Year 1	Core		Applied	
	Big Questions	Small Questions	Big Questions	Small Questions
Autumn 1	Algebra and Functions (Part 1) [chapter 1 &3]	• Multiply and divide integer powers • Expand a single term over brackets and collect like terms • Expand the product of two or three expressions • Factorise linear, quadratics and simple cubic expressions • Know and use the laws of indices • Simplify and use the rules of surds • Rationalise denominators • Solve linear simultaneous equations using elimination or substitution • Solve simultaneous equations: one linear and one quadratic • Interpret algebraic solutions of equation graphically • Solve linear inequalities • Solve quadratic inequalities • Interpret inequalities graphically • Represent linear and quadratic inequalities graphically	Statistical Sampling [chapter 1]	• Understand 'population', 'sample', and 'census' and comment on the advantages and disadvantages of each • Understand the advantages and disadvantages of simple random sampling, systematic sampling, stratified sampling, quota sampling and opportunity sampling • Define qualitative, quantitative, discrete and continuous data and understand grouped data • Understand the large data set and how to collect data from it, identify types of data and calculate simple statistics
			Data Presentation and Interpretation (part 1) [chapter 2&3]	• Calculate measures of central tendency such as the mean, median and mode • Calculate measures of spread such as range, interquartile range and interpercentile range • Calculate the variance and standard deviation • Understand and use coding • Identify outliers in data sets • Draw and interpret box plots • Draw and interpret cumulative frequency diagrams • Draw and interpret histograms • Compare two data sets
	Further Algebra [chapter 2 &4]	• Solve quadratic equations using factorisation, the quadratics formula and completing the square • Read and use f(x) notation when working with functions • Sketch the graph and find the turning point of a quadratic function • Find and interpret the discriminant of a quadratic expression • Use and apply models that involve quadratic functions • Sketch cubic graphs • Sketch quartic graphs	Quantities and units in Mechanics [Chapter 8]	• Understand how the concept of a mathematical model applies to mechanics • Understand and be able to apply some of the common assumptions used in mechanical models • Know SI units for quantities and derived quantities used in mechanics • Know the difference between scalar and vector quantities

		• Sketch reciprocal graphs of the form $y=\dfrac{a}{x}$ and $y=\dfrac{a}{x^2}$ • Use intersection points of graphs to solve equations • Translate graphs • Stretch graphs • Transform graphs of unfamiliar functions		

Autumn 2	Differentiation [ch 12]	• Find the derivative, $f'(x)$ or $\dfrac{dy}{dx}$, of a simple function • Use the derivative to solve problems involving gradients, tangents and normal • Identify increasing and decreasing functions • Find the second order derivative, $f''(x)$ or $\dfrac{d^2y}{dx^2}$, of a simple function • Find stationary points of functions and determine their nature • Sketch the gradient function of a given function • Model real-life situation with differentiation	Probability [Chapter 5]	• Calculate probabilities for single events • Draw and interpret Venn diagrams • Understand mutually exclusive and independent events, and determine whether two events are independent • Use and understand tree diagrams
			Statistical Distributions	• Understand and use simple discrete probability distributions including the discrete uniform distribution • Understand the binomial distribution as a model and comment on appropriateness • Calculate individual probabilities for the binomial distribution • Calculate cumulative probabilities for the binomial distribution
	Integration [ch 13]	• Find y given $\dfrac{dy}{dx}$ for x^n • Integrate polynomials • Find $f(x)$, given $f'(x)$ and a point on the curve • Evaluate a definite integral • Find the area bounded by a curve and the x-axis • Find areas bounded by curves and straight lines	Kinematics 1 [Chapter 9]	• Understand and interpret displacement-time graphs • Understand and interpret velocity-time graphs • Derive the constant acceleration formulae and use them to solve problems • Use the constant acceleration formulae to solve problems involving vertical motion under gravity

Spring 1	Vectors (2D) [ch 11]	• Use vectors in two dimensions • Use column vectors and carry out arithmetic operations on vectors • Calculate the magnitude and direction of a vector • Understand and use position vectors • Use vectors to solve geometric problems • Understand vector magnitude and use vectors in speed and distance calculations • Use vectors to solve problems in context	Statistical Hypothesis Testing [Chapter 7]	• Understand the language and concepts of hypothesis testing • Understand that a sample is used to make an inference about a population • Find critical values of binomial distribution using tables • Carry out a one-tailed test for the proportion of the binomial distribution and interpret the results • Carry out a two-tailed test for the proportion of the binomial distribution and interpret the results
	Coordinate Geometry in the (x, y) plane [ch 5 & 6]	• Calculate the gradient of a line joining a pair of points • Understand the link between the equation of a line, and its gradient and intercept • Find the equation of a line given (i) the gradient and one point on the line or (ii) two points on the line • Fine the point of intersection for a pair of straight	Forces and Newton's Laws [Chapter 10]	• Draw force diagrams and calculate resultant forces • Understand and use Newton's first law • Calculate resultant forces by adding vectors • Understanding and use Newton's second law, F = *ma* • Apply Newton's second law to vector forces

