# **Curriculum Planning Document**

Model 3 – Covid 19 disrupted year 13 cohort

Introduction

This Curriculum Planning Document (CPD) has been designed to suggest a way of covering the A Level Mathematics course for the cohort that had their two year course interrupted by the national ‘lockdown’ and period of school closures. There are links to the resources freely available on the OCR A H240 A Level Mathematics qualification pages.

OCR offers two specifications.

**Download specifications, sample assessment materials, teaching and learning resources at**

[AS and A Level Mathematics A H230/H240](https://www.ocr.org.uk/qualifications/as-and-a-level/mathematics-a-h230-h240-from-2017/)

[AS and A Level Mathematics B(MEI) H630/H640](https://www.ocr.org.uk/qualifications/as-and-a-level/mathematics-b-mei-h630-h640-from-2017/)

This CPD is for information only. It is intended as a resource to be used in conjunction with the specification. You may find useful as a starting point or as a ‘double-check’ against what you already have. If you don’t find it useful please don’t use it and if you disagree with the suggested teaching times please go with your own judgement and experience. Sometimes it is useful to have somebody else’s opinion if only to crystallise your own.

The structure taken in this document assumes a two-teacher split, with both delivering pure first and then each teacher taking one strand of the applied. It is not necessarily implied or recommended that centres must teach the specification in the order show here.

There are so many different ways in which A Level Mathematics timetabling and teaching is structured in different schools and colleges that it is impossible to produce even a suggestion for a Scheme of Work for all circumstances. This document is fully editable for teachers to adapt to their structure and preferences.

One key factor to take into consideration when using this document is the prior knowledge retained from the previous disrupted academic years. Some topics may need more or less teaching time depending on the confidence of your students. Those with a strong GCSE background may be also to spend less time on topics such as basic trigonometry (1.05a and 1.05b), single variable data (2.02a) and measures of average (2.02f). However, it should not be assumed that even candidates with a grade 9 at GCSE would not benefit from strengthening their algebra skills. The OCR resource [Student guide to bridging the gap between GCSE and AS/A Level](https://www.ocr.org.uk/Images/373371-bridging-the-gap-between-gcse-and-as-a-level-mathematics-a-student-guide.docx) is recommended as a source of questions, especially on algebra.

Naturally a reduction in teaching time means that students are going to have to do plenty of work on their own. See our [delivery guides](https://www.ocr.org.uk/Images/578450-complete-pack-of-h230-h240-delivery-guides.zip) and recent [blog posts](https://www.ocr.org.uk/qualifications/as-and-a-level/mathematics-a-h230-h240-from-2017/planning-and-teaching/) for suggested activities that students could complete themselves.

Consolidation and the development of the skills needed to take a complete mathematics examination paper need building up throughout the course; summary exercises covering a number of topics should be done regularly.

