



12th August 2010

Dear Admissions Tutor,

We are writing to draw your attention to three recent developments in pre-university mathematics that are relevant to your admissions policy.

Large increases in AS and A level Further Mathematics

Since 2003 the number of students taking A level Further Mathematics has roughly doubled, from 5315 to 10 473, and the figure for AS Further Mathematics has roughly trebled, standing at 13 164 in 2009. Appendix 1 gives entry data for A level Mathematics and Further Mathematics since 1989.

Taking A level Further Mathematics has obvious advantages for students going on to degrees in mathematics. It is not just that they know more mathematics; they are much more fluent in it and are more confident. These days it is most common to take Further Mathematics in parallel with Mathematics, over Years 12 and 13, although a few schools and colleges teach them in series, with Mathematics in Year 12 and Further Mathematics in Year 13.

There are also very considerable benefits to students from taking Further Mathematics at AS level. They are introduced to important topics such as complex numbers and matrices, which are not included in A level Mathematics, and they improve their algebraic and general mathematical fluency. Students can take AS level Further Mathematics in year 12, over two years, or in year 13. It is becoming increasingly common for students to take up AS Further Mathematics in year 13, to support their university applications.

The Further Mathematics Support Programme (FMSP) (formerly the Further Mathematics Network), enables universal access to Further Mathematics tuition, even when the students' own schools and colleges are unable to offer it. This means that universities can encourage prospective undergraduates to take Further Mathematics without the concern that some students do not have the opportunity to take it.

Schools and colleges now understand that all students aspiring to study mathematics at university would benefit from taking Further Mathematics. We suggest that all university mathematics departments consider encouraging prospective undergraduates to study Further Mathematics to at least AS level. Many university mathematics departments are already using various mechanisms to do this, and the FMSP website provides information about them:

www.furthermaths.org.uk/universities.php.

(If your university does not appear on this page, but should do, please let us know.)

Tuition support for the Advanced Extension Award (AEA) and the Sixth Term Entry Paper (STEP) in Mathematics

Expert tuition developed by the Further Mathematics Network is now available live online to support students studying for STEP and AEA qualifications in Mathematics – see www.mei.org.uk/stepaea. These qualifications use unstructured problems to assess students' mathematical problem-solving skills, rather than merely requiring them to regurgitate standard techniques to answer standard questions. Unlike A level, they allow students 'thinking time' to get to grips with harder problems.

In the past a valid criticism of these examinations has been that only the most privileged students could access expert tuition to develop the high level mathematical problem solving skills needed. The live online support now available means that such tuition can be accessible to all.

The A* Grade in A level Mathematics and Further Mathematics

We suggest strongly that universities do not use the A* grade for Mathematics or the A* grade for Further Mathematics in their offers. Appendix 2 is a letter from the Council for Mathematical Sciences to the former Secretary of State for Children, Schools and Families, explaining why the A* grade is not useful for selecting Mathematics students. Those universities seeking to select the most mathematically-able students should require high grades in both A level Mathematics and A level Further Mathematics and should also consider specifying STEP or AEA in their offers.

We hope that you will bear our recommendations concerning these developments in mind when considering your department's entry requirements and advice for prospective undergraduate mathematics students.



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Appendix 1

Data relating to A Level Mathematics 1989 – 2009 (Source JCQ) & predictions for 2010-11

