Subject: Mathematics

NPCAT Curriculum Overview 2021-2022

		Autumn 1					Autumn 2				Spring 1					Spring 2	
Y12	**Teaching focus**	**Pure**											**Statistics**			**Mechanics**	
		GCSE Transition	Proof	Polynomials	Straight lines and circles	Inequalities	Trigonometry	Curve sketching	Differentiation	Exponentials and logs	Integration	Vectors	Collecting, representing and interpreting data	Probability and distributions	Hypothesis testing	Units and Kinematics	Forces
	Rationale	To ensure pupils are confident with prior knowledge and algebra skills from KS4.	Building on basic algebraic proof from year 11, to look at different types of proof.	Applying knowledge of quadratics to expressions and equations of exponents higher than 2.	Building on KS4 knowledge of straight line graphs, and to apply this to equations of circles, applying skills from the GCSE transition unit.	Continuation of skills from GCSE, including graphs from the previous topics.	The first unit of trigonometry in the course, building on GCSE prior knowledge, and applying skills from previous block to trigonometric equations.	Pupils know how to manipulate the algebra, this is then applied to manipulating graphs,	Understanding of straight line graphs and curves, leads on to the introduction of calculus.	Pupils have seen the graph of an exponential, they are now introduced to logarithms.	Understanding of straight line graphs and curves, leads on from differentiation to integration.	Building on from KS4 knowledge of column vectors and vector journeys.	Delving deeper into interpreting data using KS4 skills for example interpreting key values on a box plot.	Building upon KS4 knowledge of probability, including conditional probability, introducing more probability rules.	Leading on from probability and distributions, pupils begin to apply knowledge to tests.	Linking knowledge from Physics, pupils look at representing mechanics on graphs.	Building on the understanding of units of mechanics.
	End point	**By the end of this year in Mathematics, pupils will be able to understand, reason with and solve problems involving...**															
		Laws of indices Surds Trigonometry Quadratics Simultaneous equations	Proof by deduction Proof by exhaustion Disproof by counter-example	Binomial theorem Algebraic division Factor theorem	Equations of straight lines Equations of circles	Solve linear and quadratic inequalities	Sine, cosine and tangent function Trigonometric identities Trigonometric equations	Graphs of functions Transformations of graphs	First derivative Second derivative Polynomials Applications including tangents, normal, increasing and decreasing functions and turning points	Laws of logarithms Exponential equations Exponential graphs Exponential functions Exponential models Exponential growth and decay Curve fitting	Fundamental theorem of calculus Polynomials Definite integration	Properties of a vector Components of a vector Position vectors Vector equations	Sampling Central tendency and spread Single variable data Bivariate data Analysis	Probability Probability distribution functions Binomial distribution	Formulating a test Conducting a test	SI units Displacement time and velocity time graphs Constant acceleration formulae Variable acceleration	Newton's first law Dynamics – Newton's second law Motion under gravity Systems of forces – Newton's third law
	Key vocabulary	Exponent Surd Rationalise Discriminant Roots Vertex	Exhaustion Set notation	Polynomial Binomial Factor Discriminant	Gradient Perpendicular Tangent Normal Chord	Inequality Critical value Region	Sine Cosine Tangent Range Identity	Intercepts Shape Translate Reflect Stretch Scale factor	Differentiate Index form Increasing Stationary point Tangent Normal	Exponent Logarithm Base e Model	Integration Constant of integration Definite integral Limits Area	Magnitude Direction Component i j Unit vector	Sampling Mean Standard deviation Outlier Boxplot Histogram Correlation	Independent Mutually exclusive Distribution	Hypotheses Significance Binomial	Speed Velocity Distance Displacement Acceleration Calculus	Force Mass Weight Gravity Equilibrium Tension
	Summative assessment		Induction assessment			HT1 assessment			AP1 (90 mins)						HT3 assessment		AP2 (2x90 min)

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						(45 mins)									(45 mins)		

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		Summer 1			Summer 2	
Y12	**Focus**	**<u>Pure</u>**				
		Differentiation	Calculus of exponential and trigonometric functions	Partial fractions	Binomial expansion	Numerical methods
	Rationale	Pupils can now build on their basic differentiation understanding. This leads on to differential equations in year 13.	Building on from Trigonometry and Logarithms earlier in the year. Leading on to solving problems in context throughout year 13.	A key skill needed for further differentiation of more complex equations	Building on KS4 use of expanding brackets, using a theorem,	Exploring other ways to solve equations, beyond quadratic equation and iteration from KS4
	End point	**By the end of this year in Mathematics, pupils will be able to understand, reason with and solve problems involving...**				
		Chain, product and quotient rule Implicit differentiation Differentiation of a^{kx} Inverse functions	Integration of exponential and trigonometric functions Definite integration of exponential and trigonometric functions		General binomial theorem (1+x)^n for any rational n Validity of expansion, Use for approximations	Locating roots of a function Newton-Raphson method Fixed point iteration
	Key vocabulary	Chain Product Quotient Implicit	Exponential Logarithm Trigonometric Differentiate Integrate	Partial Repeated roots Degree of polynomial	Binomial Range of validity Partial fraction	Numerical Iteration Trapezium Staircase Cobweb
	Assessment schedule		HT5 assessment (2x30mins)		AP3 (PPE) Progression exams 2 x 90 mins	

