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# The changes to AS/A level Further Mathematics for September 2004

...and how, with your help, they can raise standards in pre-university Mathematics

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**Charlie Stripp**  
Maths in Education and  
Industry (MEI)

charlie.stripp@mei.org.uk



Charlie Stripp Coordinates the MEI 'Access to Further Mathematics' Project and is Chair of the Teaching Committee of the Mathematical Association.

Mathematics in Education and Industry (MEI) is a curriculum development organisation, responsible in terms of student numbers for the second-largest Mathematics A level specification.

Recent rule changes from the Qualifications and Curriculum Authority (QCA), along with the Smith Inquiry's strong endorsement of the need for Further Mathematics, mean that there are now genuine grounds for optimism that numbers of students taking Further Mathematics qualifications will increase significantly. Universities can help to make this happen and it will be much to their benefit.

Further Mathematics has been in crisis, with numbers falling by two thirds since 1980 to fewer than 5000 now. Many schools and colleges (from now on please read 'schools' to mean 'schools and colleges') have stopped offering it because small class sizes are not financially viable and the skills shortage in mathematics teachers means many do not have staff able to teach it. As a result large numbers of students who would have benefited from studying Further Mathematics have been denied access.

## *Changes to the QCA rules*

The new QCA rule changes coming in from September will make it far easier for ordinary schools to offer Further Mathematics.

Under the old rules, an AS in Further Mathematics had to include a compulsory unit, 'Pure Mathematics 4'. This unit required the candidates to know the whole of the standard A-level Mathematics core. Hardly any students could take AS Further Mathematics in year 12 because they had not yet learnt sufficient pure mathematics to be able to get to grips with Pure Mathematics 4.

Furthermore, despite being called an AS-level, AS-level Further Mathematics could only include one AS unit. The other two units, 'Pure Mathematics 4' plus one other, had to be at A2 standard. This meant the old AS-level Further Mathematics was actually harder than A-level Mathematics and was extremely awkward for most schools to timetable alongside A-level Mathematics.

These issues have seriously contributed to the decline of Further Mathematics in recent years. Further Mathematics was only offered easily by more privileged schools who were able to run a dedicated class to cover the whole of A-level Mathematics in year 12, then Further Mathematics in year 13. Most other schools that continued to offer it had to cobble the course together by doing one or two extra applied units in year 12 and leaving everything else to year 13.

The rule changes mean that AS-level Further Mathematics is now allowed to comprise three AS standard units, one of which is a compulsory new AS 'pure' unit called 'Further Pure 1' (FP1). Students have a choice for the other two units. Awarding bodies have designed the AS FP1 unit to be taught alongside the new AS 'pure' core in year 12. All of the new AS FP1 units (there are four, from different awarding bodies) include introductions to complex numbers and matrices and more in-depth work on algebra and proof.

The new AS will be more a 'broadening' than a 'deepening' option. This means that AS-Level Further Mathematics is no longer an 'elite' qualification, suitable only for A-level Mathematics high-fliers. It will be a very useful

qualification for any student who plans to do a strongly mathematics-related degree, such as engineering or science, as well as Mathematics itself. Such students will benefit not only from the new mathematics they will learn but also simply from doing more mathematics, which will have a positive effect on their mathematical fluency and confidence.

Students doing a new full A-level in Further Mathematics must do three more A2 units, in addition to their AS-level. There is a compulsory A2 unit, Further Pure 2 (FP2). The other two units are chosen from more 'pure' mathematics, mechanics, statistics, decision mathematics or numerical methods. At A-level the emphasis in Further Mathematics shifts from broadening to deepening and the full A-level will continue to stretch and inspire the high-fliers as it has before.

Two of the three English awarding bodies will be offering the new style Further Mathematics. The only bad news is that not all will. However, it is possible to do A-level Mathematics with one awarding body and Further Mathematics with another. Many schools already do this and more are planning to do so.

### **Implications from the Smith Inquiry**

The Smith Inquiry provides a clear endorsement of the importance of Further Mathematics.

Paragraph 4.38 of 'Making Mathematics Count' states: *'... Candidates who have studied Further Mathematics or the AEA in Mathematics are likely to be much more confident with the inner workings of the subject. University departments in all subjects identified as vulnerable in the Roberts SET for Success report would benefit greatly if more candidates were qualified at this level. Further Mathematics and the Advanced Extension Award in Mathematics (redesigned if necessary) are the courses that could and should provide the extra stimulation for the top fifteen per cent or so of the A-level mathematics cohort of students and the Inquiry is deeply concerned that the current system is not able to make adequate provision for this important cohort.'*

Recommendation 4.10 then states:

*'The Inquiry recommends that there should be an immediate review by the DfES, LSC and the relevant devolved authorities of measures that could be taken to support and encourage current GCE course provision for the most able mathematics students. In particular, we believe there is a need to ensure that there are no funding disincentives in schools and colleges for providing access to Further Mathematics*

*and the Advanced Extension Award in Mathematics ...'*

The DfES have responded positively. In their initial response to the Smith Inquiry report, the DfES state: *'To encourage increased take-up of Further Mathematics we will also develop proposals to replicate and expand the current Mathematics in Education and Industry Project with a view to establishing a Further Mathematics centre in each of the 47 local Learning and Skills Council areas,'*

The Mathematics in Education and Industry (MEI) 'Access to Further Mathematics' Project uses on-line resources and coordinated collaboration between schools and universities that form local 'Further Maths Centres'. These help schools to offer Further Mathematics and enable students in schools that cannot offer it directly to access external tutoring and support. The project has had a very successful pilot phase, so we know this can work. With DfES support the project should now be able to expand to cover the whole of England. This means that, in the foreseeable future, **ALL** year 12 and 13 students should have access to Further Mathematics. This should really raise the standard of new undergraduates.

### **What universities can do**

To really make this happen schools need the support of the universities. Further Mathematics has been the victim of a vicious circle: Schools and colleges find it hard to offer it. Universities see this and so stop asking for it, for fear of discouraging applicants. Schools see this and so decide they need not offer it...

Universities must encourage students to do Further Mathematics. They can do this in two ways.

1. By stating explicitly in their prospectuses that Further Mathematics will be useful to students intending to take mathematics-related degree courses.
2. By including Further Mathematics in their offers. Initially this could be through alternative offers, eg. 'B in Mathematics plus C, C or B in Mathematics plus C, E + C in AS Further Mathematics'.

In the past it has been difficult to see the value of demanding Further Mathematics when there has been no prospect of schools producing a supply of students to meet the demand. Now we have a real prospect of increasing the supply. It's up to the universities to ensure this happens by creating the demand.