

Switching Guide

International AS and A-level

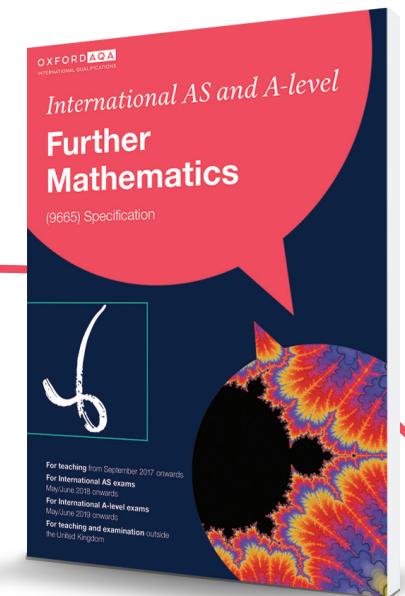
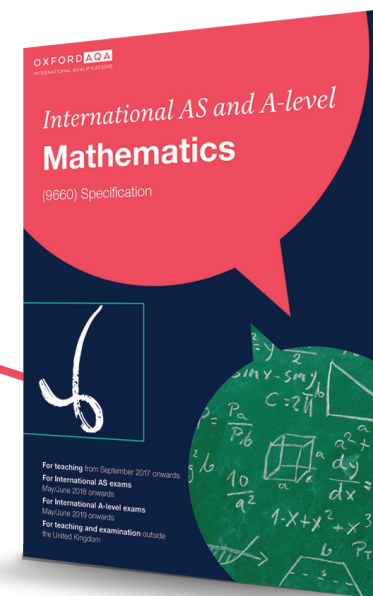
Mathematics (9660)

and **Further**

Mathematics (9665)

Switching from Pearson Edexcel or
Cambridge International to
OxfordAQA International Qualifications

oxfordaqa.com



At OxfordAQA
we put fairness first

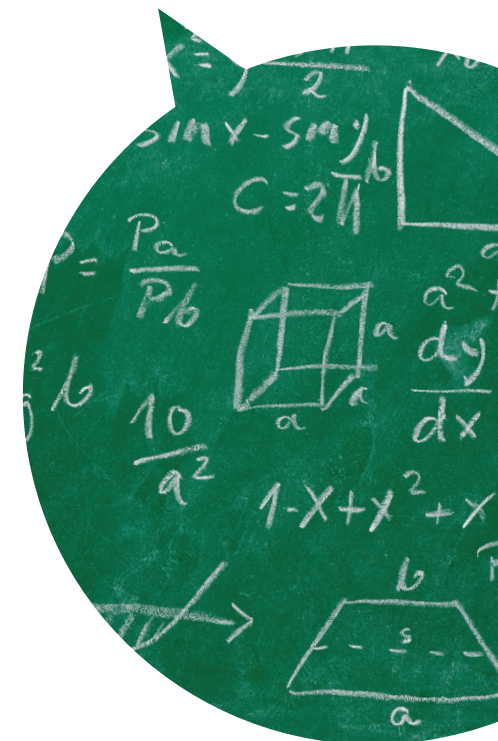
Contents

Switching to OxfordAQA International AS and A-level Mathematics and Further Mathematics	3
Qualifications offered	4
Qualification Assessment Objectives	5
Summary of specifications and assessment models	6
Comparison of content	8
Comparison of exam papers and course structure for International AS and A-level Mathematics	8
Advantages of OxfordAQA International AS and A-level Mathematics	11
Comparison of exam papers and course structure for International AS and A-level Further Mathematics	11
Advantages of OxfordAQA International AS and A-level Further Mathematics	15
International AS and A-level Mathematics content – Overview of modules	15
Comment on comparison of AS and A-level Mathematics content	20
AS and A-level Further Mathematics content	21
Comment on comparison of AS and A-level Further Mathematics content	25
Appendix	26
Analysis and comparison of OxfordAQA Unit 1 Pure Maths	26
Analysis and comparison of OxfordAQA Unit PSM1 (Pure Maths, Statistics and Mechanics)	29

Introduction

This guide aims to help those centres looking to switch to **OxfordAQA International AS and A-level Mathematics** or **Further Mathematics** from either the Cambridge International or the Pearson Edexcel International qualifications.

It identifies the main similarities and differences in terms of content and assessment approaches between the qualifications.



The international exam board *that puts fairness first*

Switching to OxfordAQA International AS and A-level Mathematics (9660) and Further Mathematics (9665)

OxfordAQA International AS and A-level Mathematics and Further Mathematics are stand-alone, modular qualifications, designed for teaching outside the United Kingdom. OxfordAQA have built on the success of previous modular qualifications in Mathematics and Further Mathematics incorporating the best of the AQA specifications, blending attractive features for both teachers and students with ideas, concepts and approaches to learning to ensure these qualifications are appropriate for international schools.

All the International AS and A-level Mathematics and Further Mathematics options include both Mechanics and Statistics. This feature is consistent with the A-level Mathematics exams. As such the qualifications have widespread recognition for university entrance in the UK as well as in other international universities, including those in the USA, Canada and Australia.

Key features AS and A-level Mathematics:

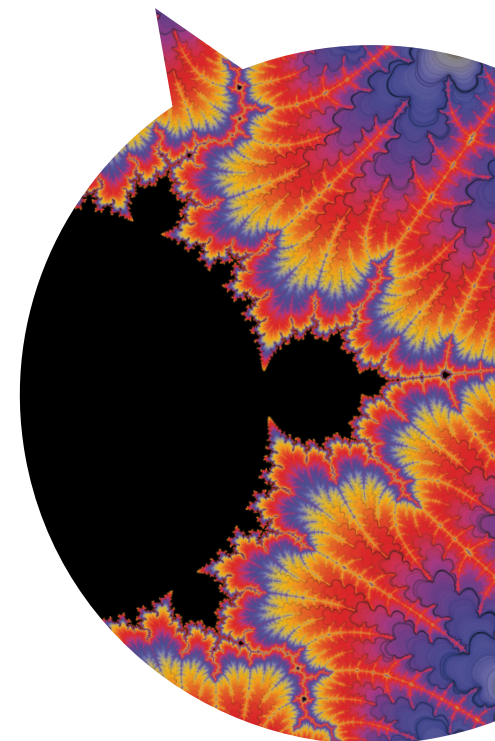
- Exam papers are designed specifically for non-native English speakers, to give them the best possible opportunity to demonstrate their knowledge and understanding of Maths.
- Meet the expectations of top universities, with a solid, collective grounding in pure maths, statistics and mechanics.
- Plenty of opportunities for problem-solving and reasoning to prepare students for university entrance tests and the demands of the 21st-century workplace.

