A level Mathematics Curriculum Overview (Year 12)

Unit name

Introduction
We have identified some key areas that students require additional practice at to succeed early on in the A level Maths Course. We use an old Edexcel text book to cover these areas at the beginning of the course. This has the additional benefits of providing an early 'taster' of some key topics (ie calculus) which are revisited later in the year, and also provides the opportunity to complete exam papers on the topics covered after the first term. **Edexcel specification:** https://qualifications.pearson.com/en/qualifications/edexcel-a-levels/mathematics-2017.html **Extension links** UKMT senior challenge (https://ukmt.org.uk/senior-challenges) MAT (https://www.maths.ox.ac.uk/study-here/undergraduate-study/maths-admissions-test) STEP modules (https://maths.org/step/assignments)

Term 1 Half Term 1				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**Evaluation and assessment methods**	**Implementation**	**What additional resources are available?**
Foundations of the A level: basic algebra and surds quadratics and the discriminant simultaneous equations, and inequalities graph sketching and transformations linear graphs arithmetic sequences basics of differentiation and integration	**Knowledge**: quadratic formula, cases of the discriminant, graphs shapes for reciprocal, linear, quadratic and cubic, apply transformations to graphs and use the correct language to describe them, y=mx+c, parallel and perpendicular lines, use of arithmetic sequence nth term and sum formulae, how to differentiate and integrate a polynomial **Understanding:** Understand and use the laws of indices for all rational exponents (2.1) Understand and use the derivative of f(x) as the gradient of the tangent to the graph of y = f(x) at a general point (x, y) (7.1) **Skills:** Solve simultaneous equations in two variables by elimination and by substitution, including one linear and one quadratic equation (2.4)	**Formal homeworks:** Chapter 1 Assessment Chapter 2 Assessment Chapter 3 Assessment Chapter 4 Assessment Chapter 5 Assessment Chapter 6 Assessment Chapter 7 Assessment Chapter 8 Assessment Assessments use old exam questions. Many short assessment approximate to 1/week to encourage good study skills at the start of the course.	Old Edexcel C1 Textbook Note: Much of Ch1-5 will be familiar to the majority of students from GCSE, however most students will still be developing mastery of them. Key new content includes: Ch2 – use of discriminant Ch6 builds on use of sequences and nth terms from GCSE but the use of the formulae and sigma notation is new Ch7-8 are new concepts but build on the ideas of gradient, and use a lot of the algebraic and index manipulations from GCSE and Ch1	Scheme of Learning – guidance on key learning points and selected questions for each individual lesson Outline PowerPoints with suggested examples and scaffolding activities Practice questions (and markschemes) covering topics using previous exam questions available for each chapter via SharePoint. For extension: UKMT senior challenge, MAT and STEP Foundation materials Online resource: https://sites.google.com/view/tlmaths/home/a-level-maths

Term 1 Half Term 2				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**Evaluation and assessment methods**	**Implementation**	**What additional resources are available?**
Review of some topics covered in Half term 1 but with a focus on harder contexts and modelling Functions Quartic graphs, inequalities and regions Equations of circles Factor Theorem, and proofs Binomial expansion Trigonometry, including identities and equations	**Knowledge**: Function notation and language. Be able to sketch quartic graphs. Equation of a circle. The Factor Theorem. Binomial expansion formulae. Trigonometry ratios, graphs, basic identities. **Understanding:** Graphing regions for inequalities. Using the correct language and techniques for proving and disproving mathematical statements. Apply the binomial expansion formula in different cases. **Skills:** Further confidence in manipulating algebra and surds. Modelling real-life situations using straight line graphs and quadratics.	**Formal homeworks:** Chapter 1-3 Assessment Chapter 4-6 Assessment Chapter 7-8 Assessment Chapter 9-10 Assessment **Exam conditions:** C1 Exam paper (note this is the early Y12 mock, which might be early in January)	Edexcel Pure 1 Textbook Note: Basic circles centred on the origin are seen at GCSE but this extends to any circle. Proofs are used at GCSE but this will formalise the ideas of deduction, exhaustion and using counter-examples Trigonometry directly revisits concepts used at GCSE and builds them into using trigonometric identities to solve equations	Scheme of Learning – guidance on key learning points and selected questions for each individual lesson Outline PowerPoints with suggested examples and scaffolding activities Practice questions (and markschemes) covering topics using previous exam questions available for each chapter via SharePoint. For extension: UKMT senior challenge, MAT and STEP Foundation materials Online resource: https://sites.google.com/view/tlmaths/home/a-level-maths

Term 2 Half Term 1				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**Evaluation and assessment methods**	**Implementation**	**What additional resources are available?**
2D vectors Differentiation including stationary points Integration – including definite integration and areas Exponentials and logarithms	**Knowledge**: Vectors – representation, magnitude, position and direction, problem solving and modelling. Differentiation. Integration. Exponentials, logarithms, the natural logarithm, nonlinear data. **Understanding:** To understand column vectors and unit vectors i and j. Using vectors to find velocity, displacement, and force. Increasing and decreasing functions, stationary points and second derivatives. Differentiation from first principles. Definite integrals, area under a curve, area between curve and straight lines. $y=e^{x,}$ the law of logarithms. Logarithms as inverse of exponential. **Skills:** Using Pythagoras and trigonometry to find magnitude and direction form. Manipulating functions and sketching gradient functions, applying knowledge to problems, recognise how to solve the area under graphs and between curves and straight lines. Solving equations using logs, plotting graphs using logs.	**Formal homeworks:** Chapter 11 Assessment Chapter 12 Assessment Chapter 13 Assessment Chapter 14 Assessment	Edexcel Pure 1 Textbook Note: Vectors builds upon knowledge from GCSE Higher Differentiation and integration both build directly on from work in Term 1.	Scheme of Learning – guidance on key learning points and selected questions for each individual lesson Outline PowerPoints with suggested examples and scaffolding activities Practice questions (and markschemes) covering topics using previous exam questions available for each chapter via SharePoint. For extension: UKMT senior challenge, MAT and STEP Foundation materials Online resource: https://sites.google.com/view/tlmaths/home/a-level-maths

