

## ACME response to Ofqual consultation on A-level Reform – September 2012

### About ACME

The Advisory Committee on Mathematics Education (ACME) is an independent committee, based at the Royal Society and operating under its auspices, that aims to influence Government strategy and policies with a view to improving the outcomes of mathematics teaching and learning in England and so secure a mathematically enabled population. ACME acts as a single voice for the mathematics community.

### About this response

Our response to this consultation has been informed by our discussions with the mathematics community, awarding organisations and ACME's 'Outer Circle' of advisors. It has been created for submission to Ofqual, with the aim of informing the A-level Reform programme.

ACME met with leading mathematics organisations to discuss A-level reform on 23 April 2012. Committee members have also met with awarding organisations to discuss A-level and GCSE reform. The document was reviewed by ACME's 'Outer Circle' of advisors.

In parallel, ACME also convened a workshop on 13 August of awarding organisations, mathematics organisations, HE and others to discuss the core content for AS and A-level Mathematics and Further Mathematics. Although this meeting was not arranged to discuss ACME's response to this consultation *per se*, unsurprisingly, many related issues arose and hence this meeting has also informed ACME's thinking.

Our response focuses on the subject of mathematics (including qualifications within this family such as Further Mathematics, and components such as Statistics, Mechanics, and Decision Mathematics).

### Headline messages

- Ensure that reform does not jeopardise uptake of mathematics qualifications by taking time to investigate the specific effects of proposals on mathematics
- Introduce National Subject Committees to facilitate HE engagement
- Recognise that Mathematics and Further Mathematics require a modular structure that:
  - Retains the relationship between AS and A2
  - Retains a choice of applied mathematics options
  - Retains the sharing of components between Mathematics and Further Mathematics
- The core content of A-level Mathematics is not the problem; attention is needed on the validity of assessment
- Mathematics should not be part of the first phase of reform; an extension to the timescale of at least two years is needed, with progress by 2014 focused on structures for engagement

## Executive Summary

- **Many of the proposed changes to Mathematics and Further Mathematics at AS and A-level risk reducing uptake of these subjects. Reform must be carefully considered, and must not jeopardise the significant increases in uptake of these qualifications in recent years.** This positive progress must be sustained, and a thorough risk analysis should be undertaken before any change is made.
- **There are huge national implications of a loss of uptake, academically and for employers.** The impact would not be limited to university mathematics departments, as many other disciplines rely on students having studied A-level Mathematics, and there would be a great loss of momentum in the current drive to ensure that everyone studies some mathematics post-16.
- A key question to ask before making any change is whether such reform will improve the quality of learning of all those who take these courses, and evidence must be provided to support the case for change.
- ACME warmly welcomes the concept of re-engaging higher education in improving A-levels. This should be alongside other key stakeholders such as learned societies, teachers and employers. For HE participation to be effective this must happen through long-term, in-depth engagement on a national level, not merely rubber-stamping by a selection of universities. **We believe that a critical step to achieving effective HE engagement is to establish a suitably funded national subject committee for mathematics**, as advocated in the recent Select Committee report. This would also allow for coordinated input from other relevant stakeholders and would ensure that there is a clear national set of A-levels. To allow the necessary pool of expertise to evolve in HE, the obligations imposed by BIS on publicly funded universities need to be broadened in a way that facilitates HE involvement in pre-19 education.
- There is a risk that reform will focus on A-level specifications, but there is general agreement that the core content for A-level Mathematics is broadly appropriate as it stands. **Attention should be focused on the strength of the connection between the content and the quality of assessment**, given that this is what drives classroom experience, and produces the effects that prompt concern from HE about A-levels.
- There are a number of issues relating to re-sitting, and a balance needs to be struck between it providing a formative element in students' learning and it being used excessively in a quest for extra marks. Some of the measures suggested in the document are designed to limit excessive re-sitting of AS units, but not all.
- **The relationship between AS and A-level needs to be retained, but it is worth considering reducing the weighting of the AS component in Mathematics.** In mathematics any change to the weighting would have to take account of (and preserve) the way in which Mathematics and Further Mathematics share applied mathematics options, which can be used in both the AS and the A2. Our response outlines one possible way of accommodating a change in weighting to Mathematics,

but we suggest that the current weightings are maintained for Further Mathematics as there is no way of changing the weighting that preserves the essential aspects of the qualification.