### Summary

| **wk/ Term** | **Teacher A** | **Teacher B** | **Notes** |
| --- | --- | --- | --- |
| **Pure Maths and Statistics** | **Pure Maths and Mechanics** | **A** | **B** |
| 1/T1 | [1.02 Algebra and functions](https://www.ocr.org.uk/Images/407095-section-1.02-algebra-and-functions-delivery-guide-version-1-.docx)Indices, surds, simultaneous equations and quadratics. | [1.05 Trigonometry](https://www.ocr.org.uk/Images/416575-section-1.05-trigonometry-delivery-guide-version-1-.docx)Radians, triangles and sectors.Exact and approximate values.  | The Algebra section is fundamental to the whole course and to subsequent progression so even though much of this would have been covered in year 12 there is good reason to take time to recap these skills at the beginning of year 13 and to revisit on a regular basis throughout the year.The chief problem with algebra that most students face in moving to A Level is that the skills they need are not as predictable as are many GCSE questions. A wide range of questions is needed, and they should not always be “set up on a plate” for the students. For example, students should be able to solve more intricate examples of simultaneous equations (one of which is quadratic), such as 3*x* + 2*y* = 7, 9*x*2 + 5*y* – *y*2 = 15Students find fractional and negative indices hard, but competence with them is crucial to success in calculus.Curve sketching is fundamental to developing mathematical skill and understanding. The importance of being able to visualise the shape of a curve without having to plot points cannot be over-emphasised.With surds it is important to address misunderstandings such as √8 = 4√2.Quadratic inequalities are often found hard but are important. Drawing a sketch is recommended even when not explicitly required. | The initial part of trigonometry section is a repeat of higher tier GCSE and may not need much time.Students need to “speak radians” fluently and to make appoint of checking the mode of their calculator.Solving trigonometry equations needs good algebra skills and often leads to quadratic equations. Students find it hard to find multiple solutions to trigonometric equations; it is a good idea to draw graphs.Inverse trigonometric functions are essential but the notation can cause difficulties. The compound angle formulae are quite challenging at this stage, but they are needed to enable the differentiation of sine and cosine functions. Students need to memorise the double angle formulae and be able to select the most appropriate of the cos 2*θ* formulae.If time is short, harder examples might be deferred until the end of the course. |
| 2/T1 | [1.02 Algebra and functions](https://www.ocr.org.uk/Images/407095-section-1.02-algebra-and-functions-delivery-guide-version-1-.docx)Inequalities, polynomials, including factorisation. Curve sketching. | [1.05 Trigonometry](https://www.ocr.org.uk/Images/416575-section-1.05-trigonometry-delivery-guide-version-1-.docx)Graphs, identities, reciprocals. Trig equations. |
| 3/T1 | [1.02 Algebra and functions](https://www.ocr.org.uk/Images/407095-section-1.02-algebra-and-functions-delivery-guide-version-1-.docx)Function notation and terminology. Function transformations and modulus functions. | [1.05 Trigonometry](https://www.ocr.org.uk/Images/416575-section-1.05-trigonometry-delivery-guide-version-1-.docx)Further identities and equations. Modelling. |
| 4/T1 | [1.02 Algebra and functions](https://www.ocr.org.uk/Images/407095-section-1.02-algebra-and-functions-delivery-guide-version-1-.docx)Proportionality. Algebraic fractions, including partial fractions. | [1.07 Differentiation](https://www.ocr.org.uk/Images/412031-section-1.07-differentiation-delivery-guide.docx)Differentiate a range of functions, the use of first principles, techniques for identification of stationary points. | Initial work on differentiation is best approached with sketches of the curve to visualise the link between position on the curve with the gradient at that point. A simple numerical concept of the limit is all that is required.There is a natural link between the work on tangents and normal with the general topic of equations of a straight line.The more advanced differentiation of compound functions requires careful algebraic manipulation. It might be worth revising fractional and negative indices here.Rates of change problems often include some interpretation of the model defined in the context of the question.Implicit differentiation and differentiation of curves defined parametrically are often considered quite challenging for most candidates, although carefully set out working can yield partial credit. (Leave differential equations until integration covered). |
