Northallerton School & Sixth Form College
Being the best we can be

Year 12 Mathematics

In Year 12 students start the OCR A-Level course. This course builds on work studied at GCSE and develops students' understanding, reasoning and analysing skills. The course is taught through three main strands - Pure Maths (number/algebra), Statistics (probability/averages/graphs) and Mechanics (forces/motion). The course is taught by two teachers so students will be learning two different topics simultaneously. Lessons will involve a mix of teacher led lessons, individual work and group work. Students are encouraged to work together and to ask questions throughout.

Methods of deepening and securing knowledge:	
Interleaving	Starter tasks are designed to check knowledge from not only the previous lesson, but also lessons earlier in the topic and sometimes even other topics within maths which students will have covered previously.
Checkpoints/ mini plenaries	These are used within lessons to check understanding and address any misconceptions before moving on.
Independent study	Exam questions are used to provide plenty of practise at applying students' knowledge to new situations.
Assessment for progress	At the end of each half term a cumulative assessment is given to cover work from that half term as well as chosen topics from previous half terms, to embed learning and give an experience of each of the three papers set at the end of Year 13.

	Autumn term 1	Autumn term 2	Spring term 1
Topic(s)	**Teacher A** • **Single variable data** • **Sampling -** building on their GCSE knowledge students will learn a variety of sampling methods, their advantages and disadvantages. • **Coordinate geometry/equations of lines -** building on GCSE knowledge of straight line graphs, students will understand and be able to use the equation of a straight line, in a variety of forms. They will apply these skills to solve problems such as finding the length of a line segment and continue working with parallel and perpendicular lines. • **Equations of circles -** students will understand and be able to use the coordinate geometry of a circle including using the equation of a circle. They will be able to complete the square to find the centre and radius of a circle as well as using circle properties in context. **Teacher B** • **Algebraic functions -** building on GCSE, students will be able to use the laws of indices for all rational exponents. They will review how to use and manipulate surds, including rationalising the denominator. They will be able to solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation. • **Proof -** students will be able to use the structure of mathematical proof,	**Teacher A** • **Vectors -** students will build upon the knowledge of vectors from GCSE and be able to use them in calculations and in solving problems. • **Probability -** students will recap their knowledge from GCSE ensuring they can use a variety of diagrams including Venn and tree diagrams. They will practise calculating the probability of combined events. • **Binomial distribution -** students will build upon their knowledge of the probability of repeated events to develop a formula for calculating the probability of a given number of successes knowing the probability of success. Students will be able to determine whether a situation can be modelled using the binomial distribution. Students will learn how to use the binomial distribution to determine the probability of a given number of successful trials. • **Graph transformations -** students will learn how the graphs of functions are affected by single and multiple transformations and will be able to identify and perform given stretches and translations. • **Polynomial equations -** building on GCSE knowledge, students will recap simplifying, expanding and factorising brackets. They will learn about simple algebraic division and the factor theorem. **Teacher B** • **Kinematic graphs -** students will build upon their knowledge of how the relationships between speed and time,	**Teacher A** • **Inequalities -** building on GCSE knowledge, students will be able to solve linear and quadratic inequalities in a single variable and interpret such inequalities graphically, including inequalities with brackets and fractions. They will express solutions through correct use of 'and' and 'or', or through set notation and represent linear and quadratic inequalities graphically. • **Representing data -** building on their GCSE knowledge, students will learn how to draw and interpret a variety of graphs including histograms. Students will need to justify a choice of graphs, evaluating advantages and disadvantages. • **Bivariate data -** students will learn how to compare two variables in a variety of methods including scatter graphs and correlation coefficients. • **Averages and spread -** building on their GCSE knowledge, students will recap the key measures of average and spread. Students will need to justify choices of average by evaluating advantages and disadvantages. They will be introduced to standard deviation and variance. **Teacher B** • **Stationary points -** students will use their knowledge of differentiation and coordinate geometry to establish the position and nature of turning points on the graphs of functions.