		lines • Know and use the rules for parallel and perpendicular gradients • Solve length and area problems on coordinate grids • Use straight line graphs to construct mathematical models • Find the mid-point of a line segment • Find the equation of the perpendicular bisector to a line segment • Know how to find the equation of a circle • Solve geometric problems involving straight lines and circles • Use circle properties to solve problems on coordinate grids • Find the angle in a semicircle and solve other problems involving circles and triangles		and acceleration • Understand and use Newton's third law • Solve problems involving connected particles
	Trigonometry [ch 9]	• Use the cosine rule to find a missing side or angle • Use the sine rule to find a missing side or angle • Find the area of triangle using an appropriate formula • Solve problems involving triangles • Sketch the graphs of the sine, cosine and tangent functions • Sketch simple transformations of these graphs		

| Spring 2 | Trigonometry

[ch 10] | • Calculate the sine, cosine and tangent of any angle
• Know the exact trigonometric ratios for 30°, 45° and 60°
• Know and use the relationships $tan\theta \equiv \dfrac{sin\theta}{cos\theta}$ and $sin^2\theta + cos^2\theta \equiv 1$ | Data Presentation and Interpretation (part 2)

[Chapter 4] | • Draw and interpret scatter diagrams for the bivariate data
• Interpret correlation and understand that it does not imply causation
• Understand when you can use a regression line to make predictions |

		• Solve simple trigonometric equations of the forms $sin\theta=k, cos\theta=k$ and $tan\theta=k$ • Solve more complicated trigonometric equations of the forms $\sin n\theta=k$ and $\sin(\theta\pm\alpha)=k$ and equivalent equations involving cos and tan • Solve trigonometric equations that produce quadratics		
	Algebra and Functions (part 2) [ch 7 & 8]	• Cancel factors in algebraic fractions • Divide a polynomial by a linear expression • Use the factor theorem to factorise a cubic expression • Construct mathematical proofs using algebra • Use proof by exhaustion and disproof by counter-example • Use Pascal's triangle to identify binomial coefficients and use them to expand simple binomial expressions • Use combinations and factorial notation • Use the binomial expansion to expand brackets • Find individual coefficients in a binomial expansion • Make approximations using the binomial expansion	Kinematics 2 [Chapter 11]	• Understand that displacement, velocity and acceleration may be given as functions of time • Use differentiation to solve kinematics problems • Use calculus to solve problems involving maxima and minima • Use integration to solve kinematics problems • Use calculus to derive constant acceleration formulae

1 Summ	Exponential and Logarithms	• Sketch graphs of the form $y=a^x$, $y=e^x$, and transformations of these graphs • Differentiate e^{kx} and understand why this result	Normal Distribution	• Understand the normal distribution and the characteristics of a normal distribution • Find the percentage points on a standard normal curve

Summer 2	Algebraic and Partial Fractions [ch 1.2, 1.3, 1.4, 1.5]	• Multiply and divide two or more algebraic fractions • Add or subtract two or more algebraic fractions • Convert an expression with linear factors in the denominator into partial fractions • Convert an expression with repeated linear factors in the denominator into partial fractions • Divide algebraic expressions	Forces at any angle (part 1) [Chapter 5]	• Resolve forces into components • Use the triangle law to find a resultant force • Solve problems involving smooth or rough inclined planes • Understand friction and the coefficient of friction • Use $F \leq \mu R$

		• Convert an improper fraction into partial fraction form		
	Trigonometry (Part 1) [ch 5 & 6]	• Convert between degrees and radians and apply this to trigonometric graphs and their transformations • Know exact values of angles measured in radians • Find an arc length using radians • Find areas of sectors and segments using radians • Solve trigonometric equations in radians • Use approximate trigonometric values when θ is small • Understand the definitions of secant, cosecant and cotangent and their relationship to cosine, sine and tangent • Understand the graphs of sec, cosec and cot and their domain and range • Simplify expressions, prove simple identities and solve equations involving sec, cosec and cot • Prove and use $sec^2 x \equiv 1 + \tan^2 x$ and $$cosec^2 x \equiv 1 + \cot^2 x$$ • Understand and use inverse trigonometric functions and their domain and ranges		
	Differentiation [ch 9]	• Differentiate trigonometric functions • Differentiate exponentials and logarithms • Differentiate functions using the chain, product and quotient rules • Differentiate parametric functions • Differentiate functions which are defined implicitly • Use the second derivative to describe the behaviour of a function • Solve problems involving connected rates of change and construct simple differential equations		