| 5/T1 | [1.03 Coordinate geometry](https://www.ocr.org.uk/Images/413786-section-1.03-coordinate-geometry-delivery-guide.docx)Straight lines. | [1.07 Differentiation](https://www.ocr.org.uk/Images/412031-section-1.07-differentiation-delivery-guide.docx)Use of differentiation to find tangents and normal.  | Although introduced at GCSE, at A Level the emphasis is often on the formal algebra manipulation and problem solving. Similarly, the work on circles requires good algebraic manipulation and often involves solving simultaneous equations, or even inequalities. Completing the square is an important skill here, at least where the coefficient of *x*2 or *y*2 is 1.The section on parametric equations brings together the skills of algebraic manipulation with trigonometry (also links to projectiles). Simultaneous equations such as *R*sin*θ* = 3, *R*cosθ*=*4 are very important. |
| 6/T1 | [1.03 Coordinate geometry](https://www.ocr.org.uk/Images/413786-section-1.03-coordinate-geometry-delivery-guide.docx)Parametric equations. | [1.07 Differentiation](https://www.ocr.org.uk/Images/412031-section-1.07-differentiation-delivery-guide.docx)Differentiation of sine and cosine. Product, quotient and chain rules (NB: exp and log may not have been met yet). |
| 7/T1 | [1.03 Coordinate geometry](https://www.ocr.org.uk/Images/413786-section-1.03-coordinate-geometry-delivery-guide.docx)Circles. | [1.07 Differentiation](https://www.ocr.org.uk/Images/412031-section-1.07-differentiation-delivery-guide.docx)Implicit differentiation and parametric differentiation. Problem solving, including rates of change. |
| Half term |
| 8/T1 | [1.06 Exponential and logarithms](https://www.ocr.org.uk/Images/416786-section-1.06-exponential-and-logarithms-delivery-guide.docx)Properties of exponential curves, including the e^*x* curve. Laws and graphs of logarithms. | [1.08 Integration](https://www.ocr.org.uk/Images/412032-section-1.08-integration-delivery-guide.docx)Indefinite and definite integrals for functions of *x*, excluding *x* (-1).  | There is a direct link to a review of the laws of indices and an opportunity to revisit curve sketching and solutions to simultaneous equations. Solving equations where the unknown is the exponent generally leads back to linear equations but when it generates quadratics then careful justification needs to be shown of how the standard quadratic format has been used to get the solution.Care is needed in using logarithms to solve inequalities; often the direction of the inequality changes.Extended response modelling questions often involve reduction to linear form and estimates from the line. | Initial work on integration could be covered in parallel with the work on differentiation. Important to emphasise the constant term, which can be demonstrated by investigating families of curves.The correct use of modulus function may be needed for full credit.Many problem solving questions bring together ideas of finding roots, or where tangents meet axes, in order to determine the limits used to find enclosed areas.The more complex integration techniques need careful presentation to avoid mistakes in algebraic manipulation. (Integration of, for example, (3*x*)(–1) often causes problems.) Advanced integration is often found hard. The key skill is to recognise which method to use. It is most important to recognise when one part of the integrand is the derivative of another part, for example when integrating *x*3 sin(*x*4). Only when this does not work should parts be tried. In particular, it is helpful to see how different methods of differentiation are associated with different methods of integration. For example, differentiation using the chain rule produces a result that can be integrated by substitution; differentiating using the product rule produces a result that can be integrated by parts. Again, for differential equations careful presentation is needed to avoid mistakes in algebraic manipulation. |
| 9/T1 | [1.06 Exponential and logarithms](https://www.ocr.org.uk/Images/416786-section-1.06-exponential-and-logarithms-delivery-guide.docx)Solving equations and inequalities involving or by using logarithms. | [1.07 Differentiation](https://www.ocr.org.uk/Images/412031-section-1.07-differentiation-delivery-guide.docx), [1.08 Integration](https://www.ocr.org.uk/Images/412032-section-1.08-integration-delivery-guide.docx)Differentiation of e*x* and ln *x*. Integration of trig and exponential functions and of 1/*x.* |