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	Autumn 1	Autumn 2	Spring 1	Spring 2

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		Pure									**Statistics**			**Mechanics**			
	Teaching Focus	Proof	Differentiation	Trig and circle measure	Functions and transformations	Further trigonometry	Sequences and series	Integration	Differential equations	Parametric equations	Probability	Statistical distributions	Hypothesis testing	Kinematics and vectors	Forces	Projectiles	Moments
	Rationale	Building on skills with proof from KS4 and year 12	Developing basic differentiation covered in year 12 Properties of Curves Points of inflection	Using pupils knowledge of year 12 trigonometry along with binomial expansion	In KS4 pupils have explored composite and inverse functions with function machines as well as notation, along side transformations.	Building on identities learned in year 12, to allow pupils to be able to solve more complex trigonometric equations in context.	In KS4 pupils have explored arithmetic linear and quadratic sequences, this unit extends this and looks at geometric sequences, and modelling in real life context.	Developing pupils understanding of basic integration, exploring integration of more complex expressions, involving trigonometry too.	Using skills from basic differentiation of expressions, pupils will learn to apply these to equations.	Pupils have not yet come across parametric equations, however they will be able to apply their algebraic and differential skills to this topic. Rates of change also looks at different contexts.	This is a recap of probability skills covered in KS4 at GCSE.	Building on pupils understanding of probability of events happening and how the outcomes are distributed. Looking forward to hypothesis testing.	Using knowledge from the previous unit, pupils now begin to apply concepts to the normal distribution.	Building on kinematics from year 12.	Building on Newton's laws from year 12, pupils begin resolving forces to solve more complex problems	Building on Newton's laws from year 12, pupils begin resolving forces to solve more complex problems, involving parabola shapes covered in Pure	Building on Newton's laws from year 12, pupils begin resolving forces to solve more complex problems, involving parabola shapes covered in Pure
Y 1 3		**By the end of this year in Mathematics, pupils will be able to understand, reason with and solve problems involving...**															
	End point	Proof by contradiction (including proof of the irrationality of root2 and the infinity of primes) Criticising proofs		Working with radians Small angle approximations Exact values Inverse trigonometric functions	Composite and inverse functions Combined transformations Modulus of a linear function	Reciprocal trigonometric functions Trigonometric identities and equations Compound and double angle formulae Harmonic form Trigonometric equations	General sequences Sigma notation Arithmetic sequences and series Geometric sequences and series Infinite geometric series Modelling	Standard integrals Substitution Integration by parts Trigonometric identities Partial fractions Definite integration Numerical integration	Separable differential equations Forming differential equations Modelling with differential equations Interpreting solutions	Parametric equations Modelling in contexts Differentiation of parametric equations Rates of change	Set notation and Venn diagrams Conditional probability formula Two-way tables Tree diagrams Modelling	Normal distribution Modelling with normal distributions	Mean of a normal distribution Correlation coefficient	Describing motion in 2 dimensions Constant acceleration formulae Calculus with vectors Trigonometric functions Vectors in 3 dimensions	Resolving forces – forces in equilibrium Resolving forces – dynamic motion Newton's second law Coefficient of friction Inclined planes	Describing motion in 2 dimensions Projectile model	Unit of a moment Moments of a force
	Key Vocabulary	Contradiction Rational	Chain Product Quotient Stationary Implicit Inflection Concave Convex Concave	Radians Identities Sectors	Domain Range Composite Inverse Transformation Modulus	Reciprocal Identities Harmonic form Radians	Sigma Arithmetic Geometric Sequence Series Difference	Integrate Composite Chain Product Numerical	Differential eq. Rate of change F=ma Proportion	Parametric Parameters Chain Cartesian	Conditional Independent Mutually exclusive	Mean Standard deviation Distribution Inverse	Hypothesis Significance Sample	Magnitude Direction Calculus Displacement Velocity	Equilibrium Resolving Friction Force Tension Mass	Velocity Acceleration Displacement Gravity Newton Assumption	Moment Perpendicular Force

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							Ratio		Direct vs. inverse					Acceleration	Weight		
	Summative Assessment	Baseline assessment (75 mins)		AP1 (95 mins)		AP2 (PPE) 2 x 90 mins				HT3 Assessment (45 mins)					AP3 (PPE) 3 x 120 mins		<u>Summer</u> A level exams (May/June) 3 x 120 mins