	working in logical steps. They will learn to prove by exhaustion, deduction as well as disproof by counterexample. Students will be shown mathematical language and symbols to use. • **Binomial expansion -** students will be able to calculate binomial coefficients for expanding brackets. They will know the relationship of the binomial coefficients to Pascal's triangle and their use in a binomial expansion to create a formula. • **Polynomial graphs -** students will build upon their knowledge of the features of quadratic and cubic graphs and how the form of the equation links to these features. • **Units and kinematics -** students will learn the SI units used to describe motion. Students will gain an understanding of both scaler and vector measurements and how they are related.	velocity and time, and distance and time can be represented graphically. They will be able to use these graphs to solve problems in context. • **Equations of constant acceleration -** students will learn how the movement of objects travelling with a constant acceleration can be modelled. They will be able to use known relationships between acceleration, velocity and displacement to solve problems. Students will also consider limitations of these models. • **Differentiation and gradients -** students will learn how to differentiate a function from first principles and differentiate simple functions. They will draw upon their knowledge of index laws to convert functions into a form that can be differentiated. Students will learn how the differentiated function can be used to determine the gradient of a given function at any given point. • **Tangents and normals -** students will apply their knowledge of differentiation and coordinate geometry to find the gradients and equations of tangents and normals at a point on the circumference of a circle.	• **Forces -** students will learn how forces on an object can be represented diagrammatically. They will learn how to calculate the magnitude and direction of the resultant of two or more forces acting upon an object in the same plane. • **Newton's laws -** students will learn Newton's laws of motion, and how they can be used to model movement in real life contexts. • **Equilibrium -** students will learn forces act in order to keep a system in equilibrium. Students will be able to calculate the magnitude and direction of forces needed to keep a system in equilibrium and be able to determine whether or not a system is in equilibrium given the magnitude and direction of the forces acting upon it. • **Friction -** students will learn how friction is a limiting force and how it is dependent upon the nature of the two surfaces in contact. They will learn about the relationship between friction and the reaction force and be able to use this relationship to model and solve problems.
Assessment	A Pure and Stats. B Pure.	A Pure. B Pure and Mechanics.	A Pure and Stats. B Pure and Mechanics.
CEIAG *(Careers that are linked to that topic)*		Insurance and banking.	Statistician.

	Spring term 2	Summer term 1	Summer term 2
Topic(s)	**Teacher A** ● **Exponentials and logs -** students will learn and use the definition of log x a. They will be able to convert from index to logarithmic form and vice versa. They will understand and be able to use the laws of logarithms. They will apply this knowledge to exponential growth and decay and use the exponential function in modelling. ● **Hypothesis testing -** students will learn how to use their knowledge of the binomial distribution to create a formula which can test whether a hypothesis should be accepted or not. **Teacher B** ● **Trigonometric functions -** building on GCSE knowledge, students will understand and be able to use the sine, cosine and tangent functions, their graphs, symmetries and periodicities. They will learn how to use graphs to find the values of certain angles. ● **Calculus -** students will learn the fundamental theorem of calculus. They will be able to integrate expressions. ● **Area under a curve -** using knowledge from the previous topic, students will be able to evaluate definite integrals and use these to calculate the area between a curve and the x axis. ● **Variable acceleration -** students will build upon their knowledge of applying integration and differentiation to find acceleration and velocities in one dimension to finding accelerations and	**Teacher A** ● **Conditional probability** ● **Functions** ● **Series and sequences -** students will build upon their knowledge from GCSE to be able to work with sequences, including those given by a formula for the nth term and those generated by a simple relationship form. They will understand the meaning of and work with increasing sequences, decreasing sequences and periodic sequences. Students will be able to work with arithmetic and geometric sequences and series, including the formulae for the nth term and the sum to n terms. Students will learn the difference between convergent and divergent geometric sequences and series and be able to work with the sum to infinity of a convergent geometric series. Students will also learn how to use sequences and series in modelling growth and decay. **Teacher B** ● **Radians** ● **Numerical methods -** students will build upon their knowledge of using iterative methods to solve equations. They will develop an understanding of how specific diagrams relate to this methodology. ● **Newton Raphson -** students will be able to use the Newton Raphson and other recurrence relationships to solve equations and will be able to show when and why they can fail.	**Teacher A** ● **Parametric form of equations -** students will learn about the parametric form of an equation. They will be able to convert between parametric and cartesian forms and understand the language used to describe elements of the parametric form. Students will be able to sketch simple parametric curves. students will be able to use parametric equations to model both real-life and abstract mathematical contexts. **Teacher B** ● **Moments about a point -** students will develop an understanding of what a moment of a force is and how to calculate a moment. Students will learn how to model real life situations, involving moments of forces, the language used to describe elements of the model and the limitations of such models. Students will be able to use these models to determine resultant moment of forces and determine forces and distances to maintain a static model.

	velocities in two dimensions.		
Assessment	A Pure. B Pure.	A Pure and Stats. B Pure.	End of year.
CEIAG *(Careers that are linked to that topic)*			

Independent Study

Students will be set an hour of independent study a week from each teacher, this is expected to be handed in for marking at an agreed deadline. On top of this, it is expected that students do an additional two hours of private study - they can use books, websites (for example physics and maths tutor), or complete questions. This additional work needs to be evident within their maths files for half-termly file checks. Work and interesting articles will also be put onto the A-Level Google Classroom to support students with this independent study.