Key features AS and A-level Further Mathematics:

- Designed with an identical structure to the OxfordAQA International A-level Mathematics specification to make co-teaching simple.
- The four units of the Further Mathematics qualifications taken by candidates are all distinct from the A-level Mathematics units.
- Provides challenge for the most able mathematicians who are intending to study a maths-related degree.
- Excellent preparation for mathematical entrance tests at top universities such as Oxford and Cambridge.

Qualifications offered

OxfordAQA	Pearson Edexcel International	Cambridge International
AS Mathematics (XMA01). A-level Mathematics (YMA01).	AS Mathematics (XMA01). A-level Mathematics (YMA01).	AS and A-level Mathematics (9709).
AS Further Mathematics (XFM01). A-level Further Mathematics (YFM01).	AS Further Mathematics (XFM01). A-level Further Mathematics (YFM01).	A-level Mathematics Further (9231).
	AS Pure Mathematics (XPM01). A-level Pure Mathematics (YPM01).	



Qualification Assessment Objectives

OxfordAQA	Pearson Edexcel International	Cambridge International
<p>Two are identified:</p> <ol style="list-style-type: none"> AO1: Recall and select knowledge of mathematical facts, concepts, models and techniques required to solve problems in a variety of contexts. AO2: Construct rigorous mathematical arguments and proofs through use of precise statements, mathematical manipulation, logical deduction, modelling assumptions and justifications to solve structured and unstructured problems, and to deduce, interpret and communicate results. <p>Approximate weighting 45:55</p>	<p>Five are identified:</p> <ol style="list-style-type: none"> Recall, select and use their knowledge of mathematical facts, concepts and techniques in a variety of contexts. Construct rigorous mathematical arguments and proofs through use of precise statements, logical deduction and inference and by the manipulation of mathematical expressions, including the construction of extended arguments for handling substantial problems presented in unstructured form. Recall, select and use their knowledge of standard mathematical models to represent situations in the real world; recognise and understand given representations involving standard models; present and interpret results from such models in terms of the original situation, including discussion of the assumptions made and refinement of such models. Comprehend translations of common realistic contexts into mathematics; use the results of calculations to make predictions, or comment on the context; and, where appropriate, read critically and comprehend longer mathematical arguments or examples of applications. Use contemporary calculator technology and other permitted resources (such as formulae booklets or statistical tables) accurately and efficiently; understand when not to use such technology, and its limitations. Give answers to appropriate accuracy. <p>Minimum weighting: 30%, 30%, 10%, 5%, 5%</p>	<p>One single area broken down in to five elements.</p> <p>The abilities assessed in the exams cover a single area: Technique with application.</p> <p>The exam will test the ability of candidates to:</p> <ol style="list-style-type: none"> Understand relevant mathematical concepts, terminology and notation Recall accurately and use successfully appropriate manipulative techniques Recognise the appropriate mathematical procedure for a given situation Apply combinations of mathematical skills and techniques in solving problems Present mathematical work, and communicate conclusions, in a clear and logical way No weighting given between the different elements.

Summary of specifications and assessment models

Aspect	OxfordAQA	Pearson Edexcel International	Cambridge International
Content	Includes Pure Maths, Statistics and Mechanics. Includes the study of pure maths, along with both statistics and mechanics. Students chose between further courses in either Statistics or Mechanics for the fourth module for both Mathematics and Further Mathematics. Five modules offered at both Mathematics and Further Mathematics. (10 in total)	Includes Pure Maths, Statistics and Mechanics. AS Mathematics can be just Pure Maths. A-level includes either Mechanics and/or Statistics. Seven modules offered for Mathematics. Some choice of questions between Mechanics and Statistics within the second paper for Further Mathematics.	Includes Pure Mathematics, Mechanics, Statistics and Decision Mathematics. AS requires one application paper, either Mechanics, Stats or Decision. A-level includes either Mechanics, Statistics and/or Decision Mathematics. An A-level in Pure Maths is also offered. Seven modules offered for Mathematics and eight for Further Mathematics. (12 in total)
Time	180 Guided Learning Hours for AS. 360 Guided Learning Hours for A-level.	No guidance given.	180 Guided Learning Hours for AS. 360 Guided Learning Hours for A-level.
Assessment AS Mathematics	Two modules prescribed. Pure Mathematics, Mechanics and Statistics.	Two modules, three options. Common Pure Maths paper with either second pure maths, mechanics or stats paper.	Two modules, three options. Common Pure Maths paper with either second pure maths, mechanics or stats paper.
Assessment A-level Mathematics	Four modules, three prescribed and either Mechanics or Statistics paper, which can be taken either throughout the course in January and May/June (with repeated attempts) or at the end of the course. All AS papers can contribute to the full A-level.	Four modules, two prescribed and two from Mechanics(2 papers) Statistics(2) and Decision (1), which can be taken either throughout the course in January and May/June (with repeated attempts) or at the end of the course. All AS papers can contribute to the full A-level.	Four modules, two prescribed and two Mechanics and/or Stats papers, which can be taken either throughout the course in January and May/June (with repeated attempts) or at the end of the course. AS second Pure paper cannot contribute to the full A-level – other papers can.

