Maths Y13 PURE		***Curriculum Checkpoints: What do students know and what can they do?***			
Summative Comment		**Developing**	**Securing**	**Mastering**	**Excelling**
AF1	**Algebra and functions**	Basic algebraic manipulation, such as adding, subtracting, multiplying, and dividing monomials and polynomials. Understanding the basic concepts of inequalities, such as how to represent inequalities with symbols and how to solve inequalities involving one variable. Graphing basic functions, such as linear and quadratic functions. Understanding the basic concepts of transformations, such as translations, reflections, and dilations.	Quadratic functions – factorizing, solving, graphs, and the discriminants. Equations – quadratic/linear simultaneous. Inequalities – linear and quadratic (including graphical solutions). Graphs – cubic, quartic, and reciprocal. Transformations – transforming graphs – f(x) notation.	Factoring polynomials, including quadratics. Solving quadratic equations, and using quadratic functions to model real-world phenomena. Understanding the features of graphs of functions, such as intercepts, asymptotes, and increasing/decreasing intervals. Understanding the relationship between transformations and function notation.	Applying the concepts of quadratic functions to more advanced topics, such as calculus and physics. Solving more complex systems of equations, and applying the concepts of equations to real-world problems. Solving more complex inequalities, and applying the concepts of inequalities to real-world problems. Applying the concepts of graphs to real-world problems, such as modeling the growth of a population or the trajectory of a projectile. Applying the concepts of transformations to more advanced topics, such as calculus and chaos theory.
AF2	**Algebraic methods,**	Simplify Algebraic fractions and can use proof by exhaustion to	Decompose rational functions into partial fractions (denominators not more complicated than squared linear terms and with no more than 3 terms, numerators constant or linear)	Use proof by contradiction to prove a statement. Find constants for Linear, Repeated and Improper Partial fractions	Use an appropriate proof within other areas of the specification. Use algebraic division to then convert into partial fractions work with fractional indices postive or negative and simplify them into given formats
AF3	**Functions**	Understand what is meant by a modulus of a linear function; sketch graphs of functions involving modulus functions; solve equations and inequalities involving modulus functions.	Work out the domain and range of functions and know the definition of a one-one and a many-one mappings; Work out the composition of two functions; work out the inverse of a function and sketch its graph; understand the condition for an inverse function to exist.	Know the effect of simple transformations on the graph of y = f(x) including sketching associated graphs and combinations of the transformations: y = af(x), y = f(x) + a, y = f(x + a), y = f(ax); transform graphs to produce other graphs; understand the effect of composite transformations on equations of curves and be able to describe them geometrically.	Use functions in modelling, including consideration of limitations and refinements of the models. Eg H = 11 – 10 cos (80t)° + 3 sin (80t)°

AF4	**Sequences & series**	Arithemtic sequence find the nth term can calculate the number of terms in a sequence. Find the sum of an arithmetic series and missing constants given the sum of the arithemtic series	geometric sequence find the nth term can calculate the number of terms in a sequence. Find the sum of an Geometric series and missing constants given the sum of the Geometric series	Able to prove geometric proof $S_n = a(1-r^n)/1-r$. Arithmetic proof on Sn =n/2(2a +(n-1)d). know the difference between convergent and divergent sequences	be familiar with ∑ notation and how it can be used to generate a sequence and series; know how this notation will lead to an AP or GP and its sum; Know that ∑_1^n▒1=n know that a sequence can be generated using a formula for the nth term or a recurrence relation of the form xn + 1 = f(xn); know the difference between increasing, decreasing and periodic sequences; understand how a recurrence relation of the form Un = f(Un-1) can generate a sequence; be able to describe increasing, decreasing and periodic sequences.
AF5	**Radians**	Convert between radians and degrees;	Use exact values of sin, cos and tan of , π/6, π/4, π/3, π/2, π (and their multiples).	Derive and use the formulae for arc length and area of sector. length of arc = rθ and area of sector = 1/2 r2θ. use the standard small angle approximations for sine, cosine and tangent.	Use cos θ ≈ 1 – θ^2/2 or sin θ ≈ θ annd tanθ ≈ θ to find approximate values for e.g 3x-1 /(x sin4x) when using small values of θ
AF6	**Binomial expansion**	Find the binomial expansion of $(1-x)^{-1}$ for rational values of n and |x|<1. Find the binomial expansion of $(1+x)^n$ for rational values of n and |x|<1; be able to find the binomial expansion of $(1+bx)^n$ for rational values of n and |x|<1/|b| ;	Find the binomial expansion of $(a+x)^n$ for rational values of n and |x|<a; Find the binomial expansion of $(a+bx)^n$ for rational values of n and |bx/a| < 1; know how to use the binomial theorem to find approximations (including roots).	Use partial fractions to write a rational function as a series expansion.	Using binomial expansion with suitable value of x to obtain an approximation or to obtain a exact square root value
AF7	**Trigonometric functions**	Understand the secant, cosecant and cotangent functions, and their relationships to sine, cosine and tangent and finding exact values of these trig functions	Know how to sketch the graph of secant, cosecant and cotangent in given intervals and transformation of these types of function	Simplify expressions and solve involving sec, cosec and cot Use the identities 1 + tan2 x = sec2 x and 1 + cot2 x = cosec2 x to prove other identities and solve equations in degrees and/or radians	Work with the inverse trig functions sin–1, cos–1 and tan–1. Sketch the graphs of sin–1, cos–1 and tan–1.

