On – Line Programme of Learning for Year 13

Autumn (1st term)	Autumn (2nd term)	Spring (1st term)	Spring (2nd term)	Summer (1st term)	Summer (2nd term)
From:September To: October	From:November To: December	From:January To: February	From:March To: April	From:April To: May	From:June To: July
Topic/Key Questions/ **Pure:** Re-teach: Binomial expansion; Radians; Trigonometric functions **Applied maths:** Mechanics: Moments; Forces and Friction **Learning Outcomes:** By the end of the sub-unit, students will be able to perform all the skills highlighted below.	**Topic/Key Questions/** **Pure:** Trigonometry and modelling; Parametric Equations; Differentiation **Applied maths:** Mechanics: Applications of forces; Projectiles **Learning Outcomes:** By the end of the sub-unit, students will be able to perform all the skills highlighted below.	**Topic/Key Questions/** **Pure:** Numerical Methods; Integration and Vector **Applied maths:** Statistics: Conditional probability. Mechanics- Further Kinematics **Learning Outcomes:** By the end of the sub-unit, students will be able to perform all the skills highlighted below.	**Topic/Key Questions/** **Pure:** **Revisions, Review and Re-teach** **Examination Preparations** **Applied maths:** Statistics: Normal distribution **Learning Outcomes:** By the end of the sub-unit, students will be able to perform all the skills highlighted below.	**Topic/Key Questions/** Revisions, Review and Re-teach. Examination Preparations **Learning Outcomes:** By the end of the sub-unit, students will be able to perform all the skills highlighted below.	**Topic/Key Questions/** **External Examinations** **Learning Outcomes:** By the end of the sub-unit, students will be able to perform all the skills highlighted below.
Skills (students should be able to do): Know the difference between an arithmetic and geometric sequence. Know the difference between a sequence and series.	**Skills** (students should be able to do): Prove and use the addition formulae. Understand and use the double-angle formulae.	**Skills** (students should be able to do): Carry out formal mathematical proofs. Locate roots of f(x) = 0 by considering changes of sign.	**Skills** (students should be able to do): Understand the normal distribution and the characteristics of a normal distribution curve.	**Skills** (students should be able to do): N/A	**Skills** (students should be able to do): N/A

Recall and use the formulae for the nth term and summations of arithmetic and geometric sequences and series. Generate sequences using recurrence relations. Model real-life situations with sequences and series. Carry out binomial expansions for any rational constant and determine the range of values for which the expansion is valid. Convert between degrees and 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 x is small. Understand the definitions of secant, cosecant, and cotangent	Solve trigonometric equations using the double angle and addition formulae. Simplify expressions of the form acosx + bsinx . Prove trigonometric identities using a variety of identities. Use trigonometric functions to model real-life situations. Convert parametric equations into Cartesian form by substitution and by 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. Differentiate trigonometric functions. Differentiate exponentials and logarithms.	Use iteration to find an approximation to the root of the equation f(x) = 0. Use the Newton-Raphson method Applications to be modelling. 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. Use 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. Use vectors in 3D Use vectors to solve geometric problems Model 3D motion in mechanics with vectors.	Find percentage points and calculate values on a standard normal curve. Find unknown means and or standard deviations for a normal distribution. Approximate a binomial distribution using a normal distribution. Select appropriate distributions and solve real-life problems in context.		

and their relationship to cosine, sine and tangent. Simplify expressions, prove simple identities and solve equations using secant, cosecant, and cotangent. 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. 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	Differentiate functions using the chain, product and quotient rules. Differentiate functions which are defined implicitly. Use the second derivative to describe the behaviour of a function. Find an unknown force 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 rough or smooth inclined planes. Solve problems involving connected particles that require the resolution of forces. Model motion under gravity for an object projected horizontally. Resolve velocity into components.	Understand set notation 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. Work with vectors for displacement, velocity and acceleration when using the vector equation of motion. Use calculus with harder functions of time involving variable acceleration. Differentiate and integrate vectors with respect to time.			