Aspect	OxfordAQA	Pearson Edexcel International	Cambridge International
Assessment AS Further Mathematics	Two modules prescribed covering Further Pure Mathematics, Mechanics and Statistics.	Three modules, one further pure maths paper prescribed with two of pure maths, mechanics, statistics and/or decision maths.	Not offered.
Assessment A-level Further Mathematics	Four exam papers in total, three of which are compulsory. Both AS papers contribute to the full A-level.	Six exam papers in total. All three AS papers contribute to the full A-level.	Two exam papers in total including Pure, Mechanics and Statistics.
Calculators	Electronic calculators or graphical calculators may be used in all papers.	Electronic calculators or graphical calculators may be used in all papers. Calculators with a facility for symbolic algebra, differentiation and/or integration are not permitted.	It is expected that candidates will have a calculator with standard 'scientific' functions available for use for all papers in the exam. Computers, graphical calculators and calculators capable of algebraic manipulation are not permitted.

Comparison of exam papers and course structure for AS and A-level Mathematics

Aspect	OxfordAQA	Pearson Edexcel International	Cambridge International
AS Mathematics Two modules are studied in all exams leading to two exam papers.	Unit 1: Pure Maths. Unit PSM1 (Pure Maths, Statistics and Mechanics).	Paper 1 Core Maths C12 and one of: <ul style="list-style-type: none"> • Mechanics M1, • Statistics S1; or • Decision D1. 	Paper 1: Pure Mathematics 1 (P1) and one of: <ul style="list-style-type: none"> • Paper 2: Pure Mathematics 2 (P2) • Paper 4: Mechanics 1 (M1) or • Paper 6: Probability and Statistics 1 (S1).
Weighting of papers (%)	50:50	66.6:33.3	60:40
Weighting Pure: Applied	75:25	66.6:33.3	either 100:0 or 60:40
A-level Mathematics Four modules are studied in all exams leading to four exam papers.	Four module course where five modules are offered, three of which are compulsory (Bold). <ol style="list-style-type: none"> Unit 1: Pure Maths Unit PSM1 (Pure Maths, Statistics and Mechanics) Unit P2: Pure Maths Unit S2: Statistics Unit M2: Mechanics Two combinations can be taken. Either: <ul style="list-style-type: none"> • P1 + PSM1 + P2 + S2; or • P1 + PSM1 + P2 + M2. 	Four module course where seven modules are offered, two of which are compulsory (Bold). <ol style="list-style-type: none"> Unit C12: Core Mathematics 12 Unit C34: Pure Mathematics 34 Unit M1: Mechanics 1 Unit M2: Mechanics 2 Unit S1: Statistics 1 Unit S2: Statistics 2 Unit D1: Decision Mathematics 1 Five combinations can be taken. Either: <ul style="list-style-type: none"> • CP12 + C34 + M1 and S1 • CP12 + C34 + M1 and D1 • CP12 + C34 + M1 and M2 • CP12 + C34 + S1 and D1; or • CP12 + C34 + S1 and S2. 	Six modules are offered, two of which are compulsory (Bold). <ol style="list-style-type: none"> Unit P1: Pure Mathematics 1 Unit P3: Pure Mathematics 3 Unit M1: Mechanics 1 Unit M2: Mechanics 2 Unit S1: Statistics 1 Unit S2: Statistics 2 Three combinations can be taken. Either: <ul style="list-style-type: none"> • P1 + P3 + M1 and S1 • P1 + P3 + M1 and M2; or • P1 + P3 + S1 and S2.

Aspect	OxfordAQA	Pearson Edexcel International	Cambridge International
Weighting of papers (%)	20 20 37.5 22.5	33.3 33.3 16.7 16.7	30 30 20 20
Weighting Pure: Applied	67.5:32.5	66.6:33.3	60:40
Note:	Both AS papers contribute to the full A-level.	Both AS papers contribute to the full A-level.	Pure Mathematics 2 (P2) does not contribute to the full A-level. 0:40

OxfordAQA International (5 papers)

	P1	PSM1	P2	S2	M2
Timing – hours: mins	1:30	1:30	2:30	1:30	1:30
Marks	80	80	120	80	80
Compulsory (✓)/optional modules for AS	✓	✓	n/a	n/a	n/a
Weighting of papers (%)	50	50			
Compulsory (✓)/optional modules for A-level	✓	✓	✓	1 of 2	1 of 2
Weighting of papers (%)	20	20	37.5	22.5	22.5

Possible combinations	AS (2 papers)	P1, PSM1	
	A-level (4 papers)	P1, PSM1, P2, S2	P1, PSM1, P2, M2

Pearson Edexcel International (7 papers)

	C12	C34	M1	M2	S1	S2	D1
Timing – hours: mins	2:30	2:30	1:30	1:30	1:30	1:30	1:30
Marks	125	125	75	75	75	75	75
Compulsory (✓)/optional modules for AS	✓	n/a	1 of 3	n/a	1 of 3	n/a	1 of 3
Weighting of papers (%)	66.6		33.3		33.3		33.3
Compulsory (✓)/optional modules for A-level	✓	✓	1 of 5	1 of 5	1 of 5	1 of 5	1 of 5
Weighting of papers (%)	33.3	33.3	16.7	16.7	16.7	16.7	16.7

Possible combinations	AS (2 papers)	C12, M1	C12, S1	C12, D1		
	A-level (4 papers)	C12, C34, M1, S1	C12, C34, M1, D1	C12, C34, M1, M2	C12, C34, S1, D1	C12, C34, S1, S2

Cambridge International (7 papers)

	P1	P2	P3	M1	M2	S1	S2
Timing – hours: mins	1:45	1:15	1:45	1:15	1:15	1:15	1:15
Marks	75	50	75	50	50	50	50
Compulsory (✓)/optional modules for AS	✓	1 of 3	n/a	1 of 3	n/a	1 of 3	
Weighting of papers (%)	60	40		40		40	
Compulsory (✓)/optional modules for A-level	✓	n/a	✓	1 of 4	1 of 4	1 of 4	1 of 4
Weighting of papers (%)	20	20	37.5	22.5	22.5		

Possible combinations	AS (2 papers)	P1, P2	P1, M1	P1,S1
	A-level (4 papers)	P1, P3, M1, S1	P1, P3, M1, M2	P1, P3, S1, S2

Advantages of OxfordAQA International AS and A-level Mathematics

The prescribed modules for International AS and limited choice for International A-level means it is easier for centres to offer all options, it lowers the possibility of confusion, and is simpler to administrate.