| 10/T1 | [1.06 Exponential and logarithms](https://www.ocr.org.uk/Images/416786-section-1.06-exponential-and-logarithms-delivery-guide.docx)Reduction to linear form and modelling using logarithms. | [1.08 Integration](https://www.ocr.org.uk/Images/412032-section-1.08-integration-delivery-guide.docx)Use of integration to find enclosed areas, and as the limit of a sum. |
| 11/T1 | [1.04 Sequences and series](https://www.ocr.org.uk/Images/415095-section-1.04-sequences-and-series-delivery-guide.docx)Binomial expansion of polynomials where *n* is a positive integer and for any rational value of *n.* | [1.08 Integration](https://www.ocr.org.uk/Images/412032-section-1.08-integration-delivery-guide.docx)Integration by substitution and by parts. Use of partial fractions where appropriate. | The difference between, for example, *un*+1 = *kun* and *un*= *kn* worries many students but is crucial.Common mistakes on binomial expansion questions involve missing brackets and mistakes with signs. Also, for example, with the 3 in(9 + *x*)1/2 = 3(1 + *x*/9)1/2.Iterative relationships will be used again later with numerical methods and may also appear in probability problems.Students generally have no issues with routine application of the formulae given in the formula sheet, but issues arise in modelling problems. Particular care with signs is needed with the formulae for the sum of a geometric progression.Many problem solving questions lead to quadratic equations with two solutions, only one of which is a solution to the actual problem. In such cases it is important to state the irrelevant solution and then say that it *is* rejected. |
| 12/T1 | [1.04 Sequences and series](https://www.ocr.org.uk/Images/415095-section-1.04-sequences-and-series-delivery-guide.docx)Generate and interpret sequences. Increasing, decreasing, convergent sequences, etc. | [1.08 Integration](https://www.ocr.org.uk/Images/412032-section-1.08-integration-delivery-guide.docx)Solving differential equations, modelling using differential equations. |
| 13/T1 | [1.04 Sequences and series](https://www.ocr.org.uk/Images/415095-section-1.04-sequences-and-series-delivery-guide.docx)Using formulae for arithmetic and geometric sequences and series. | [1.10 Vectors](https://www.ocr.org.uk/Images/413780-section-1.10-vectors-delivery-guide.docx)Basic operations in 2 dimensions. | Vector problems in 2 dimensions are generally simple to visualise with a sketch and are applied in mechanics. 3-dimensional problems are more difficult to visualise. Sketches are almost essential.A common issue on questions is appropriate use of conventions and notations. The direction of a vector in 2 dimensions is usually given by an angle measured anticlockwise from the *x*-axis. |
| 14/T1 | [1.04 Sequences and series](https://www.ocr.org.uk/Images/415095-section-1.04-sequences-and-series-delivery-guide.docx)Solving problems and modelling with sequences and series. | [1.10 Vectors](https://www.ocr.org.uk/Images/413780-section-1.10-vectors-delivery-guide.docx)Problem solving in 2 dimensional pure maths contexts of geometry, extending to modelling in mechanics and 3 dimensions. |
| Christmas break |
| 1/T2 | [1.01 Proof](https://www.ocr.org.uk/Images/407055-section-1.01-proof-delivery-guide.docx)Use of logical connectives, proof by exhaustion and proof by counter example. | [1.09 Numerical methods](https://www.ocr.org.uk/Images/415109-section-1.09-numerical-methods-delivery-guide.docx)Roots of equations. | Proof is what distinguishes mathematics from other subjects, and particularly from the sciences. If the teaching programme makes use of proof on a daily basis, the right mind-set is much easier to acquire.Proof questions can be challenging for many students. Careful definition of algebraic variables at the start is important: for example, if *n* is an odd integer, a proof can start with “Let *n* = 2*k* – 1”. | Students would have undertaken some informal estimations of roots and areas at GCSE. After the sign-change method, the simple iterative method can consolidate the previous work on sequences.It is very likely that some revision of the different methods of integration will be needed. This may be a good time to do it. |