	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 Key Skills. – Mechanics: Work with vectors for displacement, velocity and acceleration when using the vector equation of motion. Use calculus with harder functions of time involving variable acceleration. Differentiate and integrate vectors with respect to time. Use iteration to find an approximation to the root of the equation f(x) = 0 Use the Newton-Raphson method Applications to be modelling. -Statistics: Understand set notation 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. Understand the normal distribution and the characteristics of a normal distribution curve. Find percentage points and calculate values on a standard normal curve. Find unknown means and / or standard deviations for a normal distribution. Approximate a binomial distribution using a normal distribution. Select appropriate distributions and solve real-life problems in context. Solve problems involving particles projected at an angle.				

	Derive the formulae for time of flight, range and greatest height, and the equation of the path of a projectile.				
End of term 1 assessment to cover: At the beginning of Spring 1, all year 13 pupils will be doing their Mocks. They will be tested on the following: Pure: All contents of AS in addition to Sequences and Series, Binomial expansion; Radians; Trigonometric functions Trigonometry and modelling; Parametric Equations; Differentiation. Applied: All contents of applied plus Moments; Forces and Friction, Applications of forces; Projectiles		**End of term 2 assessment to cover:** At the beginning of summer 1 term, we desire to do a final Mock Examination that will be covering **all topics** from the Pure and from the Applied sections of the specification.		**End of year assessment to cover:** Pupils will be sitting the Public Examination	
Building understanding: Rationale / breakdown for your sequence of lessons: Sequences and Series will be retaught, anticipating that there will be those who would have missed the opportunity to have attended the prescribed lessons in year 12 Summer 2. This will also give rise to further strengthening the bases of the pupils who	**Building understanding: Rationale / breakdown for your sequence of lessons:** In terms of the trigonometric graphs and their solutions, the modelling of situation allows for the pupils to put into practice the content that they would have seen in the previous term as well as undergirding the AS concepts they saw.	**Building understanding: Rationale / breakdown for your sequence of lessons:** Much of mechanics at a higher level and engineering at university relies on the ability to solve differential equations in some form or another. This is touched upon at a basic level here, however once again it is important for	**Building understanding: Rationale / breakdown for your sequence of lessons:** N/A	**Building understanding: Rationale / breakdown for your sequence of lessons:** N/A	**Building understanding: Rationale / breakdown for your sequence of lessons:** N/A

would have seen it all prior to now. Doing Radians at this point will lead to a greater appreciation of trigonometrical differentiation as it is the substratum of the basic differentials on which all others are built. Doing a more advanced form of trigonometry at this point will give pupils a continuous platform to build on the concepts that they would have seen in year 12. This will be more meaningful to them as they will be able to make the needed connections with little noise barriers to the Teaching and learning process.	In kinematics this can then be extended to the waves themselves and the sporting context to surfing and other examples. The extensive use of graphs throughout this topic is vital to gaining an understanding of what is going on. However, there are other ways to set this process into context. The work on connected rates of change should all be set into practical contexts so that this too becomes a practical based topic rather than purely symbolic manipulation. However, it is often here that learners can find a difficulty because each type of question is slightly different and there is no "magic formula" to solve them. A carefully built understanding of the format of this section should help to overcome this. Lastly, constructing differential equations for a	learners to know what is that they can achieve in the long term were they to pursue this further. Numerical Methods links with polynomials and finding roots using algebraic methods; curve sketching; number sets and irrational numbers. It is also related to limits, derivatives, recurrence relations, integrals and sequences. The idea of iteration is conceptually important and links well with arithmetic and geometric sequences. The philosophical ideas underlying upper and lower bounds would be interesting to discuss and would have long term benefits for mathematics students. Investigating and developing a good understanding of the fixed-point process would also be beneficial. Stationary points and gradients play a part in numerical methods and will allow teachers to revisit			

