Introducing the new AS and A Levels in Mathematics and Further Mathematics for first teaching from 2017

What's changing?

The **grade-set will stay the same**: A* - E for A Level and A - E for AS Level.

The new qualifications will be **fully linear** so assessment of a student's knowledge and understanding of the whole course takes place at the end of their course of study.

- The first exams for AS Level Mathematics, AS Level Further Mathematics and A Level Mathematics will be in June 2018
- The first exams for A Level Further Mathematics will be in June 2019
- Qualifications will be assessed in the summer. There'll be no exams in January.

The new **AS Levels will be stand-alone** qualifications in their own right. They will remain broadly at their current standard. They will not count towards the final grade of an A Level and students may or may not take AS Level on the way to A Level. We have carefully designed our AS Levels to be co-taught with the first year of the A Level.

There will be **no coursework** in either Mathematics or Further Mathematics.

There is an increased focus on the **use of technology in the teaching and learning** of mathematics. Learners should be proficient in the use of their calculator, including obtaining probability values from standard statistical distributions, rather than using statistical tables, and should use technology such as graphing software and spreadsheets in the classroom.

Content and **criteria** were published in December 2014 by the Department for Education, with assessment objectives and arrangements following in April 2016. Documents detailing these are available from Ofqual for [Mathematics](#) and [Further Mathematics](#).

- AS and A Level **Maths** have 100% fixed content, and include **both** Statistics and Mechanics
  - Both are approximately 2/3 Pure, 1/6 Statistics and 1/6 Mechanics, with the AS Level content a subset of the A Level content
  - There is no Decision Maths in AS and A Level Maths (although there will be some content in Discrete Maths in our Further Maths qualifications).

- AS and A Level **Maths** include a pre-released large data set for students to use throughout the course. This is designed to encourage learners to work with real data and to have used technology such as spreadsheets or specialist statistical packages to explore data

- AS and A Level **Further Maths** have approx. 33⅓% and 50% fixed Pure Core respectively, allowing the remainder of the course to cover optional content as designed by OCR and MEI

- In Mathematics and Further Mathematics there is an emphasis on proof, problem solving and modelling.

Two suites of qualifications

We appreciate that one size doesn't fit all so we offer two suites of qualifications in mathematics and further mathematics.

- **Mathematics A** developed by OCR
- **Mathematics B (MEI)**, which has been developed in collaboration with Mathematics in Education and Industry.

Mathematics A and **Further Mathematics A** build on our existing popular course. We've based the redevelopment of our current suite around an understanding of what works well in centres and have updated areas of content and assessment where stakeholders have identified that improvements could be made.

Mathematics B (MEI) and **Further Mathematics B (MEI)** have been developed in collaboration with Mathematics in Education and Industry, and are based on the existing suite of qualifications assessed by OCR. MEI is a long established, independent curriculum development body; this well-established partnership provides a firm foundation for curriculum and qualification development.

AS Level (H230) and A Level (H240) Mathematics A

Content Area	Overview
1 Pure Mathematics	Pure mathematics includes proof, algebra, graphs, sequences, trigonometry, logarithms, calculus and vectors.
	At A Level learners study these topics in more depth and also study functions, numerical methods and differential equations.
2 Statistics	Statistics includes working with data from a sample to make inferences about a population, probability calculations, using binomial distribution as a model and statistical hypothesis testing.
	At A Level learners study these topics in more depth and also study the Normal distribution.
	There is a pre-release data set for both AS and A Level. The purpose of the large data set is that learners experience working with real data in the classroom and explore this data using appropriate technology. It is principally intended to enrich the teaching and learning of statistics.
3 Mechanics	Mechanics includes kinematics, working with forces and Newton's laws
	At A Level learners study these topics in more depth, and also study motion under gravity, friction and simple moments.

- Learners must take all components of a qualification to be awarded that qualification

- Learners are permitted to use a scientific or graphical calculator for all papers.