Including both Statistics and Mechanics in a compulsory module for both International AS and A-level means that students can make a better-informed choice for studying subsequent modules.

All International AS modules contribute to the full International A-level whereas this is not the case with the Cambridge International P2 module.

Comparison of exam papers and course structure for International AS and A-level Further Mathematics

Aspect	OxfordAQA	Pearson Edexcel International	Cambridge International
AS Further Mathematics Two modules are studied in all exams leading to two exam papers.	Unit FP1: Pure Maths. Unit FPSM1 (Pure Maths, Statistics and Mechanics).	Unit F1 Further Pure Maths. Any two of modules in: Further Pure Maths F2, F3, Mechanics M1, M2; Statistics S1, S2; or Decision D1, but must be distinct from any A-level Mathematics entry.	Seemingly not offered.
Weighting of papers (%)	50:50	33.3 : 33.3 : 33.3.	

Aspect	OxfordAQA	Pearson Edexcel International	Cambridge International
<p>A-level Further Mathematics</p> <p>Two modules are studied in all exams leading to two exam papers.</p>	<p>Four module course where five modules are offered, three of which are compulsory (Bold).</p> <ol style="list-style-type: none"> 1 Unit FP1: Pure Maths 2 Unit FPSM1 (Pure Maths, Statistics and Mechanics) 3 Unit FP2 (Pure Maths) 4 Unit FS2: Statistics 5 Unit FM2: Mechanics. <p>Two combinations can be taken. Either:</p> <ul style="list-style-type: none"> • FP1 + FPSM1 + FP2 + FS2; or • FP1 + FPSM1 + FP2 + FM2. 	<p>Six module course where eight modules are offered, F1 is compulsory along with either F2 and/or F3 (Bold).</p> <ol style="list-style-type: none"> 1 Unit F1 Further Pure Maths 2 Unit F2 Further Pure Maths 3 Unit F3 Further Pure Maths 4 Unit M1: Mechanics 1 5 Unit M2: Mechanics 2 6 Unit M3: Mechanics 3 7 Unit S1: Statistics 1 8 Unit S2: Statistics 2 9 Unit S3: Statistics 3 10 Unit D1: Decision Mathematics 1 <p>Various combinations (105 possible options?) but must be distinct from any A-level Mathematics entry.</p>	<p>Paper 1: Pure Mathematics and assumes knowledge of the syllabus for Pure Mathematics (units P1 and P3).</p> <p>Paper comprises about 11 questions of different marks and lengths on Pure Mathematics. Candidates should answer all questions and one of the two alternatives for the final question (worth 12–14 marks).</p> <p>Paper 2: Mechanics and Statistics and assumes knowledge of the syllabuses for Mechanics (units M1 and M2) and Probability and Statistics (units S1 and S2).</p> <p>Paper comprises 4 or 5 questions on Mechanics (worth a total of 43 or 44 marks) followed by 4 or 5 questions on Statistics (worth a total of 43 or 44 marks) and one final question worth 12 or 14 marks on either Mechanics or Statistics.</p>
Weighting of papers (%)	20 : 20 : 37.5 : 22.5	16.7% for each module.	50:50.
Note	Four exam papers in total. Both AS papers contribute to the full A-level.	Six exam papers in total. All three AS papers contribute to the full A-level.	Two exam papers in total.

OxfordAQA International (5 papers)

	FP1	FPSM1	FP2	FS2	FM2
Timing – hours: mins	1:30	1:30	2:30	1:30	1:30
Marks	80	80	120	80	80
Compulsory (✓)/optional modules for AS	✓	✓	n/a	n/a	n/a
Weighting of papers (%)	50	50			
Compulsory (✓)/optional modules for A-level	✓	✓	✓	1 of 2	1 of 2
Weighting of papers (%)	20	20	37.5	22.5	22.5

Possible combinations	AS (2 papers)	FP1, FPSM1	
	A-level (4 papers)	FP1, FPSM1, FP2, FS2	FP1, FPSM1, FP2, FM2

Pearson Edexcel International (10 papers)

	F1	F2	F3	M1-3	S1-3	D1
Timing – hours: mins	1:30	1:30	1:30	1:30	1:30	1:30
Marks	75	75	75	75	75	75
Compulsory (✓)/optional modules for AS	✓	1 of 3	1 of 3	Up to 2 of 3	Up to 2 of 3	1 of 3
Weighting of papers (%)	33.3	33.3	33.3	33.3	33.3	33.3
Compulsory (✓)/optional modules for A-level	✓	1 of 2	1 of 2	Up to 3 of 6	Up to 3 of 6	1 of 6
Weighting of papers (%)	16.7	16.7	16.7	16.7	16.7	16.7

Possible combinations	AS (2 papers)	F1+2	
	A-level (4 papers)	F1 + F2 or F3 + 4 others	F1, F2, F3 +3 others

Cambridge International 2019 (2 papers)

	Paper 1	Paper 2
Timing – hours: mins	3:00	3:00
Marks	100	100
Compulsory (✓)/optional modules for AS	n/a	n/a
Weighting of papers (%)	n/a	n/a
Compulsory (✓)/optional modules for A-level	✓	✓
Weighting of papers (%)	50	50

Possible combinations	AS (2 papers)	n/a
	A-level (2 papers)	Paper 1, Paper 2

Advantages of OxfordAQA International AS and A-level Further Mathematics

As with the Mathematics qualifications the prescribed modules for International AS and limited choice for International A-level means it is easier for centres to offer all options, it lowers the possibility of confusion, and is simpler to administrate. It also follows the familiar four module structure of the International AS and A-level Mathematics qualifications.

Including both Statistics and Mechanics in a compulsory module for both International AS and A-level means that students can make a better-informed choice for studying subsequent modules.

