

MATHS		Curriculum Checkpoints: What do students know and what can they do?			
Year 12 Pure					
Summative Comment		Developing	Securing	Mastering	Excelling
AF1	Algebra and functions	<p>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.</p>	<p>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.</p>	<p>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.</p>	<p>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.</p>
AF2	Algebra expressions	<p>Perform essential algebraic manipulations, such as expanding brackets, collecting like terms, factorising etc;</p>	<p>Factorise quadratics and cubics Understand and be able to use the laws of indices for all rational exponents;</p>	<p>Use and manipulate surds, including rationalising the denominator.</p>	<p>Manipulate surds, including rationalising the denominator Rationalise denminators into given exact forms. work with fractional indices postive or negative and simplify them into given formats</p>
AF3	Quadratics	<p>Solve a quadratic equation by factorising;</p>	<p>Work with quadratic functions and their graphs;</p>	<p>Know and be able to use the discriminant b^2-4ac of a quadratic function, including the conditions for real and repeated roots;</p>	<p>Complete the square. e.g. $ax^2+bx+c=a(x+b/2a)^2+(c-b^2/4a)$. Solve quadratic equations, including in a function of the unknown. Modelling with quadratics</p>

AF4	Equations & Inequalities	Solve linear simultaneous equations using elimination and substitution	Substitution to solve simultaneous equations where one equation is linear and the other quadratic.	Solve quadratics with inequalities and sketch the quadratic with highlighted region	Find solution between linear and quadratic equations and the correct solution that satisfy the region and using set notation when giving solution So, for example: $x < a$ or $x > b$ is equivalent to $\{x: x < a\} \cup \{x: x > b\}$ and $\{x: c < x\} \cap \{x: x < d\}$. Shade the correct region between at least two equations and interpreting the third inequality as the range of x for which the curve $y = px^2 + qx + r$ is below the line with equation $y = ax + b$.
AF5	Graphs & transformation	Sketch curves defined by simple equations such as cubic graphs and find solutions where it crosses the coordinate axis	Sketch curves of quartic graphs and find solutions where it crosses the coordinate axis	Sketch curves defined by simple equations such as reciprocal graphs and define the asymptotes of of reciprocals for $1/x$ or $1/(x-2)$. Students should be able to sketch curves like $y = (x-3)^2 + 2$ and $y = 2/(x-3) + 2$	Use intersection points of graphs to solve equations for reciprocal, cubic, quartic with other graphs. Understand the effect of simple transformations on the graph of $y = f(x)$. Sketch the result of a simple transformation given the graph of any function $y = f(x)$ and then sketch graphs of $f(x), f(-x), f(x-a), f(x+a), f(ax), af(x)$
AF5	straight line graphs	can write equation of a straight line in the form $y = mx+c$ and find the gradient between 2 points.	write the equation of a straight line in the form $y-y_1=m(x-x_1)$ and the form $ax+by+c = 0$	find intersection point between two lines of the form $y = mx+c$ and $ax+by+c=0$ Find the length between the two coordinates	identify parallel and perpendicular lines and find intersection points between the two lines find the distance between two points and the area between lines and coordinate axes and modelling with straight lines.

AF5	Circles	Using the equation of a circle in the form $(x-a)^2 + (y-b)^2 = r^2$ and finding the midpoints between two points on the circle and perpendicular bisector	Completing the square to find the centre and radius of a circle.	Find the coordinates of the points where the a linear line meets the circle.	Finding equation of a tangent in the form $ax+by+c$.when it touches a circle. Finding two possible linear equations with two tangents with same gradient and to use the properties of chords and tangents.
AF5	Differentiation	Derivative of $f(x)$ as the gradient of the tangent to the graph of $y = f(x)$ at a general point (x, y) ;	Differentiating ax^n and differentiating quadratics and differentiating functions with two or more terms	Finding equations of tangents normals and determine if a function is increasing or decreasing based on given x values. Finding 2nd order derivatives	Know how to differentiate from first principles. Students should be able to use the gradient expression $\lim_{h \rightarrow 0} \frac{(x+h)^n - x^n}{h}$. The alternative notations $h \rightarrow 0$ rather than $\delta x \rightarrow 0$ are acceptable. Able to determine Stationary points whether they are maximum or minimum. sketching gradient functions and modelling
AF5	Integration	Integrate x^n (excluding $n = -1$),	To evaluate definite integrals and use a definite integral to find the area under a curve	Find the constant c of a function given it passes through a point	Finding area under curves between given roots and under the x axis and between curves and lines find missing limits of a definite integral given the area.

AF5	Trigonometry ratios	Use sine and cosine rules to find missing sides and angles; the area of a triangle in the form $\frac{1}{2} ab \sin C$	Solve triangle problems involving sine and cosine rules	Use the sine, cosine and tangent functions; their graphs, symmetries and periodicity.	Transforming trigonometric graphs and finding missing constants from transforming r =trigonometric graphs
AF5	Trigonometric identities	Finding negative & positive angles using rules of $\sin x, \cos x$ and $\tan x$	Know the exact trig ratios of 30,60 and 45 degrees $\sin x, \cos x$ and $\tan x$ functions	$\sin^2 \theta + \cos^2 \theta = 1$ $\tan \theta = \frac{\sin \theta}{\cos \theta}$ Understand and use $\sin^2 \theta + \cos^2 \theta = 1$	Solve simple trigonometric equations in a given interval, including quadratic equations in \sin, \cos and \tan and equations involving multiples of the unknown angle solve hard trigonometric equations and using their identities
AF5	vectors	Finding vectors between different locations	Representing vectors with different scalars involving λ . Add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations	Finding magnitude and direction of given vectors e.g calculate the distance between two points represented by position vectors	Finding position vectors from given partial vectors and understand and be able to use position vectors be able to add vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations

AF5	Algebraic methods, division, factor theorem and proof	Simplify Algebraic fractions	Use remainder theorem to divide polynomials with given factors	Use factor theorem to find factors	Using mathematical proof, proceeding from given assumptions through a series of logical steps to a conclusion; use methods of proof, including: proof by deduction, proof by exhaustion, disproof by counter-example use mathematical proofs with contradiction
AF5	Binomial expansion	Use pascals triangle to identify coefficient for expansion of $(a + bx)^n$	Use factorial notation ${}^n C_r$, to find entries in a pascals triangle from a calculator	Use the binomial expansion of $(a + bx)^n$ for positive integer n ; and to find an unknown coefficient of a binomial expansion	Find unknown powers of a binomial expansion of $(2k + x)^n$
AF5	Exponential & Logarithms	Sketch exponential functions of the form a^x	Identify intersection points of e^x on the coordinate axis with different transformations Solve equations of the form $a^x=b$ Use logarithmic graphs to estimate parameters in relationships of the form $y=ax^n$ and $y=kb^x$, given data for x and y	Know that the gradient of e^{kx} is equal to ke^{kx} and hence understand why the exponential model is suitable in many applications. Use logarithmic graphs to estimate parameters in relationships of the form $y=ax^n$ and $y=kb^x$, given data for x and y	Know and use the definition of $\log_a x$ as the inverse of a^x , where a is positive and $x \geq 0$ Know and use the function $\ln x$ and its graph Know and use $\ln x$ as the inverse function of e^x Understand and use exponential growth and decay; use in modelling (examples may include the use of e in continuous compound interest, radioactive decay, drug concentration decay, exponential growth as a model for population growth); consideration of limitations and refinements of exponential models