AS Level Mathematics A (H230)

Component	Marks	Duration	Weighting
Pure Mathematics and Statistics (01) • The assessment is structured in two sections: approximately 50 marks of Pure Mathematics and approximately 25 marks of Statistics • Each section has a gradient of difficulty throughout the section and consists of a mix of short and long questions • Some questions will be set on the pre-release data set. These questions should give a material advantage to learners who have studied, and are familiar with, the prescribed large data set. They might include questions requiring learners to interpret data in ways which would be too demanding in an unfamiliar context.	75	1 hour 30 mins	50%
Pure Mathematics and Mechanics (02) • The assessment is structured in two sections: approximately 50 marks of Pure Mathematics and approximately 25 marks of Mechanics • Each section has a gradient of difficulty throughout the section and consists of a mix of short and long questions.	75	1 hour 30 mins	50%

A Level Mathematics A (H240)

Component	Marks	Duration	Weighting
Pure Mathematics (01) • The assessment has a gradient of difficulty throughout the paper and consists of a mix of short and long questions.	100	2 hours	33⅓%
Pure Mathematics and Statistics (02) • The assessment is structured in two sections of approximately 50 marks each: Pure Mathematics, and Statistics • Each section has a gradient of difficulty throughout the section and consists of a mix of short and long questions • Some questions will be set on the pre-release data set. These questions should give a material advantage to learners who have studied, and are familiar with, the prescribed large data set. They might include questions requiring learners to interpret data in ways which would be too demanding in an unfamiliar context.	100	2 hours	33⅓%
Pure Mathematics and Mechanics (03) • The assessment is structured in two sections of approximately 50 marks each: Pure Mathematics, and Mechanics • Each section has a gradient of difficulty throughout the section and consists of a mix of short and long questions.	100	2 hours	33⅓%

AS Level (H235) and A Level (H245) Further Mathematics A

- All learners must study the Pure Core and **two** of the optional areas

- Learners may take more than two optional units to increase the breadth of their course. For details of how their grade will be awarded, see section 3g of the specification.

Content Area	Overview
4 Pure Core	In Pure Core learners will extend and deepen their knowledge of proof, algebra, functions, calculus and vectors studied in Mathematics. They will also broaden their knowledge into other areas of pure mathematics that underpin the further study of mathematics and other numerate subjects with complex numbers and matrices. At A Level learners study these topics in more depth and also study differential equations, polar coordinates and hyperbolic functions.

Content Area	Overview
5 Statistics	In Statistics learners will explore the theory which underlies the statistics content in A Level Mathematics, as well as extending their tool box of statistical concepts and techniques. This area covers combinatorics, probability distributions for discrete random variables, χ^2 tests, non-parametric tests, correlation and regression. At A Level learners study these topics in more depth and also study probability distributions for continuous random variables, hypothesis tests and confidence intervals for a population mean.
6 Mechanics	In Mechanics learners extend their knowledge of particles, kinematics and forces from A Level Mathematics, using their extended pure mathematical knowledge to explore more complex physical systems. The area covers dimensional analysis, work, energy, power, impulse, momentum, centres of mass and circular motion. At A Level learners study these topics in more depth and also study the application of vectors across the topics and variable force.
7 Discrete Mathematics	Discrete Mathematics is the part of mathematics dedicated to the study of discrete objects. Learners will study pure mathematical structures and techniques, and their application to solving real-world problems of existence, construction, enumeration and optimisation. Areas studied include counting, graphs and networks, algorithms, critical path analysis, linear programming, and game theory. At A Level learners study these topics in more depth, extending them to Hamiltonian and planar graphs, the simplex algorithm and the Nash Equilibrium.
8 Additional Pure Mathematics	In Additional Pure Mathematics learners will broaden and deepen their knowledge of pure mathematics, studying both discrete and continuous topics which form the foundation of undergraduate study in mathematics and mathematical disciplines. This area covers recurrence relations, number theory, group theory, the vector product, eigenvalues and eigenvectors, surfaces and partial differentiation. At A Level learners study these topics in more depth, in particular extending number theory and partial differentiation, and extend the integration techniques in the Pure Core.

AS Level Further Mathematics A (H235)

- All learners take unit Y531 and any two of the optional units Y532, Y533, Y534 and Y535 to be awarded OCR's AS Level in Further Mathematics A
- Learners are permitted to use a scientific or graphical calculator for all papers
- The assessments have a gradient of difficulty throughout the paper and consist of a mix of short and long questions.