With the Mathematics qualifications all International AS modules contribute to the full International A-level whereas this is not the case with the Cambridge International P2 module.

Comparison of content International AS and A-level Mathematics – Overview of modules

OxfordAQA	Pearson Edexcel International	Cambridge International
Unit 1: Pure Maths <ul style="list-style-type: none"> • P1.1: Algebra (Quadratics, Factor theorem, graphs, transformations). • P1.2 Coordinate Geometry. • P1.3: Differentiation (Polynomial, tangent, normal, max, min, 2nd derivative). • P1.4: Integration (including trapezium rule). • P1.5: Sequences and Series (arithmetic, geometric and binomial expansion). 	Core Mathematics 12 Unit C12 <ol style="list-style-type: none"> 1 Algebra and functions 2 Coordinate geometry in the (x, y) plane 3 Sequences and series 4 Exponentials and logarithms 5 Trigonometry 6 Differentiation 7 Integration 	Unit P1: Pure Mathematics 1 <ol style="list-style-type: none"> 1 Quadratics 2 Functions 3 Coordinate geometry 4 Circular measure 5 Trigonometry 6 Vectors 7 Series 8 Differentiation 9 Integration

OxfordAQA	Pearson Edexcel International	Cambridge International
<p>Unit PSM1 (Pure Maths, Statistics and Mechanics)</p> <ul style="list-style-type: none"> • PP1.1: Circle • PP1.2: Trigonometry • PP1.3 Exponential and logarithms • S1.1: Further Probability • S1.2: Discrete random variables • S1.3: Bernoulli and binomial distributions • M1.1: Motion in a straight line with constant acceleration • M1.2: Motion in a straight line with variable acceleration • M1.3: Forces and Newton's Laws • M1.4: Momentum and impulse (Restricted to motion in a straight line) 	<p>Core Mathematics 34 Unit C34</p> <ol style="list-style-type: none"> 1 Algebra and functions 2 Sequences and series 3 Trigonometry 4 Exponentials and logarithms 5 Coordinate geometry in the (x, y) plane 6 Differentiation 7 Integration 8 Numerical methods 9 Vectors 	<p>Unit P2: Pure Mathematics 2 (Paper 2)</p> <ol style="list-style-type: none"> 1 Algebra 2 Logarithmic and exponential functions 3 Trigonometry 4 Differentiation 5 Integration 6 Numerical solution of equations

OxfordAQA	Pearson Edexcel International	Cambridge International
<p>Unit P2: Pure Maths</p> <ul style="list-style-type: none"> • P2.1: Algebra and functions (composite and inverse, modulus, rational, partial fractions) • P2.2: Sequences and series • P2.3: Coordinate geometry in the (x, y) plane (parametric equations) • P2.4: Trigonometry (compound angles, identities) • P2.5: Exponentials and logarithms • P2.6: Differentiation (exponential, logarithmic, trigonometric, implicit and parametric) • P2.7: Integration (substitution, volume of revolution, partial fractions) • P2.8: Differential equations • P2.9: Numerical methods (iteration, numerical integration) • P2.10: Vectors 		<p>Unit P3: Pure Mathematics 3 (Paper 3)</p> <ol style="list-style-type: none"> 1 Algebra 2 Logarithmic and exponential functions 3 Trigonometry 4 Differentiation 5 Integration 6 Numerical solution of equations 7 Vectors 8 Differential equations 9 Complex numbers
	<p>Mechanics 1 Unit M1</p> <ol style="list-style-type: none"> 1 Mathematical models in mechanics 2 Vectors in mechanics 3 Kinematics of a particle moving in a straight line 4 Dynamics of a particle moving in a straight line or plane 5 Statics of a particle 6 Moments 	<p>Unit M1: Mechanics 1 (Paper 4)</p> <ol style="list-style-type: none"> 1 Forces and equilibrium 2 Kinematics of motion in a straight line 3 Newton's laws of motion 4 Energy, work and power

OxfordAQA	Pearson Edexcel International	Cambridge International
Unit M2: Mechanics <ul style="list-style-type: none"> • M2.1: Mathematical modelling • M2.2: Kinematics • M2.3: Statics and forces • M2.4: Newton’s Law of Motion • M2.5: Projectiles • M2.6: Work and energy • M2.7: Uniform circular motion 	Mechanics 2 Unit M2 <ol style="list-style-type: none"> 1 Kinematics of a particle moving in a straight line or plane 2 Centres of mass 3 Work and energy 4 Collisions 5 Statics of rigid bodies 	Unit M2: Mechanics 2 (Paper 5) <ol style="list-style-type: none"> 1 Motion of a projectile 2 Equilibrium of a rigid body 3 Uniform motion in a circle 4 Hooke’s law 5 Linear motion under a variable force
	Statistics 1 Unit S1 <ol style="list-style-type: none"> 1 Mathematical models in probability and statistics 2 Representation and summary of data 3 Probability 4 Correlation and regression 5 Discrete random variables 6 The Normal distribution 	Unit S1: Probability and Statistics 1 (Paper 6) <ol style="list-style-type: none"> 1 Representation of data 2 Permutations and combinations 3 Probability 4 Discrete random variables 5 The normal distribution
Unit S2: Statistics <ul style="list-style-type: none"> • S2.1: Poisson distribution • S2.2: Continuous random variables • S2.3: Exponential distribution • S2.4: Normal distribution • S2.5: Estimation • S2.6: Hypothesis testing 	Statistics 2 Unit S2 <ol style="list-style-type: none"> 1 The Binomial and Poisson distributions 2 Continuous random variables 3 Continuous distributions 4 Hypothesis tests 	Unit S2: Probability and Statistics 2 (Paper 7) <ol style="list-style-type: none"> 1 The Poisson distribution 2 Linear combinations of random variables 3 Continuous random variables 4 Sampling and estimation 5 Hypothesis tests

OxfordAQA	Pearson Edexcel International	Cambridge International
	Decision Mathematics 1 Unit D1 1 Algorithms 2 Algorithms on graphs 3 The route inspection problem 4 Critical path analysis 5 Linear programming 6 Matchings	

Comment on comparison of AS and A-level Mathematics content

Given the changes in the UK A-level Mathematics with both Mechanics and Statistics now being a compulsory element, the OxfordAQA exam is the only one that ensures that students encounter these applications of mathematics at both AS and A-level. This structure allows students to keep their options open in Year 1, by getting a good grounding in both major applications, before making a well-informed choice for their specialism in Year 2. It also provides a strong argument that the OxfordAQA exam is better preparation for studying mathematics and mathematics related subjects in UK universities.