Year	Mathematics entries (FM excl)	FM entries	Total Mathematics entries (FM incl)	FM as % of Mathematics	Total A Level entries (All subjects)	Mathematics as % of total entries (FM incl)
1989			84 744		661 591	12.8
1990			79 747		684 117	11.7
1991			74 972		699 041	10.7
1992			72 384		731 024	9.9
1993			66 340		734 081	9.0
1994			64 919		732 974	8.9
1995			62 188		725 992	8.6
1996			67 442		739 163	9.1
1997			68 880		777 710	8.9
1998			70 554		794 262	8.9
1999			69 945		783 692	8.9
2000			67 036		771 809	8.7
2001			66 247		748 866	8.8
2002			53 940		701 380	7.7
2003	50 602	5315	55 917	10.5	750 537	7.5
2004	52 788	5720	58 508	10.8	766 247	7.6
2005	52 897	5933	58 830	11.2	783 878	7.5
2006	55 982	7270	63 252	13.0	805 698	7.9
2007	60 093	7872	67 965	13.1	805 657	8.4
2008	64 593	9091	73 684	14.1	827 737	8.9
2009	72 475	10 473	82 948	14.5	846 977	9.8
2010	78 000	11 900	89 900			
2011	83 000	13 000	96 000			

Notes

1. The figures for 2010 and 2011 are predictions based on candidate numbers for early units.
2. Figures for Mathematics (column 2) and Further Mathematics (column 3) have only been reported separately since 2003, before that they were combined (column 4)
3. All the figures are consistent from year to year.
4. Apart from those for 2010 and 2011, these are the figures published by the JCQ; they differ from those used by the DCSF, which are not in the public domain.

The Council for the Mathematical Sciences

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Right Hon Ed Balls MP
Secretary of State for Children, Schools and Families
Sanctuary Buildings
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16 April 2010

Dear Secretary of State,

Advanced Extension Award (AEA) in Mathematics

I write as Chair of the Council for the Mathematical Sciences to support ACME's position on the ongoing need for an Advanced Extension Award (AEA)-type qualification in mathematics.

The Council for the Mathematical Sciences comprises the Institute of Mathematics and its Applications, the London Mathematical Society, the Royal Statistical Society, the Edinburgh Mathematical Society and the Operational Research Society, and has a particular interest in student progression to and success in mathematical sciences in Higher Education in the UK. The CMS feels that the introduction of the A* grade at A-level (and the corresponding 'stretch and challenge' material to be introduced in some A-level units) will not be effective either in discriminating between the highest achieving candidates or inspiring and challenging the very best students; the retention of an AEA in mathematics is a necessary measure that the CMS supports.

Unlike many other A-level subjects, achieving a score of over 90% in an A-level mathematics examination is not necessarily an indication of being better prepared for a highly demanding degree course in the subject than having achieved a standard grade A. Moreover, the new grade promotes an approach to learning mathematics which does not reflect what is valued at degree level. Ultimately, it is the ability to 'think mathematically' – rather than merely master the content of a syllabus and complete standard questions to a very high level of accuracy – that is the best determinant of future success in mathematical sciences in Higher Education; the Advanced Extension Award is an effective way of measuring this skill amongst those that have access to the qualification, and the nature of the AEA examination encourages a healthier approach to mathematics which stimulates and inspires students working at the highest level.

One might presume that this issue can be tackled simply by introducing AEA-type questions to A-level examinations. The intention of improving the 'stretch and challenge' content at A-level is welcome, but the breadth of the ability of the A-level mathematics cohort renders it wholly impractical to include a sufficient number of questions that truly test the very best students to the extent that the AEA does. As ACME states, this is not a failing of the A-level as a qualification but is a natural consequence of the variety of destinations and purposes for which the subject is studied. An attempt to provide for the whole cohort through A-level mathematics alone would either be ineffective at the top end or would render parts of the examinations inaccessible to the majority of students and damage participation rates; neither of these is in the national interest.

The CMS agrees with ACME's statement that an extension award, together with Further Mathematics, is a necessary and effective response to the breadth of the cohort. The CMS therefore strongly supports ACME's position that the AEA in mathematics should be retained until such time as an improved replacement has been developed. Moreover, we hope that DCSF will commit the necessary resources – working with key stakeholders across the community – to develop such a replacement for the AEA.

Yours sincerely,

A handwritten signature in black ink that reads "David Wallace". The signature is written in a cursive style with a large, prominent 'D' and 'W'.

Professor Sir David Wallace CBE FRS FREng
Chair, Council for the Mathematical Sciences