	Marks	Duration	Weighting
Mandatory Pure Core (Y531)	60	1 hour 10 mins	33⅓%

Optional Units (choose any two)

	Marks	Duration	Weighting
Statistics (Y532)	60	1 hour 10 mins	33⅓%
Mechanics (Y533)	60	1 hour 10 mins	33⅓%
Discrete Mathematics (Y534)	60	1 hour 10 mins	33⅓%
Additional Pure Mathematics (Y535)	60	1 hour 10 mins	33⅓%

A Level Further Mathematics A (H245)

- All learners take units Y540 and Y541 and any two of the optional units Y542, Y543, Y544 and Y545 to be awarded OCR's A Level in Further Mathematics A
- Learners are permitted to use a scientific or graphical calculator for all papers
- The assessments have a gradient of difficulty throughout the paper and consist of a mix of short and long questions.

	Marks	Duration	Weighting
Mandatory Pure Core 1 (Y540)	75	1 hour 30 mins	25%
Mandatory Pure Core 2 (Y541)	75	1 hour 30 mins	25%

Optional Units (choose any two)

	Marks	Duration	Weighting
Statistics (Y542)	75	1 hour 30 mins	25%
Mechanics (Y543)	75	1 hour 30 mins	25%
Discrete Mathematics (Y544)	75	1 hour 30 mins	25%
Additional Pure Mathematics (Y545)	75	1 hour 30 mins	25%

AS Level (H630) and A Level (H640) Mathematics B (MEI)

The content is in four areas, **Mathematical processes**, **Pure mathematics**, **Mechanics** and **Statistics**. Although the content is listed under four separate areas, these should not be regarded as four separate teaching modules. In particular, the mathematical processes should be applied, along with associated mathematical thinking and understanding, across the whole of the detailed content in pure mathematics, statistics and mechanics. Links should also be made between pure mathematics and each of mechanics and statistics.

Content Area	Overview
1 Mathematical processes	Mathematical processes consists of mathematical argument and language, problem solving and mathematical modelling
2 Pure Mathematics	Pure mathematics includes proof, algebra, graphs, sequences, trigonometry, logarithms, calculus and vectors. At A Level learners study these topics in more depth and also study functions, numerical methods and differential equations.
3 Mechanics	Mechanics includes kinematics, working with forces and Newton's laws. At A Level learners study these topics in more depth and also study motion under gravity, friction and simple moments.
4 Statistics	Statistics includes working with data from a sample to make inferences about a population, probability calculations, using binomial distribution as a model and statistical hypothesis testing. At A Level learners study these topics in more depth and also study the Normal distribution. The pre-release material will be a large data set that can be used as teaching material throughout the course. It is comparable to a set text for a literature course. The intention of the large data set is that it and associated contexts are explored in the classroom using technology.

- Learners must take all components of a qualification to be awarded that qualification

- Learners are permitted to use a scientific or graphical calculator for all papers.

AS Level Mathematics B (MEI) (H630)

Component	Marks	Duration	Weighting
Pure Mathematics and Mechanics (01) • Component 01 assesses content from areas 1, 2 and 3 • The paper has a gradient of difficulty from shorter to longer questions and from easier to harder questions.	70	**1 hour 30 mins**	**50%**
Pure Mathematics and Statistics (02) • Component 02 assesses content from areas 1, 2 and 4 • The paper has a gradient of difficulty from shorter to longer questions and from easier to harder questions • Some questions will be set on the pre-release data set. These questions should give a material advantage to learners who have studied, and are familiar with, the prescribed large data set. They might include questions requiring learners to interpret data in ways which would be too demanding in an unfamiliar context.	70	**1 hour 30 mins**	**50%**

A Level Mathematics B (MEI) (H640)

