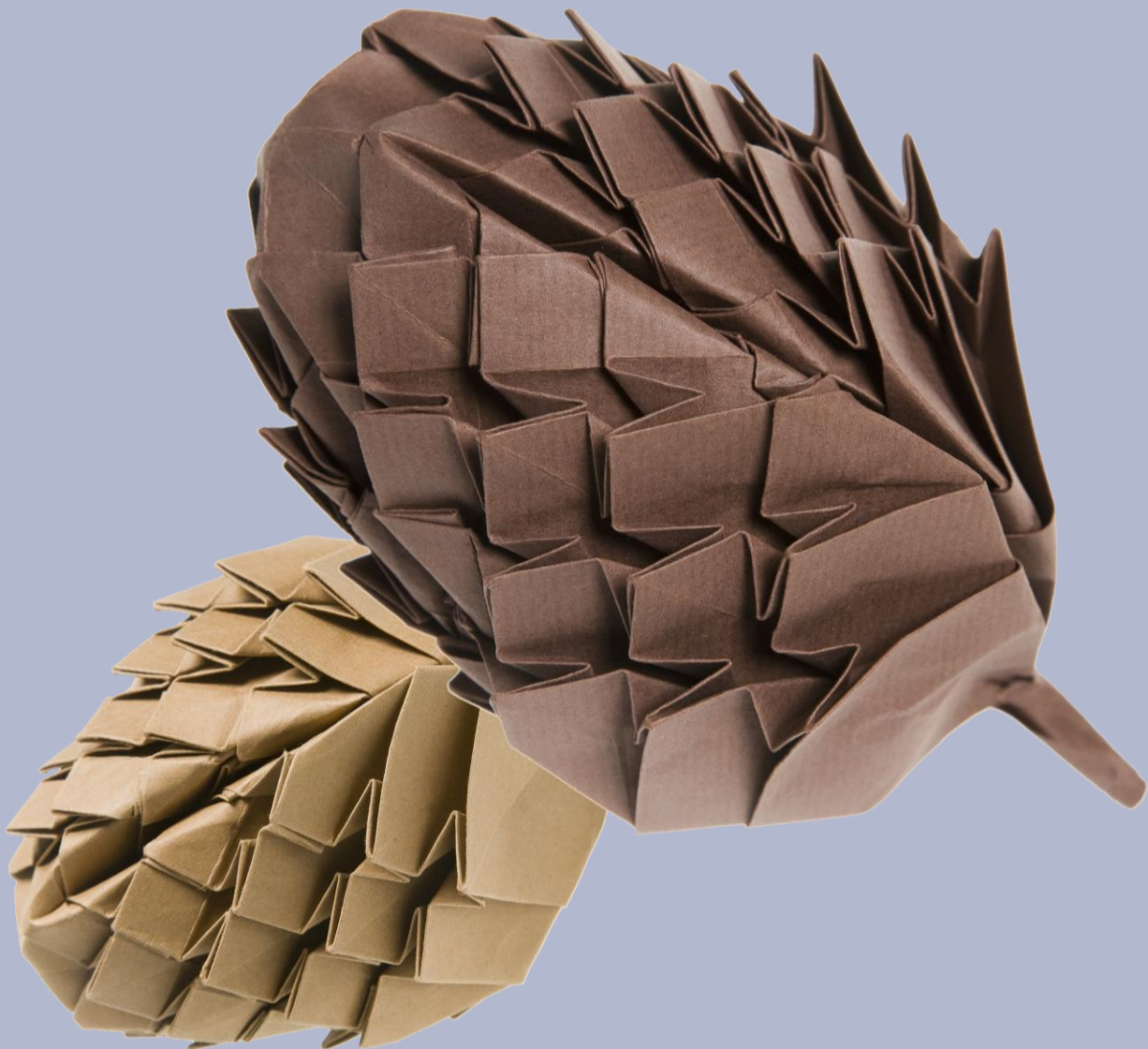edexcel

Getting Started Guide

AS AND A LEVEL MATHEMATICS AND FURTHER MATHEMATICS

Pearson Edexcel Level 3 Advanced Subsidiary GCE in Mathematics (8MA0)