Pure Mathematics: There are high levels of consistency in both content coverage and structure between the three qualifications. All include calculus at AS and A-level and numerical methods at A-level. Matrices and Complex Numbers are in all three Further mathematics specifications. The weighting given to Pure Mathematics while similar, does vary between the boards as follows: OxfordAQA 67.5%, Cambridge International 60%, Pearson Edexcel 66.6%.

Mechanics: Content appears fairly consistent between the three qualifications. Greater coverage with Cambridge International and Pearson Edexcel with their M2 papers, including centres of mass. This greater coverage is to be expected given the different weighting given to Mechanics for students doing M2. For A-level the OxfordAQA it would be a minimum of 5% and a maximum of 27.5% whereas Cambridge International is either 0%, 20% (M1 only) or 40% (M1 and M2) and Pearson Edexcel is 0%, 16.7% (M1 only) or 33.3% (M1 and M2). For AS the comparable weightings are 12.5% for OxfordAQA, either 0% or 40% for Cambridge International and either 0% or 33.3% for Pearson Edexcel.

Statistics: Similar content and structure although Binomial distribution appears on S2 for Pearson Edexcel whereas introduced in earlier modules for OxfordAQA and Cambridge International. All include hypothesis testing but only in the optional S2 papers. The comparable weighting of statistical content between the boards is the same as that for Mechanics, i.e. for OxfordAQA it would be a minimum of 5% and a maximum of 27.5% whereas Cambridge International is either 0%, 20% (S1 only) or 40% (S1 and S2) and Pearson Edexcel is 0%, 16.7% (S1 only) or 33.3% (S1 and S2). Similarly for AS the comparable weightings are 12.5% for OxfordAQA, either 0% or 40% for Cambridge International and either 0% or 33.3% for Pearson-Edexcel.

Decision Mathematics: Only offered by Pearson Edexcel as a single module with a 33.3% weighting for AS 16.7% weighting for A-level.

AS and A-level Further Mathematics content

OxfordAQA	Pearson Edexcel International	Cambridge International
<p>While there is 'assumed knowledge' from the A-level qualification none of the units offered at A-level can contribute to the Further Mathematics AS or A-level qualifications.</p> <p>Shaded units are compulsory.</p>	<p>Assumed knowledge is from the Core Mathematics 12 Unit C12 mandatory earlier module.</p> <ol style="list-style-type: none"> Algebra and functions Coordinate geometry in the (x, y) plane Sequences and series Exponentials and logarithms Trigonometry Differentiation Integration 	<p>Paper 1: Pure Mathematics assumes knowledge of the syllabus for Pure Mathematics (units P1 and P3).</p> <p>Paper 2: Mechanics and Statistics assumes knowledge of the syllabuses for Mechanics (units M1 and M2) and Probability and Statistics (units S1 and S2).</p>
<p>Unit FP1 (Pure Maths)</p> <p>FP1.1: Algebra and graphs</p> <p>FP1.2: Coordinate geometry</p> <p>FP1.3: Complex numbers</p> <p>FP1.4: Roots and coefficients of a quadratic equation</p> <p>FP1.5: Series</p> <p>FP1.6: Trigonometry</p> <p>FP1.7: Calculus</p>	<p>Further Pure Mathematics 1 Unit F1</p> <ol style="list-style-type: none"> Complex numbers Roots of quadratic equations Numerical solution of equations Coordinate systems Matrix algebra Transformations using matrices Series Proof 	<p>Paper 1</p> <ol style="list-style-type: none"> Polynomials and rational functions Polar coordinates Summation of series Mathematical induction Differentiation and integration Differential equations Complex numbers Vectors Matrices and linear spaces

OxfordAQA	Pearson Edexcel International	Cambridge International
<p>Unit FPSM1 (Pure Maths, Statistics and Mechanics)</p> <p>FPP1.1: Matrices and transformations</p> <p>FPP1.2: Linear graphs</p> <p>FPP1.3: Numerical methods</p> <p>FS1.1: Bayes' Theorem</p> <p>FS1.2: Uniform distribution</p> <p>FS1.3: Geometric distribution</p> <p>FS1.4: Probability generating functions (pgf)</p> <p>FS1.5: Linear combinations of discrete random variables</p> <p>FM1.1: Constant velocity in two dimensions</p> <p>FM1.2: Dimensional analysis</p> <p>FM1.3: Collisions in one dimension</p>	<p>Further Pure Mathematics 2 Unit F2</p> <p>1 Inequalities</p> <p>2 Series</p> <p>3 Further complex numbers</p> <p>4 First order differential equations</p> <p>5 Second order differential equations</p> <p>6 Maclaurin and Taylor series</p> <p>7 Polar coordinates</p>	

OxfordAQA	Pearson Edexcel International	Cambridge International
Unit FP2 (Pure Maths) FP2.1: Roots and polynomials FP2.2: De Moivre's Theorem FP2.3: Polar coordinates FP2.4: Proof by induction FP2.5: Finite series FP2.6: Series and limits FP2.7: The calculus of inverse trigonometrical functions. FP2.8: Arc length and area of surface of revolution about the x-axis FP2.9: Hyperbolic functions. FP2.10: Differential equations – first order FP2.11: Differential equations – second order FP2.12: Vectors and three-dimensional coordinate geometry FP2.13: Matrix algebra FP2.14: Solution of linear equations	Further Pure Mathematics 3 Unit F3 1 Hyperbolic functions 2 Further coordinate systems 3 Differentiation 4 Integration 5 Vectors 6 Further matrix algebra	
Unit FM2 (Mechanics) FM2.1: Vertical circular motion FM2.2: Projectiles launched onto inclined planes FM2.3: Elastic strings and springs FM2.4: Collisions in two dimensions FM2.5: Application of differential equations FM2.6: Simple harmonic motion	Mechanics 3 Unit M3 1 Further kinematics 2 Elastic strings and springs 3 Further dynamics 4 Motion in a circle 5 Statics of rigid bodies	Paper 2 Mechanics (Sections 1 to 5). 1 Momentum and impulse 2 Circular motion 3 Equilibrium of a rigid body under coplanar forces 4 Rotation of a rigid body 5 Simple harmonic motion

