Year 13 Maths Curriculum Map

Sequencing of topics	**What knowledge will students develop? (Including key terminology)**	**What skills will students develop? (Including literacy & numeracy)**	**Assessment opportunities**	**Homework opportunities**	**Personal development (Ursuline Values, Catholic Social Teaching, Cultural Capital, Cross-curricular, Careers)**	**Curriculum Links**
Algebraic methods	• Introduce proofs including proof by contradiction • Algebraic fractions – To multiply fractions, cancel common factors, multiply the numerators and denominators. • Add and subtract two fractions • Partial fractions – Splitting the fractions • Dealing with repeated roots • Algebraic division including dealing with improper fractions	• understand that various types of proof can be used to give confirmation that previously learnt formulae are true, and have a sound mathematical basis; • 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; • be able to use an appropriate proof within other areas of the specification later in the course. • be able to add, subtract, multiply and divide algebraic fractions; • know how to use the factor theorem to shown a linear expression of the form $(a+bx)$ is a factor of a polynomial;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning Research opportunities: Which famous Mathematicians discovered various proofs that are explored in this chapter.	**Courageous and Resilient** Proofs often involve demonstrating a statement holds true for all values. This process may involve working with unfamiliar or challenging concepts and requiring persistence and resilience in overcoming obstacles. Truth and Integrity Exposure to mathematical journals or articles that showcase different approaches to proofs. Computer science Physics Software developer mathematician research scientist	Algebraic expression Fractions

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		• know how to use the factor theorem for divisors of the form $(a+bx)$; • be able to simplify algebraic fractions by fully factorising polynomials up to cubic. be able to split a proper fraction into partial fractions; • be able to split an improper fraction into partial fractions, dividing the numerator by the denominator (by polynomial long division or by inspection).				
Functions and graphs	• Setting up modulus functions, solving and sketching them • Definition of a function and using mappings • Composite functions and inverse functions • Sketching modulus functions involving transformations • Using combinations of transformations to	• understand what is meant by a modulus of a linear function; • be able to sketch graphs of functions involving modulus functions; • be able to solve equations and inequalities involving modulus functions. • be able to work out the domain and range of functions; • know the definition of a one-one and a many-one mappings;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	Tolerant of the variety of methods that could be used to help sketch key points on a graph Computer Science Science STEM PE Telecommunications Engineering Construction	Graphs and transformations

	solve modulus problems	• be able to work out the composition of two functions; • be able to work out the inverse of a function and sketch its graph; • understand the condition for an inverse function to exist. • understand 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); • be able to transform graphs to produce other graphs; • understand the effect of composite transformations on equations of curves and be able to describe them geometrically. •			Astronomy Insurance agents Bankers Economists	
Sequence and series	• Arithmetic sequences • Arithmetic series • Geometric sequence • Geometric series • Sum of infinity • Sigma notation	• use functions in modelling, including consideration of limitations and refinements of the models. • know what a sequence of numbers is and the meaning of finite and infinite sequences; • know what a series is;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions	**Discerning and Joyful** Students can appreciate sequences as finite and infinite sums. Option for the Poor and Vulnerable Care for God's Creation	Nth term for linear and quadratic sequences

	• Recurrence relations • Modelling with series	• know the difference between convergent and divergent sequences; • know what is meant by arithmetic series and sequences; • be able to use the standard formulae associated with arithmetic series and sequences; • know what is meant by geometric series and sequences; • be able to use the standard formulae associated with geometric series and sequences; • know the condition for a geometric series to be convergent and be able to find its sum to infinity; • be able to solve problems involving arithmetic and geometric series and sequences; • know the proofs and derivations of the sum formulae (for both AP and GP). • be familiar with ∑ notation and how it can be used to generate a sequence and series;		3. Past exam questions 4. Opportunities for flipped learning	Availability of online tutorials or videos that demonstrate the process of finding Arithmetic and Geometric series for different functions. Physics Computer Science Economics Electrical Engineer Financial Analyst Game Developer	