Pearson Edexcel Level 3 Advanced GCE in Mathematics (9MA0)

Pearson Edexcel Level 3 Advanced Subsidiary GCE in Further Mathematics (8FA0)

Pearson Edexcel Level 3 Advanced GCE in Further Mathematics (9FA0)

P Pearson

Getting Started Guide: AS and A level Mathematics and Further Mathematics

Contents

Introduction

This Getting Started guide provides an overview of the new GCE Mathematics and Further Mathematics specifications. It will help you get to grips with the changes to content and assessment, and to understand what these mean for you and your students.

We are providing a package of support to help you plan and implement the new specification. This includes the following.

- **Planning**: we are providing a range of tools and resources to help you plan your teaching of the new GCE qualifications. We will support you in understanding the content with content mappings highlighting the content changes between the legacy modular specification and the new linear specifications. We are also dedicated to making the whole planning process easier, with ready-to-use course planners and schemes of work for delivering the GCE in one or two years.

- **Teaching**: we are providing plenty of teaching resources to help you deliver the content of the new GCE qualifications with confidence. This is complemented by topic-based resources to use in the classroom, particularly for the new and unfamiliar topics, problem solving, modelling and the large data set.

- **Assessing**: we are providing plenty of tools to help you assess your students and track their progress throughout the course. We know that understanding of the standard expected of students by the time they sit the examination is important, so our Sample Assessment Materials (SAMs) shows you what you can expect. Plenty of examination practice is also key, which is why we are providing two further sets of specimen papers (one set for AS Mathematics, two sets for A level Mathematics and Further Mathematics) and for the first three years of the specification we will release a secure set of mock papers. Our exemplar solutions shows real student responses to questions from SAMs, and how the examining team follow the mark schemes to demonstrate how the students would be awarded marks on these questions. We will also have fully updated editions of ResultsPlus and examWizard. ResultsPlus provides the most detailed analysis available of your students' exam performance. It can help you identify the topics and skills where further learning would benefit your students. Exam Wizard is a data bank of past exam questions (and sample paper and specimen paper questions) allowing you to create bespoke test papers.

- **Training**: attend our free Getting Ready to Teach events (face-to-face and online meetings, available right up to autumn 2017), or join one of our collaborative networks. Receive training on how to mark mock papers and our new continued professional development courses.

Not forgetting personal and ongoing support through Graham and the Mathematics Emporium.

These support documents will be available via the Teacher Support tab on the Edexcel AS and A level Mathematics and Further Mathematics page at quals.pearson.com/Alevelmaths2017 and on the Mathematics Emporium website at www.edexcelmaths.com

Ten things you need to know about the new GCE Mathematics and Further Mathematics

1. All new AS and A levels will be fully linear

All assessments must be taken in a single exam series. Retaking the complete qualification is allowed but resits of individual papers is not.

2. AS levels will be stand-alone qualifications

Not in terms of content - the content of AS level Mathematics is a subset of the A level content and the content of each AS level Further Mathematics option is a subset of one of the A level options. The AS is stand-alone in the sense that marks scored in AS exams cannot contribute to an A level grade.

3. All new AS and A levels will be assessed at the same standard as they are currently

Unlike the new GCSE in Mathematics which was intentionally made more demanding, the new AS and A levels will be assessed at the same standard as the current qualifications. The only difference is that all A level of exams will be set at A level demand unlike current A levels for which the assessment is made up of exams at both AS and A2 levels of demand.

4. There are new Assessment Objectives

The number of assessment objectives will be reduced from five to three and they are the same as the new GCSE assessment objectives.

- AO1 - standard processes
- AO2 - mathematical communication
- AO3 - problem solving (includes modelling)

5. The grading system is still the same

The grades available will be the same as the current GCE qualifications

- AS - grade A to E
- A level - grades A* to E

6. A level Mathematics – 100% core content

Although the term core content is currently associated with the pure maths content of the current AS and A level mathematics, it actually refers to content which is common to all AS or A levels in the subject (i.e. it is defined in the criteria). The new AS and A level Mathematics have 100% defined content which will be same for all awarding organisations. The core content includes some statistics and some mechanics as well as pure maths. Decision maths is not available in the new AS and A level Mathematics.

