

Rt. Hon Michael Gove MP
Secretary of State
Department for Education
Sanctuary Buildings
Great Smith Street
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15 July 2010

Dear Secretary of State

Future of Post-16 Mathematics

We are writing to you in light of the report of your comments in your speech at Wellington College on 4 July on the future of AS and A-Levels. We agree that the most mathematically able students must be stretched and challenged in their post-16 study through a rigorous and stimulating experience in which important aspects of mathematical thinking are tested and rewarded. In this letter we share with you our thoughts about how this can be achieved and some important points to be aware of when considering the post-16 landscape.

1. The best way to improve provision for those of high ability in mathematics is to review and develop the extension papers which already exist and to encourage the study of Further Mathematics. These extension papers – that is, the Advanced Extension Award (AEA) and STEP (sixth term entry papers) – can provide the stringent and synoptic assessment which will develop and reward deep mathematical understanding and thought. Yet, your department currently intends to abolish the AEA in mathematics, with ACME having to fight hard for its retention¹. We urge you to support its retention and development in the scheduled review of post-16 mathematics.

It is also worth noting that the proposed A* grade – to be awarded to those achieving over 90% at A2 – will have no value in discriminating between the very best mathematics candidates, given the inevitable focus on accuracy rather than the ability to attempt more challenging questions. In fact, we believe that the London Mathematical Society is preparing to advise admissions tutors in university mathematics departments not to seek A* grades in mathematics, but rather to use Further Mathematics and the AEA in their offers in order to select the most mathematically-able students.

2. Mathematics A-level is studied for a wide range of purposes, and is not just a precursor to degree-level STEM subjects – it must meet the needs of a wide range of subjects. Only around 5% of those students who take mathematics in the sixth form go on to take a mathematics degree. The other 95% proceed to study a variety of subjects, with mathematics embedded in almost all of them to a greater or lesser extent.

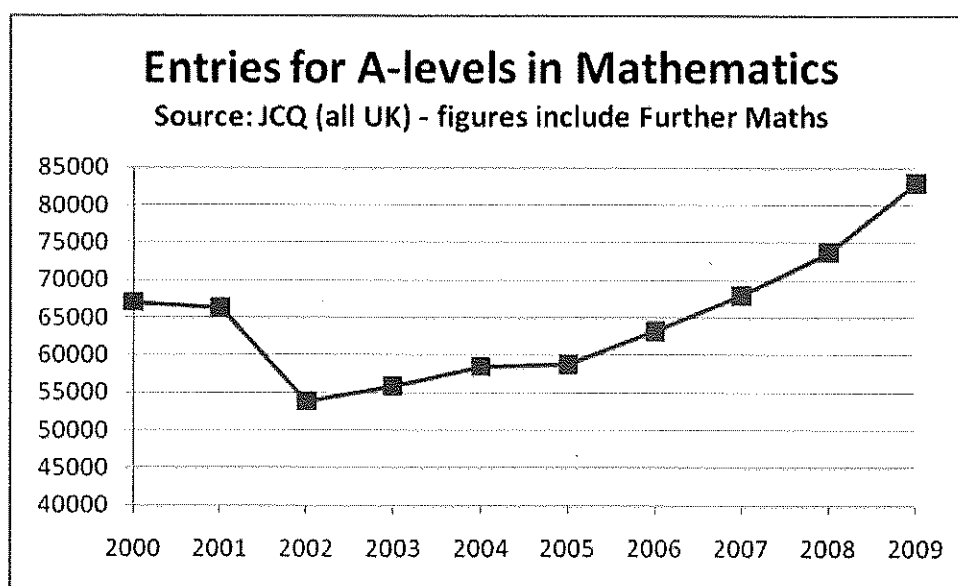
Several important points follow from this:

- **Single A-level mathematics is not, and never has been, designed to be a full preparation for university mathematics.** Further Mathematics and the AEA (formerly S-Level) are designed for those students (and current measures to ensure that all students have access to them should be actively encouraged). These qualifications thus have a critical role in the overall provision.
- **A wide range of stakeholders must be involved in the design of A-level mathematics.** You have mentioned on a number of occasions that universities should play a part in the

¹ We have set out our position in a paper on Stretch and Challenge in Level 3 Mathematics published in February 2010 (see <http://www.acme-uk.org/downloaddoc.asp?id=193> for more details) which has wide support in the mathematics community, including from the Council for Mathematical Sciences and the science community through SCORE.

revision of A-levels. The university voice is important, but it is critical that a wide range of universities are involved to represent the diversity of the sector and not just the mathematical elite. The views contained in the Sir Richard Sykes Report reflected only a small number of highly selective institutions. In addition, as mathematics is of crucial importance in so many degree courses beyond mathematics, sciences and engineering, it is vital that disciplines such as the social sciences are involved. Stakeholders beyond HE should also be engaged, including teachers, employers and the subject communities, with leadership from those with experience in the development of qualifications and curricula. We expect that with this wide involvement of stakeholders it will be demonstrated that on many occasions it is actually the *absence* of mathematics and statistics from many students' post-16 choice of subjects that is the major issue, and not simply making mathematics more rigorous.

3. Making A-level mathematics harder will mean fewer students will choose to take the qualification. There is a real danger in making A-level mathematics significantly harder than it is currently. It would make it impossible to retain appropriate provision for the full range of students taking the A-level. Experience with Curriculum 2000 – when mathematics A-level entries plummeted – shows the extreme sensitivity of the subject to details of the assessment regime. *We feel it is very important that we warn you that implementing such a policy runs a genuine risk of repeating the collapse in the numbers studying A-level mathematics witnessed in 2002.* We believe that it is very likely that we would again see university mathematics departments closing as a result of this fall in numbers. The following graph of A-Level take up during 2000-2009 shows how serious poorly designed changes can be. You will see that it took six years to recover from the damage done with Curriculum 2000.



4. Linear assessment must not be the only option available at A-level; it is incorrect to assume that the modular system is wrong for all subjects and all students. There is no doubt that modular courses make learning accessible to more students, and almost all university courses are now modular. Consequently, it is entirely predictable that a compulsory move away from the present modular structure for Mathematics and Further Mathematics A-levels would result in a substantial reduction in take up. As with making the qualifications harder, it is to be expected that some university mathematics departments would be forced to close. We recognise that there is tension between accessibility and challenge, but disallowing modular assessment would not resolve this. Linear courses can provide cumulative coherence and continuity, and a well-designed modular syllabus can allow connections to be made between topics with genuine scope for synoptic assessment. Both styles must be permissible.

5. The post-16 landscape is wider than A-level, and AS levels are an important part of this. The present demands of HE and employment would indicate that this country requires many more to have an education in mathematics well beyond GCSE, in order to stay competitive with other emerging and growing economies. This is being investigated as part of ACME's Mathematical Needs project. But

not all will need or wish for a full A-level: AS-level mathematics will remain a useful qualification in its own right. The existence of AS-level mathematics acts as a catalyst to continue to the full A-level; AS Further Mathematics provides an additional incentive for brighter students to want to pursue a higher level of mathematical study than might otherwise have been the case.

Our forthcoming position paper on Post-16 Mathematics proposes a range of A-level and sub A-level mathematics qualifications which would allow all students to study an appropriate volume and level of mathematics post-16. The problems of Curriculum 2000 have taken several years to recover from, but the AS/A2 system has left us on a strongly upward trajectory with significant increases forecast for the next two years.

To reiterate, we share your aims to improve post-16 mathematics and hope that we can work together with you on this and other important and complex issues in the provision of effective and rigorous mathematics education.

Yours sincerely

A handwritten signature in blue ink that reads "Julia Higgins". The signature is written in a cursive style with a large initial 'J'.

Professor Dame Julia Higgins FRS
Chair, ACME