AF8	**Trigonometry and modelling**	Prove geometrically the following compound angle formulae for sin (A ± B), cos (A ± B) and tan (A ± B) Use the addition formulae to simplify trignometric expressions into given format	Work out double angle identities from previous trig identities to use double angle identities to rearrange expressions or prove other identities	Use double anglesin2x = 2sinxcosx identities to rearrange equations into a different form and then solve Solve simple trigonometric equations in a given interval, including g quadratic equations in sin, cos and tan and equations involving multiples of the unknown angle	Express a cosθ+b sinθ as a single sine or cosine function; R cos (x ± α) or R sin (x ± α) Modelling with trigonometric functions to find max and min values and where it occurs at. to construct proofs involving trigonometric functions and previously learnt identities
AF9	**Parametric**	Understand the difference between the Cartesian and parametric system of expressing coordinates; be able to convert between parametric and Cartesian forms	Plot and sketch curves given in parametric form recognise some standard curves in parametric form and how they can be used for modelling.	Find intersection points when paprametric crosses the coordinate axes	Use modelling with parametrics to find intersection points on the corrdiant eaxes
AF10	**Differentiation**	Differntiate sinx and cosx function using first principles differentiate to find equations of tangents and normals to the curve	Differentiatinf exponentia and and natural logs e.g e^x ,ln(x)and show that differential of $y = a^{kx}$ is $dy/dx = a^{kx}kln(a)$ implicit differentiation to differentiate an equation involving two variablesfind the gradient of a curve using implicit differentiation; verify a given point is stationary (implicit).	knowing how to use the chain rule fo funcitons of $y = (f(x))^n$ the n $dy/dx = (f(x))^{n-1}f'(x)$. Use the product rule find and identify the nature of stationary points and understand rates of change of gradient.	use the quotient rule do differentiate fractional functions Differentiate parametric function to retrieve dy/dx. know how to model the growth or decay of 2D and 3D objects using connected rates of change; be able to set up a differential equation using given information which may include direct proportion.
AF11	**Numerical methods**	Locate roots of f(x) = 0 by considering changes of sign of f(x); to use numerical methods to find solutions of equations.	understand the principle of iteration; understand the need for convergence in iteration; to use iteration to find terms in a sequence; to sketch cobweb and staircase diagrams; to use cobweb and staircase diagrams to demonstrate convergence or divergence for equations of the form x = g(x).	to solve equations approximately using the Newton-Raphson method; and understand how the Newton-Raphson method works in geometrical terms.	able to use numerical methods to solve problems in context with modelling type problems
AF12	**vectors**	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;	To calculate the magnitude of a 3D vector; know the definition of a unit vector in 3D;	Add 3D vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations	Use position vectors, and calculate the distance between two 3D points represented by position vectors. Use vectors to solve problems in pure mathematics and in contexts (e.g. mechanics)

AF13	**Integration**	Use integration as the limit of a sum. Understand the difference between an indefinite and definite integral and why we do not need + c; integrate polynomials and other functions to find definite integrals, and use these to find the areas of regions bounded by curves and/or lines; use a definite integral to find the area under a curve and the area between two curves.	Integrate rational expressions by using partial fractions that are linear in the denominator; Simplify the expression using laws of logarithms use a definite integral to find the area under a curve and the area between two curves.	Use the trapezium rule to find an approximation to the area under a curve; and appreciate the trapezium rule is an approximation and realise when it gives an overestimate or underestimate. Find area under x axis and between line and coordinate axis. Integrate expressions using an appropriate substitution. Select the correct substitution and justify your choices.	Integrate an expression using integration by parts and select the correct method for integration and justify their choices Write a differential equation from a worded problem. Solve a differential equation. Substitute the initial conditions or otherwise into the equation to find + c and the general solution.