



FURTHER MATHEMATICS

Exam Board: Edexcel

What is Further Mathematics?

Further Mathematics is an AS/A level qualification which both broadens and deepens the mathematics covered in AS/A level Mathematics.

Why study Further Mathematics?

- Students taking Further Mathematics overwhelmingly find it to be an **enjoyable, rewarding, stimulating and empowering experience**.
- For someone who enjoys mathematics, it provides a **challenge** and a **chance to explore** new and/or more **sophisticated mathematical concepts**.
- It enables students to distinguish themselves as able mathematicians in the university and **employment market**.
- It makes the transition to a mathematics-rich university course easier.
- Some prestigious university courses will only accept students with Further Mathematics qualifications.
- Taste a more **independent style of learning**, which is good preparation for university or a career.

Further Mathematics Opportunities:

Any student planning to take a mathematics-rich degree (this covers a very wide range of academic areas – **Engineering, Sciences, Computing, Finance/Economics, etc., as well as Mathematics itself**) will benefit enormously from taking Further Mathematics, at least to AS level. Further Mathematics qualification identifies students as **having excellent analytical skills**, whatever area they plan to study or work within. Students who have studied Further Mathematics find the transition to such degrees far more straightforward. Studying Further Mathematics also boosts students' performance in AS/A level Mathematics.

Further Mathematics Requirement:

Any student capable of passing an AS/A level in Mathematics should also be able to pass AS Further Mathematics. Students planning to study for a mathematics-rich degree who did not begin AS Further Mathematics in year 12 can choose to study it alongside A level Mathematics in year 13 if the timetable permits.

Content and assessment overview

Paper 1: Further Pure Mathematics 1 (*Paper code: 9FM0/01)
<i>Written examination: 1 hour and 30 minutes</i> <i>25% of the qualification</i> <i>75 marks</i>
Content overview Proof, Complex numbers, Matrices, Further algebra and functions, Further calculus, Further vectors
Assessment overview <ul style="list-style-type: none"> • Students must answer all questions. • Calculators can be used in the assessment.

Paper 2: Further Pure Mathematics 2 (*Paper code: 9FM0/02)
<i>Written examination: 1 hour and 30 minutes</i> <i>25% of the qualification</i> <i>75 marks</i>
Content overview Complex numbers, Further algebra and functions, Further calculus, Polar coordinates, Hyperbolic functions, Differential equations
Assessment overview <ul style="list-style-type: none"> • Students must answer all questions. • Calculators can be used in the assessment.

Paper 3: Further Mathematics Option 1 (*Paper codes: 9FM0/3A-3D)
<i>Written examination: 1 hour and 30 minutes</i> <i>25% of the qualification</i> <i>75 marks</i>
Content overview Students take one of the following four options: 3A: Further Pure Mathematics 3 - Further calculus, Further differential equations, Coordinate systems, Further vectors, Further numerical methods, Inequalities 3B: Further Statistics 1 - Linear regression, Statistical distributions (discrete), Statistical distributions (continuous), Correlation, Hypothesis testing, Chi squared tests 3C: Further Mechanics 1 - Momentum and impulse, Collisions, Centres of mass, Work and energy, Elastic strings and springs 3D: Decision Mathematics 1 - Algorithms and graph theory, Algorithms on graphs, Algorithms on graphs II, Critical path analysis, Linear programming
Assessment overview <ul style="list-style-type: none"> • Students must answer all questions. • Calculators can be used in the assessment.

Paper 4: Further Mathematics Option 2 (*Paper codes: 9FM0/4A-4G)

Written examination: 1 hour and 30 minutes

25% of the qualification

75 marks

Content overview

Students take **one** of the following seven options:

4A: Further Pure Mathematics 4 - Groups, Further calculus, Further matrix algebra, Further complex numbers, Number theory, Further sequences and series

4B: Further Statistics 1 - Linear regression, Statistical distributions (discrete), Statistical distributions (continuous), Correlation, Hypothesis testing, Chi squared tests

4C: Further Statistics 2 - Probability distributions, Combinations of random variables, Estimation, Confidence intervals and tests using a normal distribution, Other hypothesis tests and confidence intervals, Other hypothesis tests and confidence intervals, Probability generating functions, Quality of tests and estimators

4D: Further Mechanics 1 - Momentum and impulse, Collisions, Centres of mass, Work and energy, Elastic strings and springs

4E: Further Mechanics 2 - Further kinematics, Further dynamics, Motion in a circle, Statics of rigid bodies, Elastic collisions in two dimensions

4F: Decision Mathematics 1 - Algorithms and graph theory, Algorithms on graphs, Algorithms on graphs II, Critical path analysis, Linear programming

4G: Decision Mathematics 2 - Transportation problems, Allocation (assignment) problems, Flows in networks, Dynamic programming, Game theory, Recurrence relations, Decision analysis

Assessment overview

- Students must answer all questions.
- Calculators can be used in the assessment.

Assessment Objectives

Students must:		% in GCE A Level
A01	<p>Use and apply standard techniques</p> <p>Learners should be able to:</p> <ul style="list-style-type: none"> • select and correctly carry out routine procedures; and • accurately recall facts, terminology and definitions 	48-52%
A02	<p>Reason, interpret and communicate mathematically</p> <p>Learners should be able to:</p> <ul style="list-style-type: none"> • construct rigorous mathematical arguments (including proofs); • make deductions and inferences; • assess the validity of mathematical arguments; • explain their reasoning; and • use mathematical language and notation correctly. 	At least 15%
A03	<p>Solve problems within mathematics and in other contexts</p> <p>Learners should be able to:</p> <ul style="list-style-type: none"> • translate problems in mathematical and non-mathematical contexts into mathematical processes; • interpret solutions to problems in their original context, and, where appropriate, evaluate their accuracy and limitations; • translate situations in context into mathematical models; • Use mathematical models; and • evaluate the outcomes of modelling in context, recognise the limitations of models and, where appropriate, explain how to refine them. 	At least 15%
Total		100%