Component	Marks	Duration	Weighting
Pure Mathematics and Mechanics (01) • Component 01 assesses content from areas 1, 2 and 3 • Section A - shorter questions with minimal reading and interpretation • Section B - longer questions and more problem solving.	100	**2 hours**	**36.4%**
Pure Mathematics and Statistics (02) • Component 02 assesses content from areas 1, 2 and 4 • Section A - shorter questions with minimal reading and interpretation • Section B - longer questions and more problem solving • Some questions will be set on the pre-release data set. These questions should give a material advantage to learners who have studied, and are familiar with, the prescribed large data set. They might include questions requiring learners to interpret data in ways which would be too demanding in an unfamiliar context.	100	**2 hours**	**36.4%**
Pure Mathematics and Comprehension (03) • Component 03 assesses content from areas 1 and 2 (areas 3 and 4 are assumed knowledge) • Section A – 60 marks on the pure core content • Section B – 15 marks on a previously unseen comprehension passage based on the pure mathematics content of the specification.	75	**2 hours**	**27.3%**

Please note percentages in the table above are rounded to 1 decimal place (exact component proportions are: $36\frac{4}{11}$, $36\frac{4}{11}$, $27\frac{3}{11}$).

AS Level (H635) Further Mathematics B (MEI)

The content is in three areas: **Mathematical processes**, **Core pure content** and options. Learners must study the Core pure and two from the six optional units.

The mathematical processes should be applied, along with associated mathematical thinking and understanding, across every permissible combination of units in this specification. The optional units assume knowledge of the Core pure (Y410).

Content Area	Overview
Mathematical processes	Mathematical processes consists of mathematical argument and language, problem solving and mathematical modelling
Core pure (Y410)	In this mandatory unit some pure topics from AS Level mathematics are studied in greater depth, while some new topics are introduced. Algebraic work with series is extended. The powerful technique of proof by induction is used in various contexts. Complex numbers are introduced, including their geometrical representation. Matrices are used to solve systems of equations and to explore transformations. Scalar products of vectors are applied to problems involving planes.

Mechanics a (Y411)	In this option, basic principles of forces and their moments, work and energy, impulse and momentum and centres of mass are used to model various situations, including: rigid bodies in equilibrium; particles moving under gravity or on a surface; bodies colliding with direct impact.
Statistics a (Y412)	In this option situations are modelled by discrete random variables; the suitability of models is tested using χ^2 tests. Bivariate data are investigated, with tests for correlation and association and modelling using regression.
Modelling with Algorithms (Y413)	Algorithms play a central part in the modern world. This option explores algorithms in their own right. This is most easily done in simple cases, but when algorithms are used to model real world problems then technology allows their application to authentic problems. A range of optimisation and network problems are introduced. Many of these can be formulated as linear programming problems, allowing them to be solved using technology.
Numerical Methods (Y414)	Much of AS/A Level Mathematics and Further Mathematics is restricted to problems which are amenable to exact solution. For many real world problems no exact methods exist, and numerical methods are required to solve them. In this option learners apply numerical approaches to four topics from mathematics: solution of equations, differentiation, integration and approximating functions. Learners learn how to use a spreadsheet to implement the methods and learn to analyse the errors associated with numerical methods.
Mechanics b (Y415)	In this option the work from Mechanics a is extended to included oblique impact collisions, circular motion, Hooke's law, centres of mass in the continuous case and variable forces. This unit assumes knowledge of Mechanics a (Y411).
Statistics b (Y416)	In this option the work from Statistics a is extended to include Bayes' theorem, continuous random variables, confidence intervals and some further hypothesis tests, and simulation. This unit assumes knowledge of Statistics a (Y412).

- Learners may take more than two optional units to increase the breadth of their course. For details of how their grade will be awarded, see section 3g of the specification.

AS Level Further Mathematics B (MEI) (H635)

- Learners must take the mandatory unit Core pure (Y410) and then any **two** from the six optional units to be awarded OCR's AS Level in Further Mathematics B (MEI)
- Learners are permitted to use a scientific or graphical calculator for all papers
- There is a gradient of demand across the papers.

	Marks	Duration	Weighting
Mandatory Core pure (Y410)	60	1 hour 15 mins	33⅓%

Optional Units (choose any two)

	Marks	Duration	Weighting
Mechanics a (Y411)	60	1 hour 15 mins	33⅓%
Statistics a (Y412)	60	1 hour 15 mins	33⅓%
Modelling with algorithms (Y413)	60	1 hour 15 mins	33⅓%
Numerical methods (Y414)	60	1 hour 15 mins	33⅓%
Mechanics b (Y415)	60	1 hour 15 mins	33⅓%
Statistics b (Y416)	60	1 hour 15 mins	33⅓%

A Level (H645) Further Mathematics B (MEI)

The content is in four areas: **Mathematical processes**, **Core pure content**, plus **Major** options and **Minor** options.