7. A level Further Mathematics – 50% core content

The DfE has defined 50% of the content of A level Further Mathematics and this defined content is all pure maths. The remaining 50% is to be defined by the Awarding Organisation and options can be offered.

8. Pre-release large data set (mathematics only)

The new criteria require us to provide a large data set at the beginning of the course which can be used in teaching the statistics content. Exam questions will assume familiarity with the context and main features of the data set.

9. Calculator

The new criteria do not include any requirement for non-calculator assessment.

In current GCE Mathematics exams, it is assumed that all students will have a calculator with all the functions available on a standard scientific calculator. Students are allowed to have more sophisticated calculators and there are rules which define functions they must not have available to them. These rules are administered by the JCQ.

The JCQ rules will not change for the new criteria but there is an increase in the minimum expectation. In addition to the functions of a standard scientific calculator, it is expected that students' calculators will also have the following features:

For AS and A level Mathematics

- the ability to compute summary statistics and access probabilities from standard statistical distributions;
- an iterative function.

For AS and A level Further Mathematics, the above plus

- the ability to perform calculations with matrices up to at least order 3 x 3.

10. Assessment

The assessment of the new GCE Mathematics and Further Mathematics qualifications will be 100% exams. NEA* will not be allowed.

* NEA is non-exam assessment and includes things like coursework and controlled assessment

The new requirements

All awarding organisations' qualifications for GCE Mathematics and Further Mathematics must meet the criteria set by the DfE and Ofqual. The criteria can be found in several documents as follows:

From the DfE: AS and A level content *

From Ofqual: General Conditions of Recognition; Guidance to the General Conditions of Recognition; GCE Qualification Level Conditions and Requirements; GCE Qualification Level Guidance; GCE Subject Level Conditions and Requirements *; GCE Subject Level Guidance*.

* These documents have separate versions for mathematics and further mathematics.

The documents can be found on the DfE's and Ofqual's websites. Requirements in addition to those mentioned in the previous section are summarised below.

- **Background knowledge**

    AS and A level Mathematics specifications must built on the skills, knowledge and understanding set out in the whole GCSE subject content for mathematics for first teaching 2015.

    AS and A level Further Mathematics specifications must built on the skills, knowledge and understanding set out in the whole GCSE subject content for mathematics and the subject content for AS and A level Mathematics.

- **Overarching themes**

    GCE specifications must require students to demonstrate skills and knowledge outlined in the following overarching themes:

    - Mathematical argument, language and proof
    - Mathematical problem solving
    - Mathematical modelling.

- **Assessment Objectives**

    Awarding organisations must comply with the guidance published by Ofqual which explains how they should interpret the Assessment Objectives in terms of the different strands and elements within each Assessment Objective.

- **Timing of assessments**

    All awarding organisations must only make GCE Mathematics and Further Mathematics examinations available in May/June each year.

- **Total assessment time**

    No rules given.

The assessment

Assessment structure

- The new Edexcel GCE Mathematics qualifications will be assessed through separate pure and applied papers
- Simple 2:1 ratio of pure to applied in A level Mathematics
- 50% optional content in further mathematics
- Further mathematics designed to aid parallel delivery with mathematics
- No non-calculator assessment

A level Mathematics

Paper 1: Pure Mathematics 1 33% 2 hours 100 marks	Any pure content can be assessed on either paper
Paper 2: Pure Mathematics 2 33% 2 hours 100 marks	
Paper 3: Statistics and Mechanics 33% 2 hours 100 marks	Section A: Statistics (50 marks) Section B: Mechanics (50 marks)

AS level Mathematics

Paper 1: Pure Mathematics 62.5% 2 hours 100 marks	AS level pure mathematics content
Paper 2: Statistics and Mechanics 37.5% 1 hour 15 minutes 60 marks	Section A: Statistics (30 marks) Section B: Mechanics (30 marks)

