trigonometric functions | • understand the secant, cosecant and cotangent functions, and their relationships to sine, cosine and tangent;<br>• be able to sketch the graphs of secant, cosecant and cotangent;<br>• be able to simplify expressions and solve involving sec, cosec and cot;<br>• be able to solve identities involving sec, cosec and cot;<br>• know and be able to use the identities $1 + tan^2x = sec^2x$ and $1 + cot^2x = cosec^2x$ to prove other identities and solve equations in degrees and/or radians<br>• be able to work with the inverse trig functions $sin^{-1}, cos^{-1}$ *and* $tan^{-1}$;<br>• be able to sketch the graphs of $sin^{-1}, cos^{-1}$ *and* $tan^{-1}$ |

| Mathematics – Pure Unit 7 – Trigonometry and Modelling | |
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| Unit content: | By the end of the sub-unit, students should: |
| 7.1 Addition formulae<br>7.2 Using the angle addition formulae<br>7.3 Double-angle formulae<br>7.4 Solving trigonometric equations<br>7.5 Simplifying acosx±bsinx<br>7.6 Proving trigonometric identities<br>7.7 Modelling with trigonometric functions | • be able to prove geometrically the following compound angle formulae for sin $(A \pm B)$, cos $(A \pm B)$ and tan $(A \pm B)$;<br>• be able to use compound angle identities to rearrange expressions or prove other identities;<br>• be able to use compound angle identities to rearrange equations into a different form and then solve;<br>• be able to recall or work out double angle identities;<br>• be able to use double angle identities to rearrange expressions or prove other identities;<br>• be able to use double angle identities to rearrange equations into a different form and then solve;<br>• be able to express $\alpha\cos\theta + b\sin\theta$ as a single sine or cosine function;<br>• be able to solve equations of the form $\alpha\cos\theta + b\sin\theta = c$ in a given interval;<br>• be able to construct proofs involving trigonometric functions and previously learnt identities;<br>• be able to use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces. |

| Mathematics – Pure Unit 8 – Parametric Equations | |
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| Unit content: | By the end of the sub-unit, students should: |
| 8.1 Parametric equations<br>8.2 Using trigonometric identities<br>8.3 Curve sketching<br>8.4 Points of intersection<br>8.5 Modelling with parametric equations | • understand the difference between the Cartesian and parametric system of expressing coordinates;<br>• be able to convert between parametric and Cartesian forms;<br>• be able to plot and sketch curves given in parametric form;<br>• be able to recognise some standard curves in parametric form and how they can be used for modelling. |

| Mathematics – Pure Unit | |
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| Unit content: | By the end of the sub-unit, students should: |
| 9.1 Differentiating sin x & cos x<br>9.2 Differentiating exponentials & logarithms<br>9.3 The chain rule<br>9.4 The product rule<br>9.5 The quotient rule<br>9.6 Differentiating trigonometric functions<br>9.7 Parametric differentiation<br>9.8 Implicit differentiation<br>9.9 Using second derivatives<br>9.10 Rates of change | • be able to find the derivative of $\sin x$ and $\cos x$ from first principles;<br>• be able to differentiate functions involving $e^x$, $\ln x$ and related functions such as $6e^{4x}$ and $5\ln 3x$ and sketch the graphs of these functions;<br>• be able to differentiate to find equations of tangents and normals to the curve;<br>• be able to differentiate composite functions using the chain rule;<br>• be able to differentiate using the product rule;<br>• be able to differentiate using the quotient rule;<br>• be able to differentiate parametric equations;<br>• be able to find the gradient at a given point from parametric equations;<br>• be able to find the equation of a tangent or normal (parametric);<br>• be able to use implicit differentiation to differentiate an equation involving two variables;<br>• be able to find the gradient of a curve using implicit differentiation;<br>• be able to verify a given point is stationary (implicit);<br>• be able to find and identify the nature of stationary points and understand rates of change of gradient;<br>• be able to use a model to find the value after a given time;<br>• be able to set up and use logarithms to solve an equation for an exponential growth or decay problem;<br>• be able to use logarithms to find the base of an exponential;<br>• know how to model the growth or decay of 2D and 3D objects using connected rates of change;<br>• be able to set up a differential equation using given information which may include direct proportion. |