Learners must take **one** of three routes through the qualification, Route A, Route B or Route C. Each comprises the one mandatory Core pure unit and then a combination of optional units.

- **Route A**: Candidates must take the mandatory Core pure and Mechanics major units and then one further optional minor unit (this unit **must not** be Mechanics minor)

- **Route B**: Candidates must take the mandatory Core pure and Statistics major units and then one further optional minor unit (this unit **must not** be Statistics minor)

- **Route C**: Candidates must take the mandatory Core pure unit and then three further minor optional units.

The mathematical processes should be applied, along with associated mathematical thinking and understanding, across every permissible combination of units in this specification. The optional units assume knowledge of the Core pure (Y420).

Content Area	Overview
Mathematical processes	Mathematical processes consists of mathematical argument and language, problem solving and mathematical modelling.
Core Pure (Y420)	In this mandatory unit some pure topics from A Level mathematics are studied in greater depth, while some new topics are introduced. Algebraic work with series is extended. The powerful technique of proof by induction is used in various contexts. Complex numbers are introduced and lead to solutions of problems in algebra, geometry and trigonometry. Matrices are used to solve systems of equations and to explore transformations. Vector methods are applied to problems involving lines and planes. Calculus techniques are extended, including the use of hyperbolic functions and polar coordinates, and culminate in the solution of differential equations.

Major options		
Mechanics Major (Y421)	In this major option, basic principles of forces and their moments, work and energy, impulse and momentum and centres of mass are used to model various situations, including: rigid bodies in equilibrium; particles moving under gravity, on a surface, in a circle, attached to springs; bodies colliding with direct or oblique impact.	
Statistics Major (Y422)	In this major option situations are modelled by discrete and continuous random variables; this allows inference about a population in the form of hypothesis testing and point and interval estimates of population parameters. The suitability of models is tested; bivariate data are investigated and Bayes' theorem used. Simulation of random variables is introduced, a powerful way of tackling challenging problems.	

Minor options	
Mechanics Minor (Y431)	In this minor option, basic principles of forces and their moments, work and energy, impulse and momentum and centres of mass are used to model various situations, including: rigid bodies in equilibrium; particles moving under gravity or on a surface; bodies colliding with direct impact.
Statistics Minor (Y432)	In this minor option situations are modelled by discrete random variables; the suitability of models is tested using χ^2 tests. Bivariate data are investigated, with tests for correlation and association and modelling using regression.
Modelling with Algorithms (Y433)	Algorithms play a central part in the modern world. This option explores algorithms in their own right. This is most easily done in simple cases, but when algorithms are used to model real world problems then technology allows their application to authentic problems. A range of optimisation and network problems are introduced. Many of these can be formulated as linear programming problems, allowing them to be solved using technology.
Numerical Methods (Y434)	Much of AS/A Level Mathematics and Further Mathematics is restricted to problems which are amenable to exact solution. For many real world problems no exact methods exist, and numerical methods are required to solve them. In this option learners apply numerical approaches to four topics from mathematics: solution of equations, differentiation, integration and approximating functions. Learners learn how to use a spreadsheet to implement the methods and learn to analyse the errors associated with numerical methods.
Extra Pure (Y435)	In this minor option learners answer questions on any three of the six pure mathematics topics. Some topics are from continuous mathematics and others from discrete mathematics. • Sets, Logic and Boolean Algebra • recurrence relations • Combinatorics • Groups • Matrices and Vectors • Multivariable calculus.
Further pure with technology (Y436)	In this minor option learners use a computer algebra system, a spreadsheet, a graph plotter and a programming language to investigate curves, explore topics in number theory and explore the solutions to families of differential equations analytically and numerically. A calculator or computer with this functionality is used in the assessment.

- Learners may take more than two optional units to increase the breadth of their course. For details of how their grade will be awarded, see section 3g of the specification.