A level Further Mathematics

Paper 1: Core Pure Mathematics 1 25% 1 hour 30 mins 75 marks	Compulsory content – any content can be assessed on either paper
Paper 2: Core Pure Mathematics 2 25% 1 hour 30 mins 75 marks	
Paper 3: Further Mathematics Option 1 25% 1 hour 30 mins 75 marks	Students take two optional papers with options available in • Further Pure Mathematics • Further Statistics • Further Mechanics • Decision Mathematics See below for details of how these options can be arranged
Paper 4: Further Mathematics Option 2 25% 1 hour 30 mins 75 marks	

AS level Further Mathematics

Paper 1: Core Pure Mathematics 50% 1 hour 40 minutes 80 marks	AS level core pure mathematics content
Paper 2: Further Mathematics Options 50% 1 hour 40 minutes 80 marks	Students take two options assessed in one paper. Same options as in A level Further Mathematics See below for details of how these options can be arranged

A level Further Mathematics options

For papers 3 and 4 students choose a pair of options, either

- any two from column A, or
- a matching pair from columns A and B

This makes a total of ten different option pairs.

Column A	Column B
Further Pure Mathematics 1	Further Pure Mathematics 2
Further Statistics 1	Further Statistics 2
Further Mechanics 1	Further Mechanics 2
Decision Mathematics 1	Decision Mathematics 2

For A level Further Mathematics papers 3 and 4, students will take one paper in each of their options.

For AS Further Mathematics paper 2, students will take a paper which contains two equally sized sections, with each section covering one of their option pair.

The AS version of each option is made up of half of the content of the A level version.

Students taking AS Further Mathematics followed by A level Further Mathematics should select the same option pair for both. Otherwise they will need to learn extra content.

Assessment Objectives

Below are the Assessment Objectives for the new GCE and the weighting for each qualification.

Objective	Mathematics		Further Mathematics	
	A level	AS level	A level	AS level
AO1 – Use and apply standard techniques	50% (±2%)	60% (±2%)	50% (±2%)	60% (±2%)
AO2 – Reason, interpret and communicate mathematically	25% (±2%)	20% (±2%)	At least 15%	At least 10%
A03 – Solve problems within mathematics and in other contexts	25% (±2%)	20% (±2%)	At least 15%	At least 10%

These assessment objectives have been broken down into strands and elements, all of which have to be assessed. In the following tables, the references in parenthesis in the elements column refer to the references used to represent these strands and elements in the mark schemes – see the next section of this guide, titled *Mark schemes*, for an explanation.

AO1: Use and apply standard techniques.	*50% (A Level), 60% (AS)*
Strands	**Elements**
1. select and correctly carry out routine procedures	1a – select routine procedures
	1b – correctly carry out routine procedures
2. accurately recall facts, terminology and definitions	This strand is a single element

AO2: Reason, interpret and communicate mathematically	*25% (A Level), 20% (AS)*
Strands	**Elements**
1. construct rigorous mathematical arguments (including proofs)	This strand is a single element
2. make deductions and inferences	2a – make deductions
	2b – make inferences
3. assess the validity of mathematical arguments	This strand is a single element
4. explain their reasoning	This strand is a single element
5. use mathematical language and notation correctly	This strand is a single element

AO3: Solve problems within mathematics and in other contexts	25% (A Level), 20% (AS)
Strands	**Elements**
1. translate problems in mathematical and non-mathematical contexts into mathematical processes	1a – translate problems in mathematical contexts into mathematical processes
	1b – translate problems in non-mathematical contexts into mathematical processes
2. interpret solutions to problems in their original context, and, where appropriate evaluate their accuracy and limitations	2a – interpret solutions to problems in their original context
	2b – where appropriate, evaluation the accuracy and limitations of solutions to problems
3. translate situations in context into mathematical models	This strand is a single element
4. use mathematical models	This strand is a single element
5. evaluate the outcomes of modelling in context, recognise the limitations of models and, where appropriate, explain how to refine them	5a – evaluate the outcomes of modelling in context
	5b – recognise the limitations of models
	5c – where appropriate, explain how to refine models

Mark schemes

The new mark schemes are similar to the current ones that you are already familiar with.

