Cambridge Assessment International Education

Comparison guide for Cambridge Pre-U Further Mathematics 9795

Cambridge Pre-U Further Mathematics 9795
Cambridge International AS & A Level Further Mathematics 9231
OCR AS/A Level GCE Further Mathematics H245 (OCR A) and H645 (OCR B MEI)

Introduction

Cambridge International has mapped the assessment objectives, methodology of assessment and topics of Cambridge Pre-U Further Mathematics 9795 to Cambridge International AS & A Level Further Mathematics 9231 and OCR AS/A Level GCE Further Mathematics H245 (OCR A) and H645 (OCR B MEI) for examination in 2022. When comparing the topics, the expressions below have been used to give an indication of overlap between the syllabuses:

- Topic coverage is **identical** to the Cambridge Pre-U syllabus.
- Topic coverage is **almost identical**. Slight differences are stated.
- Topic coverage is **similar**. Differences are stated.
- Identical coverage is **limited** compared to the content of Cambridge Pre-U syllabus
- This topic is **not covered** in this syllabus.

Assessment objectives

Cambridge Pre-U	Cambridge International AS & A Level	OCR AS/A Level GCE
Assessment objectives (AOs)		
AO1 Manipulate mathematical expressions accurately, round answers to an appropriate degree of accuracy, and understand the limitations of solutions obtained using calculators.	**AO1 Knowledge and understanding** • show understanding of relevant mathematical concepts, terminology and notation • recall accurately and use appropriate mathematical manipulative techniques.	**AO1 Use and apply standard techniques** • select and correctly carry out routine procedures • accurately recall facts, terminology and definitions.
AO2 Construct rigorous mathematical arguments and proofs through the use of precise statements and logical deduction, including extended arguments for problems presented in unstructured form.	**AO2 Application and communication** • recognise the appropriate mathematical procedure for a given situation • apply appropriate combinations of mathematical skills and techniques in solving problems • present relevant mathematical work, and communicate corresponding conclusions, in a clear and logical way.	**AO2 Reason, interpret and communicate mathematically** • construct rigorous mathematical arguments (including proofs) • make deductions and inferences • assess the validity of mathematical arguments • explain their reasoning • use mathematical language and notation correctly.
AO3 Recall, select and apply knowledge of mathematical facts, concepts and techniques in a variety of contexts.		**AO3 Solve problems within mathematics and in other contexts** • translate problems in mathematical and non-mathematical contexts into mathematical processes • interpret solutions to problems in their original context, and, where appropriate, evaluate their accuracy and limitations • translate situations in context into mathematical models • use mathematical models • evaluate the outcomes of modelling in context, recognise the limitations of models and, where appropriate, explain how to refine them.
AO4 Understand how mathematics can be used to model situations in the real world and solve problems in relation to both standard models and less familiar contexts, interpreting the results.		

Methodology of assessment

Cambridge Pre-U	Cambridge International AS & A Level	OCR AS/A Level GCE
Assessment		
• Paper 1 – 3 hours • Paper 2 – 3 hours All components are externally assessed	**AS Level** • Paper 1 – 2 hours • Plus either paper 3 or 4 – 1 hour 30 minutes **A Level - Staged over 2 years** <u>Year 1</u> • Paper 1 – 2 hours plus either paper 3 or 4 – 1 hour 30 minutes each <u>Year 2</u> • Paper 2 – (A Level) – 2 hours plus either paper 3 or 4 – 1 hour 30 minutes each **A Level** • Paper 1 – 2 hours • Paper 2 – 2 hours • Paper 3 – 1 hour 30 minutes • Paper 4 – 1 hour 30 minutes All components are externally assessed	**H245** **AS Level** • Component 1 – 1 hour 15 minutes • Plus two other papers of choice – 1 hour 15 minutes each **A Level** • Component 1 – 1 hour 30 minutes • Component 2 – 1 hour 30 minutes • Plus two other papers of choice – 1 hour 30 minutes each **H645** **AS Level** • Component 1 – 1 hour 30 minutes • Plus two other papers of choice – 1 hour 15 minutes each **A Level** • Component 1 – 2 hours 40 minutes, plus <u>Route A</u> Mechanics major (2 hours 15 minutes) plus one minor (1 hour 15 minutes–45 minutes <u>Route B</u> Statistics major (2 hour 15 minutes plus one minor Component 2 – 1 hour 30 minutes–45 minutes) <u>Route C</u> No major, 3 x minors All components externally assessed

Topics

The final column in this table combines OCR A and OCR B syllabuses, and any differences between them are highlighted in the text. The analysis that follows is based on Pure Mathematics, Mechanics and Statistics coverage, mirroring the scope of the Cambridge Pre-U.

For OCR A there is a Pure Core paper plus Mechanics and Statistics options and an Additional Pure option.

For OCR B there is a Core Pure paper plus Mechanics and Statistics major options and Mechanics, Statistics and Extra Pure minor options; in each case the syllabus content of the major option has been analysed in detail given that the minor option is a subset of that content.