OxfordAQA	Pearson Edexcel International	Cambridge International
Unit FS2 (Statistics) FS2.1: Moment generating functions (mgf) FS2.2: Estimators FS2.3: Estimation FS2.4: Further hypothesis testing	Statistics 3 Unit S3 1 Combinations of random variables 2 Sampling 3 Estimation, confidence intervals and tests 4 Goodness of fit and contingency tables 5 Correlation	Paper 2 Statistics (Sections 6 to 9) 6 Further work on distributions 7 Inference using normal and t-distributions 8 χ^2 -tests. 9 bivariate data

Comment on comparison of AS and A-level Further Mathematics content

Cambridge International do not offer an AS in Further Mathematics. Cambridge International do state that knowledge of the whole content of the Cambridge International A-level Mathematics syllabus is assumed. The consequence of this is that the equivalent of 40% of the A-level content will need to be covered dependent on the modules studied for A-level. The additional modules could be either M2S2, M1M2, or S1S2. Logistically this probably means that centres teaching the Cambridge International will prescribe the options for A-level Mathematics for Further Mathematics students. The structure of the OxfordAQA specification can be co-taught, particularly towards the end of the course with its natural division between Pure and Applied units.

For the OxfordAQA paper no additional content to the A-level is required, apart from that in the Further Maths specifications, with M2 assumed knowledge for the FM2 option and similarly with S2 for the FS2 option. Likewise, the modular structure of the Pearson Edexcel provides progression from A-level with assumed knowledge only from mandatory earlier modules. For example, FP1 requires C12, FP2 requires C12, C34, FP1, and M2 requires C12, C34 and M1. In practice, only a few centres would be able to offer every one of the many available combination for the Further Mathematics exam. Choices would be determined by a combination of factors such as modules sat for A-level Mathematics, other courses studied, university and career intentions as well as numbers of students, capacity of teaching staff and timetabling constraints.

Pure Mathematics: Content is broadly similar with all qualifications including complex numbers and matrices in compulsory elements but no explicit mention of hyperbolic functions in the Cambridge International specification. It is interesting to note that Pearson Edexcel offer a choice of two Further Pure Maths modules (F2 and F3) in addition to the compulsory Unit F1. The F2 and F3 modules are not sequential and students could do one of either, or both. Candidates doing the OxfordAQA and Cambridge International qualifications are guaranteed to have covered a wider range of Pure Mathematics topics than those who have only done two of the three Pearson Edexcel Pure Maths modules. The weighting given to Pure Mathematics while similar, does vary between the boards as follows: OxfordAQA 67.5%, Cambridge International 50%, Pearson Edexcel either 33.3% or 50% depending on whether candidates take two or three Pure Mathematics modules.

Mechanics: Content for the full Mechanics across all three boards modules is broadly similar and includes SHM and circular motion although centres of mass is not on the OxfordAQA specification. Pearson Edexcel candidates can bypass Mechanics completely by choosing other options. In the OxfordAQA specification it would be a minimum of 5% and a maximum of 27.5% whereas Cambridge International is approximately 25% (half of paper 2) and Pearson Edexcel is 0%, 16.7% (one of M1, M2 and M3) or 33.3% (two of M1, M2 and M3) or 50% (M1, M2 and M3). For AS the comparable weightings are 12.5% for OxfordAQA, and either 0%, 33.3% (one of M1, M2 and M3) or 66.7% (two of M1, M2 and M3) for Pearson Edexcel. (Cambridge International do not offer AS Further Mathematics.)

Statistics: Content could vary significantly dependent on options. Bivariate data is an interesting omission from the OxfordAQA paper whereas probability generating functions (FPSM1) and moment generating functions (FS2) are only found on the OxfordAQA qualification. The proportional content figures for the different boards and options are the same as that for Mechanics.

Decision Mathematics: As with the Mathematics qualifications Decision Mathematics is only offered by Pearson Edexcel as a single module with a 33.3% weighting for AS 16.7% weighting for A-level.

Appendix

Analysis and comparison of OxfordAQA Unit 1 Pure Maths

		OxfordAQA	Pearson Edexcel International	Cambridge International
P1.1: Algebra	1	Use and manipulation of surds.	C12	No explicit mention. Quite probably assumed knowledge.
	2	Laws of indices for all rational exponents.	C12	No explicit mention. Quite probably assumed knowledge.
	3	Quadratic functions and their graphs.	C12	P1
	4	The discriminant of a quadratic function.	C12	P1
	5	Factorisation of quadratic polynomials.	C12	P1
	6	Completing the square.	C12	P1
	7	Solution of quadratic equations.	C12	P1
	8	Simultaneous equations, eg one linear and one quadratic, analytical solution by substitution.	C12	P1
	9	Solution of linear and quadratic inequalities.	C12	P1
	10	Algebraic manipulation of polynomials, including expanding brackets and collecting like terms.	C12	P2
	11	Simple algebraic division.	C12	P2
	12	Use of the Remainder Theorem and the Factor Theorem.	C12	P2
	13	Application of the Factor Theorem.	C12	P2
	14	Graphs of functions; sketching curves defined by simple equations.	C12	P1