A Level Further Mathematics B (MEI) (H645)

- Learners must take the one of three routes through the qualification, Route A, Route B or Route C
- Learners are permitted to use a scientific or graphical calculator for all papers
- There is a gradient of demand across the papers.

	Marks	Duration	Weighting
Mandatory Core pure (Y420) • Section A – Shorter questions with minimal reading and interpretation • Section B – longer questions and more problem solving.	**144 raw (180 scaled)**	**2 hours 40 mins**	**50%**

Major options

	Marks	Duration	Weighting
Mechanics major (Y421) • Section A – Shorter questions with minimal reading and interpretation • Section B – longer questions and more problem solving.	**120 raw (120 scaled)**	**2 hours 15 mins**	**33⅓%**
Statistics major (Y422) • Section A – Shorter questions with minimal reading and interpretation • Section B – longer questions and more problem solving.	**120 raw (120 scaled)**	**2 hours 15 mins**	**33⅓%**

Minor options

	Marks	Duration	Weighting
Mechanics minor (Y431)	**60**	**1 hour 15 mins**	**16⅔%**
Statistics minor (Y432)	**60**	**1 hour 15 mins**	**16⅔%**
Modelling with algorithms (Y433)	**60**	**1 hour 15 mins**	**16⅔%**
Numerical methods (Y434)	**60**	**1 hour 15 mins**	**16⅔%**
Extra pure (Y435) • Choose three questions from six 20 mark questions on each of six topics.	**60**	**1 hour 15 mins**	**16⅔%**
Further pure with technology (Y436) • Answer all three questions, one on each of three topics • Learners need to have access to a calculator or computer with a computer algebra system, a spreadsheet, a graph plotter and a programming language in the examination • Learners' answers are handwritten in a Printed Answer Booklet.	**60**	**1 hour 45 mins**	**16⅔%**

Planned Resources and Support

Planned Resources

- Mapping documents from legacy Specifications to the new AS/A level for Maths and Further Maths Spec A & B
- Large data set resource with activities that have been trialled in the classroom
- Using technology resource with activities that have been trialled in the classroom
- A guide to bridging the gap between GCSE and AS
- Topic exploration packs and lesson elements that focus on new areas of content e.g. proof, hypothesis testing
- Check In Tests – similar in style to GCSE (10 Qs covering AO1, AO2 & AO3) but with worked solutions rather than answers and RAG grids
- A guide to calculator use
- Practical Mechanics resource
- 'Formulae you should know' poster
- SAMs commentaries
- Maths in context flipped learning resources, covering engineering, computer science, sciences, economics, social science and more…

    See the webpages for example resources at ocr.org.uk/alevelmaths

CPD and training – cpdhub.ocr.org.uk

- Face to Face events – running in February and March 2017

    o Introducing the OCR and OCR (MEI) GCE Maths qualifications
       (London, Birmingham, Manchester, Newcastle & Exeter – half day am event)

    o Introducing the OCR and OCR (MEI) GCE Further Maths qualifications
       (London, Birmingham, Manchester, Newcastle & Exeter – half day pm event).

- Live Online Training Events – running in February & March 2017

    o Practical approach to teaching Mechanics
    o Using a large data set to teach statistics
    o Using technology in the classroom
    o Teaching the new Pure Core content for Further Maths in Spec A and Spec B
    o Teaching the new Statistics content for Further Maths Spec A
    o Teaching the new Mechanics content for Further Maths Spec A
    o Teaching the new Discrete Maths content for Further Maths Spec A
    o Teaching the new Additional Pure content for Further Maths Spec A.

Further sessions may be scheduled in the summer term to cater for demand.

Specialist Advice and Guidance

You can contact our Mathematics Subject Specialists for specialist advice, guidance and support.

Meet the team at www.ocr.org.uk/qualifications/by-subject/mathematics/meet-the-team

Contact them at:

- 01223 553998
- maths@ocr.org.uk
- @OCR_Maths

To stay up to date with all the relevant news about our qualifications:

- register for email updates at ocr.org.uk/updates
- listen to the OCR Maths podcast on iTunes or Audioboom.

Mathematics community

The social network is a free platform where teachers can engage with each other – and with us – to find and offer guidance, discover and share ideas, best practice and a range of mathematics support materials.

- To sign up, go to social.ocr.org.uk