Cambridge Pre-U	Cambridge International AS & A Level	OCR AS/A Level GCE
Topics		
Rational functions	Topic coverage is almost identical. This syllabus includes the relationship between the graph of a function and the graph of related functions such as its reciprocal or modulus.	This topic is not covered in this syllabus.
Roots of polynomial equations	Topic coverage is identical to the Cambridge Pre-U syllabus.	Topic coverage is almost identical but OCR B excludes non-linear transformations of the roots.
Complex numbers	This topic is not covered in this syllabus. (It is included in 9709 A Level Pure Mathematics 3 instead.)	Topic coverage is almost identical for both OCR A and B. However OCR A also mentions using the roots of unity to solve geometrical problems. In OCR B, the split between this topic and the section on de Moivre's Theorem is slightly different: the polar form of a complex number is in the latter section.
De Moivre's theorem	Topic coverage is almost identical. This syllabus also requires candidates to prove de Moivre's theorem for a positive integer exponent. It mentions only n^{th} roots of unity whereas Cambridge Pre-U mentions n^{th} roots of complex numbers.	Topic coverage is almost identical. In OCR B there is apparently greater coverage of geometrical applications (on Argand diagrams) than for Cambridge Pre-U. In practice it is likely that 'use the n^{th} roots' in the Cambridge Pre-U syllabus would include illustrating geometrical examples on an Argand diagram.
Polar coordinates	Topic coverage is identical to the Cambridge Pre-U syllabus.	Topic coverage is identical to the Cambridge Pre-U syllabus.
Summation of series	Topic coverage is identical to the Cambridge Pre-U syllabus.	Topic coverage is almost identical. The scope of OCR B includes the concepts of convergence and sum to infinity, though the wording is slightly different. It also mentions summing a series using partial fractions. While OCR A includes the method of differences, OCR B does not.

Cambridge Pre-U	Cambridge International AS & A Level	OCR AS/A Level GCE
Topics		
Mathematical induction	Topic coverage is almost identical. This syllabus does not mention inequalities but gives an additional example of proof by induction using matrices.	Topic coverage is similar. In addition, OCR A states this topic may be tested on any relevant content e.g. derivatives, powers, exponentials and factorials. OCR B includes proof by induction applied to de Moivre's theorem. It also includes other types of proof: deduction, exhaustion, contradiction, disproof by counter example.
Calculus	Topic coverage is similar though the calculus content for this syllabus is split differently between sections. This syllabus does not mention Taylor series nor finding the surface of revolution for equations in polar form. It additionally includes differentiation of inverse hyperbolic functions and the use of rectangles to set bounds for the area under a curve. Neither differentiation nor integration of functions involving $\tan^{-1}$ appears in this syllabus because those are within the scope of 9709 A Level Pure Mathematics 3.	The OCR A syllabus topic coverage is similar, though split differently between sections. OCR B does not include reduction formulae nor arc lengths and surfaces of revolution. Neither OCR A nor OCR B includes Taylor series. Both these syllabuses additionally cover integrals using hyperbolic substitutions, improper integrals, volumes of solids of revolution, mean value and integration of partial fractions. OCR A additionally covers differentiation of inverse hyperbolic functions. Within the Extra Pure minor option, OCR B covers reduction formulae and arc lengths and areas of surfaces of revolution, though not for equations in polar form.
Hyperbolic functions	Topic coverage is almost identical, though this syllabus also mentions proving identities involving hyperbolic functions. Integration of hyperbolic functions is in a separate section in this syllabus.	Topic coverage is almost identical to the Cambridge Pre-U syllabus, though differentiation and integration involving inverse hyperbolics is additionally included in both OCR A and B.
Differential equations	Topic coverage is almost identical though this syllabus does not mention the Taylor series method of solving differential equations.	Topic coverage is almost identical for both OCR A and B though these syllabuses do not mention the Taylor series method of solving differential equations. Both OCR A and B also include coupled 1st order simultaneous linear differential equations and their applications in modelling.

Cambridge Pre-U	Cambridge International AS & A Level	OCR AS/A Level GCE
Topics		
Vector geometry	Topic coverage is similar. This syllabus does not include the scalar triple product and its use in finding the volume of a parallelepiped. Given the range of geometrical problems suggested to which methods can be applied, the remainder of the coverage is almost identical.	Topic coverage is similar. Both OCR syllabuses A and B include the vector equation of a line as well as the scalar product and applications such as intersections and shortest distances. (These are not included in the 9795 Cambridge Pre-U Further Mathematics syllabus because they are in the 9794 Cambridge Pre-U Mathematics syllabus). For OCR B, the vector product is within the syllabus for Core Pure, but for OCR A it only appears within the Additional Pure option. The scalar triple product and its use in finding volumes appears in the OCR A Additional Pure option but nowhere in the OCR B syllabus. Neither OCR A nor OCR B includes finding the line of intersection of two planes (this is explicitly excluded from OCR B).
Matrices	Topic coverage is similar. This syllabus also requires understanding of the relationship between transformations represented by a matrix (and its inverse) and a geometrical interpretation of the solutions to a system of equations in terms of lines and planes. This syllabus includes eigenvectors, eigenvalues and the characteristic equation.	Topic coverage of OCR A is similar. For OCR B Core Pure, topic coverage is similar, though in the Extra Pure minor option of this syllabus, the topic is extended to eigenvectors, eigenvalues and the characteristic equation as well as their application to transformations.
Groups	This topic is not covered in this syllabus.	OCR A includes Groups in the optional Additional Pure paper. The topic coverage is almost identical, though this syllabus mentions additional examples (geometrical shapes and complex numbers). OCR B includes Groups in the Extra Pure minor option where the topic coverage is identical to that of Cambridge Pre-U.