		• know how this notation will lead to an AP or GP and its sum; $\sum_{1}^{n} 1 = n$ • Know that . • 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.				
Binomial expansion	• Expanding $(1 + x)^n$ • Expanding $(a + bx)^n$ • Using partial fractions	• be able to find the binomial expansion of $(1-x)^{-1}$ for rational values of n and $\|x\| < 1$; • be able to find the binomial expansion of $(1+x)^n$ for rational values of n and $\|x\| < 1$;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for	**Discerning and Joyful** Students can appreciate how pascals triangle simplifies the process of binomial expansion. Availability of online tutorials and videos that show the relationship between pascals triangle and binomial expansion.	Pascal's triangle Solving binomial problems and Binomial estimation from year 1

		• be able to find the binomial expansion of $(1+bx)^n$ for rational values of n and $\|x\| < \frac{1}{\|b\|}$; • be able to find the binomial expansion of $(a+x)^n$ for rational values of n and $\|x\| < a$; • be able to find the binomial expansion of $(a+bx)^n$ for rational values of n and $\left\|\frac{bx}{a}\right\| < 1$; • know how to use the binomial theorem to find approximations (including roots). • be able to use partial fractions to write a rational function as a series expansion.		flipped learning	Physics Computer Science Economics **Electrical Engineer** **Financial Analyst** **Game Developer**	
Radians	• Radian measure • Arc length • Areas of sectors and segments • Solving trigonometric equations	• understand the definition of a radian and be able to convert between radians and degrees; • know and be able to use exact values of sin, cos and tan;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos	**Leading for Justice, Truth, and Integrity** Students can explore using a different measurement for angles to analyse the real-world accurately.	Arc length and sector area Further trigonometry

	• Small angle approximations	• be able to derive and use the formulae for arc length and area of sector. • understand and be able to use the standard small angle approximations for sine, cosine and tangent.		2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**Courageous and Resilient** Geometry requires students to approach problem-solving with courage and resilience. **Solidarity** **Option for the Poor and Vulnerable.** **Physics:** **Understanding angles is relevant in studying concepts such as projectile motion, reflection, refraction, and optics.** **Construction** **Carpentry** **Robotics** **Navigation** **Astronomy**	
Trigonometric functions	• Secant, cosecant and cotangent • Graphs of sec x, cosec x and cot x • Using sec x, cosec x and cot x • Trigonometric identities	• understand the secant, cosecant and cotangent functions, and their relationships to sine, cosine and tangent; • be able to sketch the graphs of secant, cosecant and cotangent;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions	**Leading for Justice, Truth, and Integrity** Students can explore how trigonometry enables us to model and analyse real-world accurately. **Geography**	Trigonometry identities and equations – year 12

	• Inverse trigonometric functions	• be able to simplify expressions and solve involving sec, cosec and cot; • be able to solve identities involving sec, cosec and cot; • know and be able to 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 • be able to work with the inverse trig functions sin–1, cos–1 and tan–1; • be able to sketch the graphs of sin–1, cos–1 and tan–1. •		3. Past exam questions 4. Opportunities for flipped learning	**STEM** **Physics** **Economics** **Computer Science** **Economist** **Data Scientist** **Architect** **Aerospace Engineer** **Access to online maths communities or forums that focus on advanced Trigonometry discussions and how these are applied to problem-solving.**	
Trigonometry and modelling	• Addition formulae • Using the angle addition formulae • Double-angle formulae • Solving trigonometric equations • Simplifying a cos x ± b sin x • Proving trigonometric identities • Modelling with trigonometric functions	• be able to prove geometrically the following compound angle formulae for sin (A ± B), cos (A ± B) and tan (A ± B); • be able to use compound angle identities to rearrange expressions or prove other identities; • be able to use compound angle identities to rearrange equations into a different form and then solve; • be able to recall or work out double angle identities; • be able to use double angle identities to rearrange	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**Leading for Justice, Truth, and Integrity** Students can explore how trigonometry enables us to model and analyse real-world accurately. **Geography** **STEM** **Physics** **Economics** **Computer Science** **Economist** **Data Scientist** **Architect** **Aerospace Engineer**	Trigonometry identities and equations – year 12