	variety of scenarios again should be approached practically. This then provides a neat way to lead into the necessity for integration in order to solve these practical problems. Mechanics- Learners will be familiar with equilibrium problems if the object in question has no *size*. If the object has size, then equilibrium of moments also must be considered. Recapping and making the needed link with the contents that they previous did will help learners develop the strategy of needing two equations for each situation; equilibria of forces and equilibria of moments. Finally, once they are familiar with this strategy more complex problems involving forces at angles can be attempted.	these ideas, and this will help to link these abstract areas together more. Numerical methods link very well with the idea of mathematical modelling on which a greater emphasis is now placed. Subject areas which link naturally with numerical methods include work on polynomial curves, their behaviour and shape and finding their roots. Curve sketching is also extremely relevant with the idea of an asymptote and gaps in some curves playing an important role. This would be good as the pupils are facilitated to draw on all that they would have previously saw in previous chapters. Finding integrals of curves and, also the area beneath curves is linked with numerical methods. In fact, there is also common ground shared with the study of inequalities, recurrence relations, the modulus function, gradients and tangents, mechanics, statistics and decision mathematics.			

	There is a clear link with the previous work on Newton's First Law and Applications of vectors in a plane. This topic extends the learners knowledge of these concepts and tests their ability to draw clear diagrams, resolve forces and apply conditions of equilibria to rigid body problems. For extension, learners could use these methods in conjunction with the Laws of Friction to solve sliding and toppling problems. Calculus – The initial work on gradients and the whole understanding of the nature of rate of change and gradient is essential to being able to apply this to the curve of Subsequent work on calculus will make use of natural logarithms so this section forms an important foundation for future study.	Vectors is taught at this instance as it is clearly the application to Mechanics – all forces are vectors. Pupils will then be facilitated to make the link and as such cause them to make a more meaningful appreciation of what they would have seen prior to this stage. Similarly, for most of the equations of motion, displacement, velocity and acceleration are all vectors; though this is not always made explicit when dealing with motion in a straight line.			
Calendared Centrally Planned Extended Home – Learning Tasks:	**Calendared Centrally Planned Extended Home – Learning Tasks:**	**Calendared Centrally Planned Extended Home – Learning Tasks:**	**Calendared Centrally Planned Extended Home – Learning Tasks:**	**Calendared Centrally Planned Extended Home – Learning Tasks:**	**Calendared Centrally Planned Extended Home – Learning Tasks:**

Centralised online homework as well as regular written homework will be given. In collaboration with all teachers, end of Topic tests will be centralised and will be supervised under exams conditions.	Centralised online homework as well as regular written homework will be given. In collaboration with all teachers, end of Topic tests will be centralised and will be supervised under exams conditions.	Centralised online homework as well as regular written homework will be given. In collaboration with all teachers, end of Topic tests will be centralised and will be supervised under exams conditions.	Centralised online homework as well as regular written homework will be given. In collaboration with all teachers, end of Topic tests will be centralised and will be supervised under exams conditions.	Centralised online homework as well as regular written homework will be given. In collaboration with all teachers, end of Topic tests will be centralised and will be supervised under exams conditions.	Centralised online homework as well as regular written homework will be given. In collaboration with all teachers, end of Topic tests will be centralised and will be supervised under exams conditions.

Reading / literacy / Oracy:
For reading in mathematics, see the links under enrichment. For literacy, students will learn how to break down long worded problems to extract the mathematics involved. This will be modelled in the classroom. Students should get used to reading all parts of the textbook / exam questions and challenging words they don't understand.

Numeracy: Students should be numerate in terms of knowing what a sensible answer looks like for any question they answer and not simply relying on the calculator.

Enrichment / opportunities to develop cultural capital (including careers, WRL and SMSC):
Students will participate in the UKMT senior maths challenge: all students are given the opportunity to partake in the individual challenge. Students will be selected to enter the team maths challenge. This provides students to compete in a nationally recognised mathematics competition.

Students are provided with a variety of internet resources (see links to several resources below) to develop their cultural capital in mathematics and provide them for opportunities for enrichment within the subject.
https://undergroundmathematics.org/
https://www.cimt.org.uk/projects/mepres/alevel/alevel.htm
https://www.stem.org.uk/resources/search
https://www.stem.org.uk/secondary/resources/collections/maths/a-level-maths