| Mathematics – Pure Unit 10 – Numerical Methods | |
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| Unit content: | By the end of the sub-unit, students should: |
| 10.1 Locating roots<br>10.2 Iteration<br>10.3 The Newton-Raphson method<br>10.4 Applications to modelling | • be able to locate roots of f($x$)=0 by considering changes of sign of f($x$);<br>• be able to use numerical methods to find solutions of equations;<br>• understand the principle of iteration;<br>• appreciate the need for convergence in iteration;<br>• be able to use iteration to find terms in a sequence;<br>• be able to sketch cobweb and staircase diagrams;<br>• be able to use cobweb and staircase diagrams to demonstrate convergence or divergence for equations of the form $x$=g($x$);<br>• be able to solve equations approximately using the Newton-Raphson method;<br>• understand how the Newton-Raphson method works in geometrical terms;<br>• be able to use numerical methods to solve problems in context. |

| Mathematics – Pure Unit 11 – Integration | |
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| Unit content: | By the end of the sub-unit, students should: |
| 11.1 Integrating standard functions<br>11.2 Integrating f(ax+b)<br>11.3 Using trigonometric identities<br>11.4 Reverse chain rule<br>11.5 Integration by substitution<br>11.6 Integration by parts<br>11.7 Partial fractions<br>11.8 Finding areas<br>11.9 The Trapezium rule<br>11.10 Solving differential equations<br>11.11 Modelling with differential equations | • be able to integrate expressions by inspection using the reverse of differentiation;<br>• be able to integrate $x^n$ for all values of $n$ and understand that the integral of $\frac{1}{x}$ is ln$\lvert x \rvert$;<br>• be able to integrate expressions by inspection using the reverse of the chain rule (or function of a function);<br>• be able to integrate trigonometric expression and expressions involving $e^x$;<br>• be able to integrate a function expressed parametrically;<br>• recognise integrals of the form $\int \frac{f'(x)}{f(x)} dx = ln(f(x)) + c$;<br>• be able to use trigonometric identities to manipulate and simplify expressions to a form which can be integrated directly;<br>• be able to integrate expressions using an appropriate substitution;<br>• be able to select the correct substitution and justify their choices;<br>• be able to integrate an expression using integration by parts;<br>• be able to select the correct method for integration and justify their choices;<br>• be able to integrate rational expressions by using partial fractions with linear denominators;<br>• be able to simplify the expression using laws of logarithms;<br>• understand and be able to use integration as the limit of a sum;<br>• understand the difference between an indefinite and definite integral and when we need + $c$;<br>• be able to integrate polynomials and other functions to find definite integrals, and use these to find the areas of regions bounded by curves and/or lines;<br>• be able to use a definite integral to find the area under a curve and between two curves;<br>• be able to find an area under a curve defined by a pair of parametric equations;<br>• be able to use the trapezium rule to find an approximation to the area under a curve;<br>• appreciate the trapezium rule is an approximation and realise when it gives an overestimate or underestimate;<br>• be able to write a differential equation from a worded problem;<br>• be able to use a differential equation as a model to solve a problem;<br>• be able to solve a differential equation;<br>• be able to substitute the initial conditions or otherwise into the equation to find + $c$ and the general solution. |

| Mathematics – Pure Unit 12 – Vectors | |
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| Unit content: | By the end of the sub-unit, students should: |
| 12.1 3D coordinates<br>12.2 Vectors in 3D<br>12.3 Solving geometric problems<br>12.4 Applications to mechanics | • be able to extend the work on vectors from AS Pure Mathematics to 3D with column vectors and with the use of **i**, **j** and **k** unit vectors;<br>• be able to calculate the magnitude of a 3D vector;<br>• know the definition of a unit vector in 3D;<br>• be able to add 3D vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations;<br>• understand and use position vectors, and calculate the distance between two 3D points represented by position vectors;<br>• be able to use vectors to solve problems in pure mathematics and in contexts (e.g. mechanics). |