		expressions or prove other identities; • be able to use double angle identities to rearrange equations into a different form and then solve. • be able to express $a\cos\theta+b\sin\theta$ as a single sine or cosine function; • be able to solve equations of the form $a\cos\theta+b\sin\theta=c$ in a given interval. • be able to construct proofs involving trigonometric functions and previously learnt identities. • be able to use trigonometric functions to solve problems in context, including problems involving vectors, kinematics and forces.			**Access to online maths communities or forums that focus on advanced Trigonometry discussions and how these are applied to problem-solving.**	
Parametric equations	• Parametric equations • Using trigonometric identities • Curve sketching • Points of intersection	• understand the difference between the Cartesian and parametric system of expressing coordinates; • be able to convert between parametric and Cartesian forms. • be able to plot and sketch curves given in parametric form;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions	**Discerning and Joyful**: By exploring the parametric system, students develop their ability to analyse and discern mathematical patterns, fostering a discerning mindset. Human Dignity Common Good	Coordinate geometry Trigonometric identities Graph sketching

	• Modelling with parametric equations	• recognise some standard curves in parametric form and how they can be used for modelling. •		4. Opportunities for flipped learning	Access to supplementary materials or textbooks that offer alternative explanations and problem-solving strategies. Physics computer science Aerospace engineer cryptographer mathematical modeler	
Differentiation	• Differentiating sin x and cos x • Differentiating exponentials logarithms • The chain rule • The product rule • The quotient rule • Differentiating trigonometric functions • Parametric differentiation • Implicit differentiation • Using second derivatives • Rates of change by using chain rule	• be able to find the derivative of sin x and cos x from first principles. • be able to differentiate functions involving ex, ln x and related functions such as 6e4x and 5 ln 3x and sketch the graphs of these functions; • be able to differentiate to find equations of tangents and normals to the curve. • be able to differentiate composite functions using the chain rule; • be able to differentiate using the product rule; • be able to differentiate using the quotient rule; • be able to differentiate parametric equations;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**Leading for Justice, Truth, and Integrity** Students can explore how calculus enables us to model and analyse real-world phenomena accurately. By employing calculus, mathematicians and scientists can make informed decisions, solve problems, and gain a deeper understanding of the natural world. Creation and Environment The common good **Exposure to diverse cultural contexts and perspectives in**	Year 1 Differentiation

		• be able to find the gradient at a given point from parametric equations; • be able to find the equation of a tangent or normal (parametric); • be able to use implicit differentiation to differentiate an equation involving two variables; • be able to find the gradient of a curve using implicit differentiation; • be able to verify a given point is stationary (implicit). • be able to find and identify the nature of stationary points and understand rates of change of gradient. • be able to use a model to find the value after a given time; • be able to set up and use logarithms to solve an equation for an exponential growth or decay problem; • be able to use logarithms to find the base of an exponential; • know how to model the growth or decay of 2D and 3D objects using connected rates of change;			**relation to advanced calculus techniques and their applications in various fields such as physics, engineering, and economics.** **Access to supplementary materials or textbooks that offer alternative explanations** **Solidarity** **Physics** **Economics** **Computer Science** **Aerospace Engineer** **Economist** **Data Scientist** **Architect**	

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		• be able to set up a differential equation using given information which may include direct proportion. •				
Numerical methods	• Locating roots by change of sign • Using Iteration to solve an equation • The Newton-Raphson Method • Applications to modelling	• be able to locate roots of f(x) = 0 by considering changes of sign of f(x); • be able to use numerical methods to find solutions of equations. • understand the principle of iteration; • appreciate the need for convergence in iteration; • be able to use iteration to find terms in a sequence; • be able to sketch cobweb and staircase diagrams; • be able to use cobweb and staircase diagrams to demonstrate convergence or divergence for equations of the form x = g(x). • be able to solve equations approximately using the Newton-Raphson method; • understand how the Newton-Raphson method works in geometrical terms. • be able to use numerical methods to solve problems in context.	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	United in Harmony Discerning and Joyful Dignity of the Human Person Solidarity Preferential Option for the Poor and Vulnerable Understanding how different cultures and societies have developed and applied numerical methods in various mathematical and scientific disciplines. Familiarity with significant functions and their applications in fields such as physics, engineering, or economics. Science (chemical equations and	Graph sketching Substitution Differentiation