Each mark in the mark scheme for our sample assessment materials is allocated to an Assessment Objective's strand and element.

Formulae

Formulae which students can be given during an exam and these are provided in the booklet '*Mathematical Formulae and Statistical Tables*' which will be provided for use with every paper.

There is one version of the formulae booklet which is for use in all exams for AS and A levels in both Mathematics and Further Mathematics.

Use of calculators

Students may use a calculator in all A Level Mathematics examinations. Students are responsible for making sure that their calculators meet the guidelines set out below.

The use of technology permeates the study of A Level Mathematics. Calculators used must include the following features:

* summary statistics and standard statistical distributions

* iteration

* matrices up to at least order 3 × 3 (further maths only)

In addition, students must be told these regulations before sitting an examination:

Calculators must be:	**Calculators must not:**

• of a size suitable for use on the desk;
 	
• either battery or solar powered;
 	
• free of lids, cases and covers which have printed instructions or formulas.
	• be designed or adapted to offer any of these facilities:
	  • language translators;
	  • symbolic algebra manipulation;
	  • symbolic differentiation or integration;
	  • communication with other machines or the internet;

The student is responsible for the following:
 	
• the calculator's power supply;
 	
• the calculator's working condition;
 	
• clearing anything stored in the calculator.
	• be borrowed from another candidate during an examination for any reason;
	
	• have retrievable information stored in them, including (but not limited to):
	  • databanks;
	  • dictionaries;
	  • mathematical formulas;
	  • text.

Use of data in statistics

Pearson has provided a large data set, which will support the assessment of Statistics in Paper 3: Statistics and Mechanics. Students are required to become familiar with the data set in advance of the final assessment.

Assessments will be designed in such a way that questions assume knowledge and understanding of the data set. The expectation is that these questions should be likely to give a material advantage to students who have studied and are familiar with the data set.

They might include questions/tasks that:

- assume familiarity with the terminology and contexts of the data, and do not explain them in a way that gives students who have not studied the data set the same opportunities to access marks as students who have studied them;

- use summary statistics or selected data from, or statistical diagrams based on, the data set – these might be provided in the question or task, or as stimulus materials;

- are based on samples related to the contexts in the data set, where students' work with the data set will help them understand the background context and/or;

- require students to interpret data in ways that would be too demanding in an unfamiliar context.

Students will not be required to have copies of the data set in the examination, nor will they be required to have detailed knowledge of the actual data within the data set.

The data set can be downloaded from our website. This data set should be appropriate for the lifetime of the qualification. However we will review the data set on an annual basis to ensure it is appropriate. If we need to make changes to the data set, we will notify centres before the beginning of the two-year course before students complete their examination.

The data set consists of weather data samples provided by the Met Office for five UK weather stations and three overseas weather stations in the time periods May to October 1987 and May to October 2015. The weather stations are labelled on the maps shown:

- in the UK - Camborne, Heathrow, Hurn, Leeming and Leuchars

- overseas - Beijing, Jacksonville and Perth

Further information around our data source can be accessed at http://www.metoffice.gov.uk/

To support the use of the large data set in the teaching of the statistics content, tasks such as:

- selecting a sample

- cleaning the data

- creating diagrams from the data

- calculating summary statistics such as mean, standard deviation

- calculating regression equations and correlation coefficients where applicable

- hypothesis testing,

must be carried out by students during their course of study. Students should use technology such as spreadsheets or other statistical packages to explore the data.

Students are required to become familiar with the dataset prior to being assessed in Statistics. Below are a list of suggested activities for students to undertake, using the data-set, during their course of study.

1. Calculate the mean and standard deviation for some of these variables at one location and compare with another location or time.

2. Is there any correlation between average rainfall in 1987 and average rainfall in 2015 for the 6 months available for any of the weather stations?