Term 2 Half Term 2				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**Evaluation and assessment methods**	**Implementation**	**What additional resources are available?**
Statistics: Data collection and representation, measures of location and spread, correlation, probability, distributions (binomial), hypothesis testing, the large data set	**Knowledge**: Language relating to data collection, types of sampling, existence of large data set, percentiles, deciles, variance, standard deviation, coding, outlier calculations, equation of a regression line, determining if events are independent, discrete probability distributions, the binomial distribution, the language and concept of hypothesis testing **Understanding:** understand the large data set and how to collect data from it, interpret measures of central tendency, location and spread, understand when you can use regression lines to make predictions, interpret their coefficients, utilise different methods to calculate probabilities, comment on the appropriateness of the use of binomial distributions, calculate individual and cumulative probabilities for the binomial distribution, find critical values of a binomial distribution. **Skills:** compare data sets, carry out and interpret one- and two-tailed tests	**Formal homeworks:** Chapter 1-2 Assessment Chapter 3-4 Assessment Chapter 5 Assessment Chapter 6 Assessment Chapter 7 Assessment	Edexcel Statistics and Mechanics 1 Textbook Note: Recaps Statistics GCSE (if taken) and builds upon topics from this. Builds on GCSE maths topics: mean, median, mode, range, quartiles, box plots, cumulative frequency, histograms, correlation, probability, Venn diagrams, tree diagrams.	Scheme of Learning – guidance on key learning points and selected questions for each individual lesson Outline PowerPoints with suggested examples and scaffolding activities Practice questions (and markschemes) covering topics using previous exam questions available for each chapter via SharePoint. For extension: UKMT senior challenge, MAT and STEP Foundation materials Online resource: https://sites.google.com/view/tlmaths/home/a-level-maths

Term 3 Half Term 1				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**Evaluation and assessment methods**	**Implementation**	**What additional resources are available?**
Mechanics: Modelling, constant accelerations, forces and motion, variable acceleration	**Knowledge**: Know SI units for quantities and derived quantities used in mechanics. Be able to derive the constant acceleration formulae. Be able to calculate resultant forces by adding vectors Know calculus can be used to solve kinematics problems, to solve problems involving maxima and minima and to derive constant acceleration formulae. **Understanding:** How the concept of mathematical modelling applies to mechanics and be able to apply some of the common assumptions used in mechanical models. Interpret displacement-time and velocity-time graphs. Apply Newton's first, second and third laws to solve problems. Solve problems involving connected particles **Skills:** Draw force diagrams and calculate resultant forces. Use the constant acceleration formulae to solve problems involving vertical motion under gravity.	**Formal homeworks:** Chapter 8 Assessment Chapter 9 Assessment Chapter 10 Assessment Chapter11 Assessment **Exam conditions:** Y12 Mock – AS Pure Paper	Edexcel Statistics and Mechanics 1 Textbook Note: Much of this builds on work in both GCSE Maths and Science/Physics. Students are usually familiar with measures, units, forces, and -time graphs. Students studying A level Physics will be very familiar with the ideas in Ch9 and 10, but need to be aware that g=9.8 in maths, and there is no need to rearrange formulae before substituting values.	Scheme of Learning – guidance on key learning points and selected questions for each individual lesson Outline PowerPoints with suggested examples and scaffolding activities Practice questions (and markschemes) covering topics using previous exam questions available for each chapter via SharePoint. For extension: UKMT senior challenge, MAT and STEP Foundation materials Online resource: https://sites.google.com/view/tlmaths/home/a-level-maths

Term 3 Half Term 2				
What are we learning?	**What knowledge, understanding and skills will we gain?**	**Evaluation and assessment methods**	**Implementation**	**What additional resources are available?**
Proof by contradiction, partial fractions, the modulus function	**Knowledge**: How to manipulate algebraic fractions including, adding, subtracting, multiplying, dividing, and using factorisation to simplify them. Know the format of a partial fractions for linear and repeated factors. Know how to divide with algebra. The modulus function and its notation. Formal definition of a function (one-to-one and many-to-one). Composite and inverse functions. Domain and range of a function. **Understanding:** Using proof by contradiction and a powerful tool to prove mathematical statements. Link the process of partial fractions to reversing the process of adding fractions. Link between domain and range of a function and it's inverse. Link between the graphs of a function and its inverse. **Skills:** Be able to select the appropriate method for proving a statement**.** Be able to manipulate algebraic fractions, including splitting them into partial fractions. Be able to sketch the graphs of functions involving modulus.	**Formal homeworks:** Chapter 1 Assessment Chapter 2 Assessment	Edexcel Pure 1 Textbook Note: Proof by contradiction is a technique that can be added to the proofs covered in Term 1 Half Term 2 (deduction, exhaustion, disproof by counterexample).	Scheme of Learning – guidance on key learning points and selected questions for each individual lesson Outline PowerPoints with suggested examples and scaffolding activities Practice questions (and markschemes) covering topics using previous exam questions available for each chapter via SharePoint. For extension: UKMT senior challenge, MAT and STEP Foundation materials Online resource: https://sites.google.com/view/tlmaths/home/a-level-maths