Cambridge Pre-U	Cambridge International AS & A Level	OCR AS/A Level GCE
Topics		
Poisson distribution	This topic is not covered in this syllabus. (It is included in 9709 A Level Mathematics Probability & Statistics 2.)	OCR A Statistics option: The topic coverage is similar but this syllabus does not include the Poisson approximation to the binomial. OCR B Statistics major: The topic coverage is similar but this syllabus specifically excludes calculations using the Poisson as an approximation to the binomial.
Normal distribution as an approximation	This topic is not covered in this syllabus. (It is included in 9709 A Level Mathematics: the approximation to the binomial is included in Probability & Statistics 1 and the approximation to the Poisson in Probability & Statistics 2.)	This topic is not covered in either OCR syllabus. OCR A Statistics option includes only the Wilcoxon signed-rank test and Wilcoxon rank-sum test approximations.
Continuous random variables	The topic coverage is very similar but this syllabus does not include calculating the mean and variance of a continuous random variable.	The topic coverage is very similar but OCR B Statistics major option additionally includes the mode and median from a given p.d.f. and does not include finding the c.d.f., and hence p.d.f., of related variables e.g. $Y = X^3$. Both these syllabuses mention uniform and exponential models. The OCR A Statistics option mentions piecewise functions, as does the Cambridge Pre-U syllabus, whereas OCR B does not.
Linear combinations of random variables	This topic is not covered in this syllabus. (It is included in 9709 A Level Mathematics Probability & Statistics 2.)	Topic coverage is identical.
Estimation	Identical coverage is limited compared with the content of the Cambridge Pre-U syllabus. Most of this topic is included in 9709 A Level Mathematics Probability & Statistics 2. Only the sections on *t*-distribution and pooled estimates are included in this syllabus.	Topic coverage is similar. OCR B does not mention biased and unbiased estimators, and neither OCR A nor B considers estimators in discrete distributions. In addition, they do not mention confidence intervals for a population proportion. OCR A does not include the *t*-distribution whereas OCR B does. Pooled estimates are not mentioned in OCR A. Cambridge Pre-U has a final bullet point relating to commenting on assumptions and statements. Although neither OCR syllabus has such a point, it is likely that candidates are required to comment in the course of this topic.

Cambridge Pre-U	Cambridge International AS & A Level	OCR AS/A Level GCE
Topics		
Probability generating functions	Topic coverage is identical to the Cambridge Pre-U syllabus.	This topic is not covered in this syllabus.
Moment generating functions	This topic is not covered in this syllabus.	This topic is not covered in this syllabus.
Energy, work and power	This topic is not covered in this syllabus. (It is included in 9709 A Level Mathematics Mechanics.)	Topic coverage is identical to the Cambridge Pre-U syllabus.
Motion in a circle	The topic coverage is very similar but does not include a particle moving with variable speed nor connected particles moving in a vertical circle.	Topic coverage is almost identical but neither OCR A nor B includes connected particles moving in a vertical circle.
Equilibrium of a rigid body	Topic coverage is identical to the Cambridge Pre-U syllabus.	Topic coverage is almost identical for OCR Mechanics option and OCR B Mechanics major. In addition these syllabuses mention sliding or toppling of a rigid body on an inclined plane.
Elastic strings and springs	Topic coverage is identical to the Cambridge Pre-U syllabus.	Topic coverage is identical to the Cambridge Pre-U syllabus.
Simple harmonic motion (SHM)	This topic is not covered in this syllabus.	Topic coverage is identical to the Cambridge Pre-U syllabus. This topic is covered within the differential equations section of the OCR A Pure Core syllabus and the OCR B Mechanics major option syllabus.
Further particle dynamics	Topic coverage is similar. This syllabus does not include projectiles launched and landing on an inclined plane but it additionally includes coefficient of restitution and Newton's experimental law. Direct impact of two bodies is not covered in this syllabus as it is in 9709 A Level Mathematics Mechanics.	For OCR A, identical coverage is limited compared with the Cambridge Pre-U syllabus, as this syllabus only includes motion in one dimension. For OCR B, topic coverage in the Mechanics major option is similar to that of the Cambridge Pre-U but this syllabus additionally includes coefficient of restitution and Newton's experimental law. Projectiles landing on a slope are in a separate section for OCR B.
Linear motion under a variable force	Topic coverage is identical to the Cambridge Pre-U syllabus.	Topic coverage is identical in the Mechanics option of the OCR A syllabus. It is similar in the Mechanics major option for the OCR B syllabus which extends the scope to two-dimensional motion.