					calculations in chemistry). Economics (modelling and analysis). Physics Computer Science (algorithm design and programming). Actuary Financial Analyst Data Scientist Software Engineer	
Integration	• Integrating standard functions • Integrating f (ax + b) • Using trigonometric identities • Reverse chain rule • Integration by substitution • Integration by parts • Partial fractions • Finding the area under a curve • Using the trapezium rule • Solving differential equations	• be able to integrate expressions by inspection using the reverse of differentiation; • be able to integrate xn for all values of n and understand that the integral of $\frac{1}{x}$ is ln |x|; • be able to integrate expressions by inspection using the reverse of the chain rule (or function of a function); • be able to integrate trigonometric expressions; • be able to integrate expressions involving ex.;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**Leading for Justice, Truth, and Integrity** Students can explore how calculus enables us to model and analyse real-world phenomena accurately. By employing calculus, mathematicians and scientists can make informed decisions, solve problems, and gain a deeper understanding of the natural world. Creation and Environment The common good	Integration year 1 Differentiation Area of 2D shapes Indices

	• Modelling with differential equations	• be able to integrate a function expressed parametrically. • recognise integrals of the form $\int \frac{f'(x)}{f(x)} dx$ = ln |f(x)| + c; • be able to use trigonometric identities to manipulate and simplify expressions to a form which can be integrated directly. • be able to integrate expressions using an appropriate substitution; • be able to select the correct substitution and justify their choices. • be able to integrate an expression using integration by parts; • be able to select the correct method for integration and justify their choices. • be able to integrate rational expressions by using partial fractions that are linear in the denominator; • be able to simplify the expression using laws of logarithms. • understand and be able to use integration as the limit of a sum;			**Exposure to diverse cultural contexts and perspectives in relation to advanced calculus techniques and their applications in various fields such as physics, engineering, and economics.** **Physics** **Economics** **Computer Science** **Aerospace Engineer** **Economist** **Data Scientist** **Architect**	

		• understand the difference between an indefinite and definite integral and why we do not need + c; • 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; • be able to use a definite integral to find the area under a curve and the area between two curves. • Be able to find an area under a curve defined by a pair of parametric equations • be able to use the trapezium rule to find an approximation to the area under a curve; • appreciate the trapezium rule is an approximation and realise when it gives an overestimate or underestimate. • be able to write a differential equation from a worded problem; • be able to use a differential equation as a model to solve a problem;				

		• be able to solve a differential equation; • be able to substitute the initial conditions or otherwise into the equation to find + c and the general solution.				
Vectors	• Using 3D coordinates • Vectors in 3D • Solving geometric problems • Application 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; • be able to calculate the magnitude of a 3D vector; • know the definition of a unit vector in 3D; • be able to add 3D vectors diagrammatically and perform the algebraic operations of vector addition and multiplication by scalars, and understand their geometrical interpretations; • understand and use position vectors, and calculate the distance between two 3D points represented by position vectors; • be able to use vectors to solve problems in pure mathematics and in contexts (e.g. mechanics).	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**United in Harmony** By learning about 3D vectors, students understand how different components or forces can come together to create a unified result. This value emphasizes the importance of collaboration, teamwork, and recognizing the interconnectedness of various elements. The option for the poor Creation and Environment The common good **Participation in STEM camps or workshops that focus on spatial reasoning and geometry.**	Year 1 Vectors

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		•			**Exposure to real-world examples and applications of vectors through field trips or guest speakers.** Physics Geography **STEM** **Electrical engineer** **Control systems engineer** **Mathematician** **Physicist** **Software developer** **Architect**	
Regression, correlation and hypothesis testing	• Exponential models • Measuring correlation • Hypothesis testing for zero correlation	• be able to change the variable in a regression line; • be able to estimate values from regression line. • understand correlation coefficients; • be able to calculate the PMCC (calculator only); • be able to interpret a correlation coefficient; • be able to conduct a hypothesis test for a correlation coefficient. •	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	Acting with Truth and Integrity Will enable fair conclusions based on predictions Creation and Environment **Understanding the cultural significance of certain hypothesis in different communities**	Binomial hypothesis testing