		OxfordAQA	Pearson Edexcel International	Cambridge International
	15	Geometrical interpretation of algebraic solution of equations and use of intersection points of graphs of functions to solve equations.	C12	P1 (for quadratics).
	16	Knowledge of the effect of simple transformations on the graph of $y = f(x)$ as represented by $y = af(x)$, $y = f(x) + a$, $y = f(x + a)$, $y = f(ax)$	C12	No explicit mention. Quite probably assumed knowledge.
P1.2: Coordinate Geometry	1	Equation of a straight line, including the forms $y - y_1 = m(x - x_1)$ and $ax + by + c = 0$	C12	P1
	2	Conditions for two straight lines to be parallel or perpendicular to each other.	C12	P1
	3	The intersection of a straight line and a curve.	No explicit mention. Quite probably assumed knowledge.	P1
P1.3: Differentiation	1	The derivative of $f(x)$ as the gradient of the tangent to the graph of $y = f(x)$ at a point; the gradient of the tangent as a limit; interpretation as a rate of change.	C12	P1
	2	Differentiation of polynomials.	C12	P1
	3	Differentiation of x^n , where n is a rational number, and related sums and differences.	C12	P1
	4	Applications of differentiation to gradients, tangents and normals, maxima and minima and stationary points, increasing and decreasing functions.	C12	P1
	5	Second order derivatives.	C12	P1

		OxfordAQA	Pearson Edexcel International	Cambridge International
P1.4: Integration	1	Indefinite integration as the reverse of differentiation.	C12	P1
	2	Integration of polynomials.	C12	P1
	3	Integration of x^n , where n is a rational number not equal to -1 , and related sums and differences.	C12	P1
	4	Evaluation of definite integrals. Interpretation of the definite integral as the area under a curve.	C12	P1
	5	Approximation of the area under a curve using the trapezium rule.	C12	P2
P1.5: Sequences and Series	1	Sequences, including those given by a formula for the n th term.	C12	P1
	2	Sequences generated by a simple relation of the form $x_{n+1} = f(x_n)$	C12	P2
	3	Arithmetic series, including the formula for the sum of the first n natural numbers.	C12	P1
	4	The sum of a finite geometric series.	C12	P1
	5	The sum to infinity of a convergent ($-1 < r < 1$) geometric series.	C12	P1
	6	The binomial expansion of $(1+x)^n$ for positive integer n .	C12	P1

Analysis and comparison of OxfordAQA Unit PSM1 (Pure Maths, Statistics and Mechanics)

		OxfordAQA	Pearson Edexcel International	Cambridge International
PP1.1: Circle	1	The equation of a circle in the form $(x - a)^2 + (y - b)^2 = r^2$	C12	Not included.
	2	Translation of circles.	Implied in C12.	Not included.
	3	Coordinate geometry of the circle.	C12	Not included.
	4	The equation of the tangent and normal at a given point to a circle.	C12	Not included.
PP1.2: Trigonometry	1	The sine and cosine rules. The area of a triangle in the form $\frac{1}{2}ab\sin C$	C12	No explicit mention. Quite probably assumed knowledge.
	2	Degree and radian measure.	C12	P1
	3	Arc length, area of a sector of a circle.	C12	P1
	4	Sine, cosine and tangent functions. Their graphs, symmetries and periodicity.	C12	P1
	5	Knowledge and use of $\tan\theta = \sin\theta/\cos\theta$; and $\sin^2\theta + \cos^2\theta = 1$	C12	P1
	6	Solution of simple trigonometric equations in a given interval of degrees or radians.	C12	P1
PP1.3 Exponential and logarithms	1	$y = a^x$ and its graph.	C12	P2 – implied
	2	Logarithms and the laws of logarithms.	C12	P2
	3	The solution of equations of the form $a^x = b$	C12	P2
S1.1: Further Probability	1	Elementary probability; the concept of a random event and its probability.	S1	S1
	2	Addition law of probability. Mutually exclusive events.	S1	S1

		OxfordAQA	Pearson Edexcel International	Cambridge International
	3	Multiplication law of probability and conditional probability. Independent events.	S1	S1
	4	Application of probability laws.	S1	S1
S1.2: Discrete random variables	1	Discrete random variables and their associated probability distributions.	S1	S1
	2	Measures of central tendency and spread.	Implied rather than explicitly stated.	Implied rather than explicitly stated.
	3	Mean, variance and standard deviation for discrete random variables.	S1	S1
	4	Mean, variance and standard deviation of a simple function of a discrete random variable.	S2	S1
	5	Mean and variance of the sum or difference of two independent discrete random variables.	S2	S2
	6	Mean and variance of a sum of independent discrete random variables.	S2	S2
S1.3: Bernoulli and binomial distributions	1	Conditions for application of a Bernoulli distribution.	Implied rather than explicitly stated.	Implied rather than explicitly stated.
	2	Mean and variance of a Bernoulli.	Implied rather than explicitly stated.	Implied rather than explicitly stated.
	3	Binomial distribution.	S2	S1
	4	Calculation of probabilities using formula and tables.	S2	S1
	5	Mean, variance and standard deviation of a binomial distribution.	S2	S1
M1.1: Motion in a straight line with constant acceleration	1	Displacement, speed, velocity, acceleration.	M1	M1

		OxfordAQA	Pearson Edexcel International	Cambridge International
	2	Sketching and interpreting kinematics graphs.	M1	M1
	3	Knowledge and use of constant acceleration equations.	M1	M1
	4	Vertical motion under gravity.	M2	M1
	5	Average speed.	Implied rather than explicitly stated.	Implied rather than explicitly stated.
M1.2: Motion in a straight line with variable acceleration	1	Relationship between displacement, velocity and acceleration.	M2	M2
M1.3: Forces and Newton's Laws	1	Force of gravity.	M2	M1
	2	Tensions in strings and rods, thrusts in rods. Normal Reactions. Resistive forces.	M1	M1
	3	Newton's three laws of motion.	M1	M1
	4	Connected particle problems.	M1	M1
M1.4: Momentum and impulse (Restricted to motion in a straight line)	1	Concept of momentum.	M1	Not included.
	2	The principle of conservation of momentum applied to two particles.	M1	Not included.
	3	Impulse.	M1	Not included.
	4	Direct impact with a fixed surface.	M1	Not included.

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