| 2/T2 | [1.01 Proof](https://www.ocr.org.uk/Images/407055-section-1.01-proof-delivery-guide.docx)Proof by deduction and proof by contradiction. | [1.09 Numerical methods](https://www.ocr.org.uk/Images/415109-section-1.09-numerical-methods-delivery-guide.docx)Estimation of integration. |
| 3/T2 | [2.01 Statistical sampling](https://www.ocr.org.uk/Images/412028-section-2.01-statistical-sampling-delivery-guide.docx)Understand the terms and identify bias when collecting sample data. | [3.01 Quantities and units](https://www.ocr.org.uk/Images/412029-section-3.01-quantities-and-units-delivery-guide.docx)Understand terms and undertake conversions. Discussion of what “modelling” means. Standard models (“particle”, “rod” etc). | Sampling questions will not require students to undertake the process, but a practical approach highlights sources of bias. It is useful to focus right from the start on the difference between population and sample. | Questions will rarely focus solely on this topic, but questions may need values to be converted to standard units and final answers may need correct units to be quoted for full credit. Questions may also include a focus on the modelling assumptions. |
| 4/T2 | [2.02 Data presentation and interpretation](https://www.ocr.org.uk/Images/421345-section-2.02-data-presentation-and-interpretation-delivery-guide.docx)Single variable and bivariate data charts. Draw charts and interpret displays. The Large Data Set (LDS). | [3.02 Kinematics](https://www.ocr.org.uk/Images/416565-section-3.02-kinematics-delivery-guide.docx)Constant acceleration problems in one direction using *suvat* equations. | Much will be familiar from GCSE, but the LDS needs some contact time. The LDS can be used as a source of data for calculations and graphs. Familiarity with the LDS allows interpretation of charts & results.Again, familiarity from GCSE means that not too much time should be needed here. But students need to know which value to quote (using *n* or *n*–1) when calculating standard deviation on their calculator. | Build up complexity from horizontal, to vertical and then to problems on slopes. Some students will have met *suvat* in Physics; but they need to realise that that is not the only method.Opportunity to link *suvat* to graphs and to calculus.Encourage the use of diagrams and sketches to solve unscaffolded problems.  |
| 5/T2 | [2.02 Data presentation and interpretation](https://www.ocr.org.uk/Images/421345-section-2.02-data-presentation-and-interpretation-delivery-guide.docx)Calculation and interpretation of measures of average and spread. | [3.02 Kinematics](https://www.ocr.org.uk/Images/416565-section-3.02-kinematics-delivery-guide.docx)Use calculus to solve problems. |
| 6/T2 | [2.03 Probability](https://www.ocr.org.uk/Images/415108-section-2.03-probability-delivery-guide.docx)Calculate probabilities for mutually independent and independent events using diagrams where appropriate. | [3.02 Kinematics](https://www.ocr.org.uk/Images/416565-section-3.02-kinematics-delivery-guide.docx)Solve projectile problems in 2 directions. | The distinction between multiplying and adding probabilities is crucial. This is a topic which needs plenty of practice; students often get wrong answers at first. |
| Half Term |
| 7/T2 | [2.03 Probability](https://www.ocr.org.uk/Images/415108-section-2.03-probability-delivery-guide.docx)Conditional probability. | [3.03 Forces and Newton's laws](https://www.ocr.org.uk/Images/418253-section-3.03-forces-and-newton-s-laws-delivery-guide.docx)Draw force diagrams to support problems in equilibrium, using vector notation and resolving by trig. | Careful use of notation is needed here. The focus should be on the relationship between conditional probabilities and tree diagrams, with use of formulae when a tree diagram cannot easily be drawn. | Many students find mechanics hard at first. An insistence on drawing diagrams, showing all the forces (and the acceleration, where relevant) with arrows, and labelling each equation to say where it comes from (for instance, “N2 horiz”) will amply repay the effort required. (“F = ma” is usually not enough to help either the student or the examiner)There is an opportunity to revise trigonometry. Students need to be fluent in saying that one side of a right-angled triangle is the hypotenuse multiplied by sine or cosine of an angle. A common error is to confuse sine and cosine.In using N3L it is important to focus on what body a force is acting on. It is usually wise to draw separate diagrams for each body.In connected particle situations, examiners have often reported that students who form equations for each particle separately, rather than treating the system as a whole, are more successful.  |