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					Physiology Politics **Sociology** Sports Politics Insurance Statistics Meteorologist Actuaries **Chartered Accountant**	
Conditional probability	• Set notation • Conditional probability • Conditional probability in Venn diagrams • Probability formulae • Tree diagrams	• understand and be able to use probability formulae using set notation; • be able to use tree diagrams, Venn diagrams and two-way tables; • understand and be able to use the conditional probability formula $\mathrm{P}(A \mid B) = \frac{\mathrm{P}(A \cap B)}{\mathrm{P}(B)}$ • be able to model with probability; • be able to critique assumptions made and the	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	Make sure that pupils understand the fact that mutually exclusive events cannot happen at the same time. This knowledge will help pupils to avoid confusion in later years with independent events. Pupils may also be confused by sentences with the words 'or' and 'and'. Explain the meanings carefully. United in Harmony	Calculating probabilities Venn diagrams Mutually exclusive and independent events Tree diagrams

		likely effect of more realistic assumptions.			Creation and Environment Peace Physiology Politics **Sociology** Sports Politics Insurance Statistics Meteorologist Actuaries	
The normal distribution	• The normal distribution • Finding probabilities for normal distribution • The inverse normal distribution function • The standard normal distribution • Finding Mu and Omega • Approximating a binomial distribution • Hypothesis testing with the normal distribution	• understand the properties of the Normal distribution; • be able to find probabilities using the Normal distribution; • know the position of the points of inflection of a Normal distribution. • be able to find the mean and variance of a binomial distribution; • understand and be able to apply a continuity correction; • be able to use the Normal distribution as an approximation to the binomial distribution. • be able to conduct a statistical hypothesis test for the mean of the Normal distribution;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	Acting with Truth and Integrity Will enable fair conclusions based on assumptions made using the normal distribution Creation and Environment Peace Physiology Politics **Sociology** **Access to software that allow students to**	Probability Averages

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		• be able to interpret the results in context. •			**visually interpret calculations.** Sports Politics Insurance Statistics Meteorologist Actuaries **Chartered Accountant**	
Moments	• Moments • Resultant moments • Equilibrium • Centres of mass Tilting	• realise that a force can produce a turning effect; • know that a moment of a force is given by the formula force × distance giving Nm and know what the sense of a moment is; • understand that the force and distance must be perpendicular to one another; • be able to draw mathematical models to represent horizontal rod problems; • realise what conditions are needed for a system to remain in equilibrium;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**United in harmony** Understanding how different forces work together to create equilibrium in a system of moments **Dignity of the Human Person** **Common Good** **Exposure to real-life examples of moments in daily life, such as using tools, opening doors, or balancing objects**	Solving equations Trigonometry

		• be able to solve problems when a bar is on the point of tilting. •			**Physics** **Design & Technology** **Architect** **Enginee** **Product Designer** **Mechanical** **Technician**	
Forces and friction	• Resolving forces • Inclined planes Friction	• understand the language relating to forces; • be able to identify the forces acting on a particle and represent them in a force diagram; • understand how to find the resultant force (magnitude and direction); • be able to find the resultant of several concurrent forces by vector addition; • be able to resolve a force into components and be able to select suitable directions for resolution. • understand that a rough plane will have an associated frictional force, which opposes relative motion (i.e. the direction of the frictional force is always opposite to how the object is moving or 'wants' to move); • understand that the 'roughness' of two surfaces	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**Listening and attentive** Paying close attention to the effects of forces and friction in different real-life scenarios and listening to feedback for improvement in the mathematical modes **Solidarity** **Option for the Poor and Vulnerable** **Hands-on experience with tools, machinery, and devices that demonstrate the effects of forces and friction** **Physics** **Design & Technology**	Kinematics and Forces in Y12 Mechanics