3. Explore correlations and linear regression between variables such as temperature and hours of sunshine.

4. Explore whether or not the data available gives any evidence of global warming.

5. Use the data to generate suitable graphs.

The specification content

AS level Mathematics – paper content

Paper 1: Pure Mathematics (Paper code: 8MA0/01)

Content overview

Proof, Algebra and functions, Co-ordinate geometry in the (x, y) plane, Sequences and series, Trigonometry, Exponentials and logarithms, Differentiation, Integration, Vectors

Paper 2: Statistics and Mechanics (Paper code: 8MA0/02)

Content overview

Section A: Statistics

Statistical sampling, Data presentation and interpretation, Probability, Statistical distributions, Statistical hypothesis testing

Section B: Mechanics

Quantities and units in mechanics, Kinematics, Forces and Newton's laws

A level Mathematics – paper content

Paper 1: Pure Mathematics 1 (*Paper code: 9MA0/01)

Paper 2: Pure Mathematics 2 (*Paper code: 9MA0/02)

Content overview

Proof, Algebra and functions, Coordinate geometry in the (x, y) plane, Sequences and series, Trigonometry, Exponentials and logarithms, Differentiation, Integration, Numerical methods, Vectors

Paper 3: Statistics and Mechanics (Paper code: 9MA0/03)

Content overview

Section A: Statistics

Statistical sampling, Data presentation and interpretation, Probability, Statistical distributions, Statistical hypothesis testing

Section B: Mechanics

Quantities and units in mechanics, Kinematics, Forces and Newton's laws, Moments

AS level Further Mathematics – paper content

Paper 1: Core Pure Mathematics (Paper code: 8FM0/01)
Content overview   Proof, Complex numbers, Matrices, Further algebra and functions, Further calculus, Further vectors

Paper 2: Further Mathematics Options (Paper code: 8FM0/2A – 2K)
Students take one of the following ten options: **2A: Further Pure Mathematics 1 and Further Mathematics 2**   **2B: Further Pure Mathematics 1 and Further Statistics 1**   **2C: Further Pure Mathematics 1 and Further Mechanics 1**   **2D: Further Pure Mathematics 1 and Decision Mathematics 1**   **2E: Further Statistics 1 and Further Mechanics 1**   **2F: Further Statistics 1 and Decision Mathematics 1**   **2G: Further Statistics 1 and Further Statistics 2**   **2H: Further Mechanics 1 and Decision Mathematics 1**   **2J: Further Mechanics 1 and Further Mechanics 2**   **2K: Decision Mathematics 1 and Decision Mathematics 2**   **Content overview**   FP1: Further Trigonometry, Coordinate systems, Further vectors, Numerical Methods, Inequalities   FP2: Groups, Further matrix algebra, Further complex numbers, Number theory, Further sequences and series   FS1: Discrete probability distributions, Poisson and binomial distributions, Chi Squared Tests   FS2: Linear Regression, Continuous probability distributions, Correlation   FM1: Momentum and impulse, Work and energy, Elastic collisions in one dimension   FM2: Motion in a circle, Centres of mass of plane figures, Further kinematics   D1: Algorithms and graph theory, Algorithms on graphs, Algorithms on graphs II, Critical path analysis, Linear Programming   D2: Allocation (assignment) problems, Flows in networks, Game theory, Recurrence relations

Pearson

A level Further Mathematics – paper content

Paper 1: Core Pure Mathematics 1 (Paper code: 9FM0/01)
Paper 2: Core Pure Mathematics 2 (Paper code: 9FM0/02)

Content overview
Proof, Complex numbers, Matrices, Further Algebra and functions, Further calculus, Further vectors, Polar coordinates, Hyperbolic functions, Differential equations

Paper 3: Further Mathematics Option 1 **(Paper code: 8FM0/3A – 3D)**	**Paper 4: Further Mathematics Option 2 (Paper code: 8FM0/4A – 4G)**
Students take one of the following four options:	Students take one of the following seven options:
Further Pure Mathematics 1	**Further Pure Mathematics 1**
Further Pure Mathematics 2	**Further Pure Mathematics 2**
Further Statistics 1	**Further Statistics 1**
Further Mechanics 1	**Further Statistics 2**
Decision Mathematics 1	**Further Mechanics 1**
	Further Mechanics 2
	Decision Mathematics 1
	Decision Mathematics 2