| 8/T2 | [2.04 Statistical distributions](https://www.ocr.org.uk/Images/415107-section-2.04-statistical-distributions-delivery-guide.docx)Discrete probability distribution, including binomial. | [3.03 Forces and Newton's laws](https://www.ocr.org.uk/Images/418253-section-3.03-forces-and-newton-s-laws-delivery-guide.docx)Use N2L for motion in straight line, horizontal, vertical and along slope (includes using W). | Most students can learn how to get numerical answers to questions involving probability distributions, and in particular the binomial distribution, but discussion of the modelling assumptions for binomial distributions should not be neglected.  |
| 9/T2 | [2.04 Statistical distributions](https://www.ocr.org.uk/Images/415107-section-2.04-statistical-distributions-delivery-guide.docx)Normal distribution and approximation of binomial distribution. | [3.03 Forces and Newton's laws](https://www.ocr.org.uk/Images/418253-section-3.03-forces-and-newton-s-laws-delivery-guide.docx)Use N3L. Use concept of friction on rough surfaces. | The use of sketches is advised.Finding a parameter from a normal probability is a common question. If you are finding a range of values of a binomial random variable, a normal approximation can help to get a good starting point. |
| 10/T2 | [2.05 Statistical hypothesis testing](https://www.ocr.org.uk/Images/417813-section-2.05-statistical-hypothesis-testing-delivery-guide.docx)Binomial hypothesis tests. | [3.03 Forces and Newton's laws](https://www.ocr.org.uk/Images/418253-section-3.03-forces-and-newton-s-laws-delivery-guide.docx)Connected particles, using vectors and using trig. | Initial time discussing the concept of hypothesis testing is well spent. The set up for all hypothesis tests is the same: identify the null and alternative hypothesis, defining the parameter being tested; undertake the test calculation, and draw conclusions from the results. The distinction between a sample statistic (e.g. sample mean x-bar) and a population parameter (e.g. *μ*) is all-important.Two important points:(1) Significance tests make inferences about a population parameter. The hypotheses always concern a population parameter (not a sample statistic), and this should be defined in the context of each question.(2) Conclusions should be reported in a non-assertive manner in acknowledgement that the test is based only on the sample used, and with reference to the context of the question.  |
| 11/T2 | [2.05 Statistical hypothesis testing](https://www.ocr.org.uk/Images/417813-section-2.05-statistical-hypothesis-testing-delivery-guide.docx)Normal hypothesis tests. | [3.03 Forces and Newton's laws](https://www.ocr.org.uk/Images/418253-section-3.03-forces-and-newton-s-laws-delivery-guide.docx)Problem solving questions using kinematics and forces. |
| 12/T2 | [2.05 Statistical hypothesis testing](https://www.ocr.org.uk/Images/417813-section-2.05-statistical-hypothesis-testing-delivery-guide.docx)Correlation hypothesis tests using Pearson’s Product Moment Correlation. | [3.04 Moments](https://www.ocr.org.uk/Images/417814-section-3.04-moments-delivery-guide.docx)Use moments and resultant forces in simple statics contexts. | Basic moments problems link to early work on setting up and solving linear equations. Care is needed with finding the distance from the pivot point to the force when there is an unknown to take into account. Another common error is to confuse weight and mass. |
| Easter Break |
| 1/T3 |  |  | All examination candidates will need significant time working through past papers and other revision material. The two principal skills needed are:(i) the ability to recognise what method is needed to answer a question, and(ii) remembering the specific details of that method. When there is limited time, these skills can be practised by presenting a series of exam questions, say on PowerPoint slides, and asking the students (i) how they would start the question, and (ii) what they would have to remember while answering it. | Pure mathematics topics that are particularly likely to need revision at this stage are harder trigonometry (e.g. solve 3sin*x* + 4cos*x* = 2) and integration (substitution, parts, etc). |
| 2/T3 |  |  |  |
| 3/T3 |  |  |  |
| 4/T3 |  |  |  |



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