		is represented by a value called the coefficient of friction represented by μ; • know that 0 ≤ μ but that there is no theoretical upper limit for μ although for most surfaces it tends to be less than 1 and that a 'smooth' surface has a value of μ = 0; • be able to draw force diagrams involving rough surfaces which include the frictional force • understand and be able to use the formula F ≤ μR. •			**Mechanical Engineer** **Aerospace Engineer** **Automotive Technician**	
Projectiles	• Horizontal projection • Horizontal and vertical components • Projection at any angle • Projectile motion formulae	• be able to find the time of flight of a projectile; • be able to find the range and maximum height of a projectile; • be able to derive formulae to find the greatest height, the time of flight and the horizontal range (for a full trajectory); • know how to modify projectile equations to take account of the height of release; • be able to derive and use the equation of the path. •	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**Faith-filled and hopeful** Having faith in the mathematical principles behind projectile motion and being hopeful in finding solutions to challenging problems. **Dignity of the Human Person** **Exposure to sports, games, and activities involving the concept of projectiles, such as throwing a ball or**	Kinematics in Y12 Mechanics

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					shooting a projectile in virtual simulations **Physics** **Physical Education** **Sports Coach** **Ballistics Engineer** **Sports Scientist**	
Application of forces	• Static particles • Modelling with statics • Friction and static particles • Static rigid bodies • Dynamics and inclined planes • Connected particles	• understand that a body is in equilibrium under a set of concurrent (acting through the same point) forces is if their resultant is zero; • know that vectors representing forces in equilibrium form a closed polygon; • understand how to solve problems involving equilibrium of a particle under coplanar forces, including particles on inclined planes and 2D vectors; • be able to solve statics problems for a system of forces which are not concurrent (e.g. ladder problems), thus applying the principle of moments for forces at any angle.	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for flipped learning	**Courageous and resilient** Tackling complex problems involving connected particles with courage and resilience. **Subsidiarity** **Solidarity** **Knowledge of real-world examples where connected particles are relevant, such as the motion of linked objects, pendulums, or objects attached by springs** **Physics** **Design & Technology**	Kinematics and Forces in Y12 Mechanics Moments

		• know and understand the meaning of Newton's second law; • be able to formulate the equation of motion for a particle in 1-dimensional motion where the resultant force is mass × acceleration; • be able to formulate the equation of motion for a particle in 2-dimensional motion where the resultant force is mass × acceleration; • be able to formulate and solve separate equations of motion for connected particles, where one of the particles could be on an inclined and/or rough plane. •			**Mechanical Engineer** **Civil Engineer** **Industrial Designer**	
Further kinematics	• Vectors in kinematics • Vector methods with projectiles • Variable acceleration in one dimension • Differentiating vectors • Integration vectors	• be able to recognise when the use of constant acceleration formulae is appropriate; • be able to write positions, velocities and accelerations in vector form; • understand the language of kinematics appropriate to motion in 2 dimensions • be able to find the magnitude and direction of vectors;	End of topic assessment	Textbook/Practice Book/Other online resources These include: 1. Videos 2. Practice questions 3. Past exam questions 4. Opportunities for	**Leading for justice** Applying vector analysis to ensure fairness and accuracy in representing the direction and magnitude of motion **Stewardship of Creation** **Understanding the use of directions,**	Kinematics with calculus and Forces in Y12 Mechanics Calculus Vectors

		• be able to extend techniques for motion in 1 dimension to 2 dimensions by using vectors; • know how to use velocity triangles to solve simple problems; • understand and use suvat formulae for constant acceleration in 2D; • know how to apply the equations of motion to i, j vector problems; • be able to use v = u + at , r = ut + $\frac{1}{2}$at2 etc. with vectors given in i , j or column vector form. • be able to extend techniques for motion in 1 dimension to 2 dimensions by using calculus and vector versions of equations for variable force/acceleration problems; • understand the language and notation of kinematics appropriate to variable motion in 2 dimensions, i.e. knowing the notation $\dot{\boldsymbol{r}}$ and $\ddot{\boldsymbol{r}}$ for variable acceleration in terms of time.		flipped learning	**coordinates, and vectors in navigation, mapping, or spatial awareness** **Physics** **Geography** **GPS Technician** **Cartographer** **Air Traffic Controller**	