Content overview
FP1: Further Trigonometry, Further calculus, Further differential equations, Coordinate systems, Further vectors, Numerical Methods, Inequalities
FP2: Groups, Further Calculus, Further Matrix Algebra, Further Complex Numbers, Number Theory, Further Sequences and series
FS1: Discrete probability distributions, Poisson and binomial distributions, Geometric and negative binomial distributions, Hypothesis testing, Central Limit Theorem, Chi Squared Tests, Probability generating functions, Quality of tests
FS2: Linear Regression, Continuous probability distributions, Correlation, Combinations of random variables, Estimation, confidence intervals and tests using a normal distribution, Other Hypothesis Tests and confidence intervals, Confidence intervals and tests using the t - distribution
FM1: Momentum and impulse, Work and energy, Elastic strings and springs and elastic energy, Elastic collisions in one dimension, Elastic collisions in two dimensions
FM2: Motion in a circle, Centres of mass of plane figures, Further centre of mass, Further dynamics, Further kinematics
D1: Algorithms and graph theory, Algorithms on graphs, Algorithms on graphs II, Critical path analysis, Linear Programming
D2: Transportation problems, Allocation (assignment) problems, Flows in networks, Dynamic programming, Game theory, Recurrence relations, Decision analysis

Examination entry codes

Syllabus codes

AS Mathematics: 8MA0

A level Mathematics: 9MA0

AS Further Mathematics: 8FM0

A level Further Mathematics: 9FM0

AS Further Mathematics - paper and option codes

There are ten entry routes permitted for AS Further Mathematics. Each of these routes comprises the mandatory Paper 1 and a choice of ten options for Paper 2. Students choose one option.

The table below shows the permitted combinations of examined papers, along with the option codes that must be used.

Paper 1	Paper 2 codes and titles	Option code
Core Pure Mathematics	2A: Further Pure Mathematics 1 and Further Pure Mathematics 2	A
	2B: Further Pure Mathematics 1 and Further Statistics 1	B
	2C: Further Pure Mathematics 1 and Further Mechanics 1	C
	2D: Further Pure Mathematics 1 and Decision Mathematics 1	D
	2E: Further Statistics 1 and Further Mechanics 1	E
	2F: Further Statistics 1 and Decision Mathematics 1	F
	2G: Further Statistics 1 and Further Statistics 2	G
	2H: Further Mechanics 1 and Decision Mathematics 1	H
	2J: Further Mechanics 1 and Further Mechanics 2	J
	2K: Decision Mathematics 1 and Decision Mathematics 2	K

A level Further Mathematics - paper and option codes

Paper 1	Paper 2	Paper 3	Paper 4	Option code
Core Pure Mathematics 1	Core Pure Mathematics 2	3A: Further Pure Mathematics 1	4A: Further Pure Mathematics 2	A
			4B: Further Statistics 1	B
			4D: Further Mechanics 1	C
			4F: Decision Mathematics 1	D
		3B: Further Statistics 1	4C: Further Statistics 2	E
			4D: Further Mechanics 1	F
			4F: Decision Mathematics 1	G
		3C: Further Mechanics 1	4E: Further Mechanics 2	H
			4F: Decision Mathematics 1	J
		3D: Decision Mathematics 1	4G: Decision Mathematics 2	K

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AS and A level Timeline

	2016	2017	2018	2019
Current specification	Summer series as normal	Summer series as normal	Final AS and A2 exams (first entry only)	Final resit of AS and A2 levels
New 2017 specification		First teaching of 1 year AS and 2 year A level	First AS level assessments (and A level Mathematics)	First A level Further Mathematics assessment

Useful links

AS and A level Mathematics and Further Mathematics homepage

AS and A level Mathematics and Further Mathematics support webpage

Mathematics Emporium website

Get in touch

As you have come to expect, we will provide expert and local support – from Graham Cumming, the Mathematics Emporium and the Edexcel maths team. We are here to listen and to help; at the end of a phone, by email, or in person at local network and training events.

Contact details

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