Year 2	Core			Applied	
	Big Questions	Small Questions	Big Questions		Small Questions
Autumn 1	Integration [ch 11]	- Integrate standard mathematical functions including trigonometric and exponential functions and use the reverse of the chain rule to integrate functions of the form $f(ax+b)$ - Use trigonometric identities in integration - Use the reverse of the chain rule to integrate more complex functions - Integrate functions by making a substitution, using integration by parts and using partial fractions - Use integration to find the area under a curve - Use the trapezium rule to approximate the area under a curve - Solve simple differential equations and model real-life situations with differential equations	Application of Kinematics [Chapter 6]		- Model motion under gravity for an object projected horizontally - Resolve velocity into components - Solve problems involving particles projected at an angle - Derive the formulae for time, range, greatest height and the equation of the path of a projectile

Autumn 2	Proof [ch 1.1]	• Use proof by contradictions to prove true statements	Regression and correlation [Chapter 1]	• Understand exponential models in bivariate data • Use a change of variable to estimate coefficients in an exponential model • Understand and calculate the product moment correlation coefficient Carry out a hypothesis test for zero correlation
	Functions and Modelling [ch 2]	• Understand and use the modulus function • Understand mappings and functions, and use domain and range • Combine two or more functions to make a composite function • Know how to find the inverse of a function graphically and algebraically • Sketch the graphs of the modulus functions $y=\|f(x)\|$ and $y=f(\|x\|)$ • Apply a combination of two (or more) transformations to the same curve • Transform the modulus function	Applications of Forces [Chapter 7]	• Find an unknown when a system is in equilibrium • Solve statics problems involving weight, tension and pulleys • Understand and solve problems involving limiting equilibrium • Solve problems involving motion on a rough or smooth inclined plane • Solve problems involving connected particles that require the resolution of forces
	Series and Sequences [ch 3]	• Find the nth term of an arithmetic sequence • Prove and use the formula for the sum of the first n terms of an arithmetic series • Find the nth term of a geometric sequence • Prove and use the formula for the sum of a finite geometric series • Prove and use the formula for the sum to infinity of a convergent geometric series • Use sigma notation to describe series • Generate sequences from recurrence relations • Model real-life situations with sequences and series		

Spring 1	The Binomial Theorem [ch 4]	• Expand $(1+x)^n$ for any rational constant n and determine the range of values of x for which the expansion is valid • Expand $(a+bx)^n$ for any rational constant n and determine the range of values of x for which the expansion is valid • Use partial fractions to expand fractional expressions	Probability [Chapter 2]	• Understand set notation on in probability • Understand conditional probability • Solve conditional probability problems using two-way tables and Venn Diagrams • Use probability formulae to solve problems • Solve conditional probability using tree diagrams
	Trigonometry (part 2) [ch 7]	• Prove and use the addition formulae • Understand and use the double-angle formulae • Solve trigonometric equations using the double-angle and addition formulae • Write expressions of the form $a\cos\theta \pm b\sin\theta$ in the forms $R\cos(\theta \pm \alpha)$ or $R\sin(\theta \pm \alpha)$ • Prove trigonometric identities using a variety of identities • Use trigonometric functions to model real-life situations	Further Kinematics [Chapter 8]	• Work with vectors for displacement, velocity and acceleration when using the vector equations of motion • Use calculus with harder functions of time involving variable acceleration • Differentiate and integrate vectors with respect to time

Spring 2	Parametric Equations [ch 8]	• Convert parametric equations into Cartesian form by substitution • Convert parametric equations into Cartesian form using trigonometric identities • Understand and use parametric equations of curves and sketch parametric curves • Solve coordinate geometry problems involving parametric equations • Use parametric equations in modelling in a variety of contexts	Moments [Chapter 4]	• Calculate the turning effect of a force applied to a rigid body • Calculate the resultant moment of a set of forces acting on a rigid body • Solve problems involving uniform rods in equilibrium • Solve problems involving non-uniform rods • Solve problems involving rods on the point of tilting
	Numerical Methods [ch 10]	• Locate roots of $f(x)=0$ by considering changes of sign • Use iteration to find an approximation to the root of the equations $f(x)=0$ • Use the Newton-Raphson procedure to find approximations to the solutions of equations of the form $f(x)=0$ • Use numerical methods to solve problems in context		

Summer 1	Vectors 3D [ch 12]	• Understand 3D Cartesian coordinates • Use vectors in three dimensions • Use vectors to solve geometric problems • Model 3D motion in mechanics with vectors		