- It is sometimes argued that modular *assessment* encourages students to compartmentalise their learning, and even disregard the content of a module once it has been passed. This is clearly not desirable, but in a well-designed scheme for mathematics this will not happen because the subject is naturally synoptic. Attention should be given instead to the sequencing and assessment of syllabus content in order to respond to the criticisms of modular assessment. **Modular assessment should not be conflated with modular *structure* in the design of the course, which is an essential feature of A-levels in mathematics and must be retained.** In particular, **it is crucial that reformed A-levels in mathematics include a choice of applied options, and that Mathematics and Further Mathematics continue to share components.** Removing these aspects could have a significant effect on the uptake of Further Mathematics.
- A one-size-fits-all approach to A-level reform risks damaging mathematics. Given the particular needs of mathematics, and the fact that there are several key features of the current system that need to be preserved, it would be prudent to consider whether making specific adjustments to the present successful system in mathematics would be more appropriate than implementing large scale generic reforms across all subjects.
- **Mathematics should not be part of a first wave of phased reform** – indeed, new A-levels in all relevant subjects should be introduced at the same time to ensure that uptake is not damaged by the perception that the new courses are harder. However, we agree that we should start to look at what improvements should be made in the longer term.
- **The timescale for introducing new qualifications in any subject for teaching in 2014 is far too tight with potential risks to standards and status.** However, significant progress could be made by 2014 on establishing appropriate structures for engaging higher education and wider stakeholders, and investigating issues of assessment quality. A target of introducing new courses in all subjects in 2016 is more likely to allow the qualifications to show coherent progression from the new curriculum and GCSEs being introduced from 2014 (although it should be noted that this would mean that the 2014 GCSE cohort will be ‘guinea pigs’ twice over; for this reason 2017 might be a better date).

## **1. Background**

### **Risks to the uptake of A-level Mathematics**

Mathematics and Further Mathematics are both growth subjects at AS and A-level – indeed, in England A-level Mathematics has grown by 72% since 2003, and A-level Further Mathematics by 152%. The growth of AS Further Mathematics is also particularly significant. Anything that causes this to go into reverse will outweigh the positive effects of newly-introduced qualifications.

These increases are very important for the wide variety of disciplines that rely on quantitative skills. Dramatically increasing the number of people studying some form of mathematics after the age of 16 is a major policy goal for the Government, and this vision is strongly supported by ACME; continuing the increases in AS/A-level uptake will play an important part of this. The trend is also reflected in record numbers of people studying for mathematics degrees, and the extent to which students are becoming more prepared for the mathematical demands of degree-level study of other STEM subjects. This encouraging trend must be sustained if we are to successfully compete in a global economy in the 21<sup>st</sup> century.

However, it must not be assumed that these increases are stable. Past experience proves how vulnerable mathematics can be to change in the system; for instance, there was an enormous decline in 2002 and 2003 following the Curriculum 2000 reforms, and it has taken several years to recover from this position.

Unlike many other countries, post-16 mathematics is optional in England, and it is likely to remain so without large scale reform of the system. As a result, the uptake of mathematics in this country will continue to depend on its attractiveness to students. This point is critical to understanding the risks involved in Ofqual's proposals – any reform that threatens the attractiveness of the qualification risks diminishing uptake.

Given the importance of mathematics as a facilitating subject for a wide range of further study and career options, it is imperative that any changes to the A-level design and content do not impact on the recent positive trend. There is a serious risk that the current proposals could once again result in a significant drop in the entry numbers for A-level Mathematics (and Further Mathematics), and ACME urges Ofqual and the Government to learn from previous experience in this area. Every effort must be made to avoid history repeating itself in 2014.

### **Comments on the current A-levels in mathematics**

A major stimulus of the proposed reforms to A-levels is the criticisms made by HE of the 'output' of the course, i.e. the mathematical preparedness of the first year undergraduates they admit. While we recognise that improvements could be made to the suite of A-level mathematics qualifications, care must be taken to identify the precise source of these criticisms and put them into the context of recent (and positive) expansion of HE mathematics – many people are studying for mathematics and mathematics-dependent degrees now who would previously not have done so.

There is a need for a serious dialogue between the school and college sector and higher education, concerning what improvements might be made to A-levels without risking uptake and how university teaching could be adapted to take account of the new clientele now opting to take mathematics at university.

Comments should also be compared with the results of Ofqual's international comparison of post-16 mathematics qualifications, which noted that GCE Mathematics compared favourably with qualifications in other countries and that 'A-level Further Mathematics was the broadest and deepest qualification reviewed'<sup>1</sup>.

## **2. The process for engaging with Higher Education**

ACME welcomes the idea of improved engagement with Higher Education, and this should be extended to include other key stakeholders such as learned societies, teachers and employers. However, there is a significant risk that the proposed HE 'sign-off' requirements will allow a multiplicity of A-level courses to be created, each of which is preferred by only a limited range of universities. This would present a school or college with an impossible choice, as inevitably their students would be looking to progress to a wide variety of destinations. This situation must be avoided, as the consultation acknowledges.

We should therefore establish a robust mechanism to support awarding organisations and key stakeholders (including teachers, HE, employers, subject associations and learned societies) coming together to agree a common core for A-level Mathematics at a national level. As an interim measure, ACME has brought together the awarding organisations with members of HE, learned societies, professional bodies, subject associations and other mathematics organisations to discuss this, and this meeting demonstrated that it will be easy to reach a consensus on core content.

It is already clear that universities, individual academics and mathematics organisations are being asked to engage with each awarding organisation separately. This is not a sustainable or practical way to ensure that awarding organisations have undertaken effective and relevant subject engagement, and does nothing to support comparability of demand across assessments. It also undermines the widespread agreement on the content of the common core. There is a significant risk that market pressures could encourage cherry-picking of organisations and institutions until the required number of supporters is found. Again, this suggests that a national committee structure is needed.

A fundamental issue with asking universities to engage with A-level design is the extent to which their involvement is supported by the HE funding system. At present, BIS funding obliges universities to focus on their research; without careful coordination of policy between DfE and BIS in this area it is unlikely that universities will be able to engage in the ways envisaged by the DfE.

Mathematics has an 'underpinning' role in supporting other STEM subjects. As such, the 'end-users' of A-level Mathematics are not just mathematics departments themselves, and input should also be sought from a wide range of disciplines, including areas such as

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<sup>1</sup> <http://www.ofqual.gov.uk/news-and-announcements/83-news-and-announcements-news/899-comparison-of-international-qualifications>

physics, engineering and computing and others, alongside other end users. These could be brought together through a National Subject Committee, and would give depth to the policy goal of HE engagement. This was the approach advocated by the recent Education Select Committee report.

**Recommendation: A National Subject Committee with broad stakeholder representation should be established for each of the key A-level subjects, with a suitable funding model to support them. These committees could also have a role in GCSE and earlier curriculum and assessment developments. We urge Ofqual and DfE to read ACME's earlier think piece on curriculum and qualification development which expands on this suggestion<sup>2</sup>, and to refer to the recent Education Select Committee report**

### 3. The purpose of A-levels

We agree that it is helpful to think about the primary purpose of a qualification, and to use this to drive qualification development. However, HE is not the only end-user of A-levels, and that a significant proportion of undergraduates hold qualifications other than A-levels. The situation is complex. The primary purpose of A-levels, including mathematics, is to provide rigorous, coherent, academically-focused courses of study for young people between 16 and 18 that will help them to further their knowledge, skills and understanding; this should provide a framework within which employers and higher education give advice. The alternative is a system which at every stage is designed not for those on the course itself but progressing to the next stage.

The consultation suggests that the primary purpose of an A-level should be to facilitate progress to university study of that subject, and/or related subjects. In this context, we believe that the main driver for the design of Mathematics A-level should be the needs of HE science, engineering and other highly numerate subjects such as geography and economics, rather than the needs of undergraduate mathematics itself (although it will often be used for that purpose in practice, as the current A-level continues to be sufficient for some courses). The A-level whose primary design driver should be the needs of mathematics degrees is Further Mathematics, either at AS or A-Level (although not all universities are yet able to require this qualification). For a small number of students even more selective qualifications such as AEA or, occasionally, STEP papers, are appropriate as preparation for the most competitive courses.

The work of the Further Mathematics Support Programme to make access to Further Mathematics, and also STEP and AEA, a reality for all students, whatever their background, is much to be applauded. This work provides a platform upon which we should build.

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<sup>2</sup> <http://www.acme-uk.org/news/news-items-repository/2012/6/acme-thought-piece-on-a-national-subject-committee>

#### 4. A-level design issues

ACME's discussions with the mathematics community and other users of mathematics suggest that the principle concerns raised about A-level Mathematics tend not to be about the *content* or design rules of the A-level syllabus, but relate instead to the *validity of the assessment*. That is, the specification tends to meet HE requirements, but the assessment does not always foster those skills included in the specification that HE and employers need – including confidence with unfamiliar problems and multi-step unstructured tasks. It is assessment that frames the way in which students are taught, not the specification.

We are therefore pleased to see that Ofqual will encourage awarding organisations to work together on developing assessment within a subject.

**Recommendation: Ofqual should ensure that a sufficient range of assessment instruments is used to ensure validity of the assessment, informed by stakeholder expectations and needs.**

The consultation also proposes incorporating references to 'extended essay' responses, with mathematics as a possible exception to this Condition. Although an essay format would not be appropriate in a mathematics examination, the principle does have an analogue in mathematics; if the Conditions were to refer to 'extended response' this could be interpreted to mean tackling multi-step or unstructured questions in mathematics.

#### 5. Issues arising from re-sitting

ACME agrees strongly that the culture of repeatedly re-sitting exams needs to be changed, it is a waste of public money and not an educationally worthwhile experience for students. However, allowing a resit opportunity for students who for some unfortunate circumstance underachieve should be allowed. The Ofqual consultation refers to several measures which could be used to tackle excessive re-sitting:

- Removing the January examination window
- Placing a limit on the number of re-sits allowed
- Altering the weighting of the AS component (a side effect of which would be to make re-sitting less productive)
- Returning to linear-only qualifications
- Introducing jeopardy by only counting the most recent result, rather than the highest

It is clear that the incentive to re-sit AS modules to obtain extra credit towards an overall A-level grade (and thereby allow weaker performance on A2 modules) needs to be curbed, not least as it simultaneously focuses effort on the earlier stages of a two-year course and degrades the purpose of summative and synoptic assessments. Altering the weighting of the AS component could go some way towards this (see discussion below), as will limiting the number of re-sits allowed – these alone should be sufficient to affect the necessary culture change.

The other measures proposed are much higher-risk strategies. In particular there are significant problems associated with moving away from a modular structure (as opposed to

just removing modular assessment) that are specific to mathematics, and these are discussed in section 7 below.

Introducing jeopardy means that there is a personal risk to a student in taking an exam, which is particularly unattractive to groups of students who are typically risk-averse, such as those with less home support. Research evidence also suggests that girls are more risk-averse than boys in the context of studying mathematics<sup>3</sup>, which suggests that establishing a system of 'gambling' an examination grade could have a greater impact on girls. More generally, it seems inappropriate to introduce a system in which sitting an examination involves an element of risk to the individual.

There are various arguments in favour of removing the January assessment window as a measure to reduce excessive re-sitting:

- It is known that multiple examination sessions in the year can disrupt learning
- The need to measure a student's progress within the year could be addressed through internal assessment, which would provide immediate formative response

However:

- There will always be circumstances where a re-sit opportunity is justified
- Some people have suggested that the culture of excessive re-sitting or premature attempts could instead be addressed by moving the assessment window to November rather than January

Ofqual should consider what transitional arrangements will be necessary to ensure that the proposed removal of the January assessment window does not unfairly impact on current students following existing modular courses.

## **6. The relationship between AS and A-level**

Ofqual presents three options for the future relationship between AS and A-levels:

- Option 1. Removing the AS qualification – which would mean a return to a linear two year course of study with all the assessment at the end of the course;
- Option 2. Making the AS a standalone qualification but where the results do not contribute to the A-level. This would mean the AS could be completed in one year but the A-level would be a two year course of study and assessment as in Option 1;

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<sup>3</sup> Stables, A. & Stables, S. (1995). Gender Differences in Students' Approaches to A-level Subject Choices and Perceptions of A-level Subjects: A Study of First Year A-Level Students in a Tertiary College. *Educational Research*, 37, 1, 39- 51.

- Option 3. Retaining the AS qualification and its relationship to the A-level as at present but making changes to January assessments and resitting opportunities as outlined in the paper.

AS Mathematics is an important component of the drive towards all young people studying some form of mathematics post-16 – it allows students to do an amount of mathematics that is recognised without limiting second year choices, and to remove this option would work against the government’s intention to increase mathematics participation. More generally, the AS-A2 system allows for a greater breadth of study, and provides universities with more information about the likely future achievement of applicants than GCSE alone. We believe these points rule out Option 1, which would remove the AS qualification.

Option 2 proposes that AS marks would not count towards the A-level result. ACME believes that student achievement in the first year of a course should be recognised – any move away from this would be a disincentive to full commitment in the first year, when students are still relatively inexperienced, and would lead to loss of confidence at going into A2.

**Recommendation: ACME therefore recommends that the current relationship between AS and A-level is retained, with the following features:**

- **Steps to reduce excessive re-sitting (see discussion above)**
- **Further consideration of altering the relative weighting of AS and A2 components in determining the A-level grade for Mathematics (see discussion below)**
- **Retaining the capacity to choose applied mathematics options – the ‘flexibility’ feature of modularity (see below)**
- **Retaining the relationship between Mathematics and Further Mathematics in terms of shared applications options (see below)**

## **7. Modularity**

The modular approach to assessment and course structure has brought an immense richness to mathematics and has provided a framework for major innovations and curriculum development. Of all subjects, mathematics is best suited to modular syllabuses.

An objection to modular *assessment* is the risk of compartmentalising learning and the extent to which students can disregard the content of a unit once the examination has been taken and work on a new module has begun. This is clearly undesirable, but synoptic assessment is natural part of mathematics and is integrated in a well-designed system of modular assessment as at present. Some have suggested that combining the existing C1 and C2 units into one component (and similarly for C3 and C4) would support this further and could improve the validity of the assessment.<sup>4</sup> This could be investigated further.

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<sup>4</sup> This approach was piloted by AQA and was evaluated as part of the *Evaluating Mathematics Pathways* project, with favorable results across the attainment range

However, ACME is currently looking at how to increase participation in mathematics post-16, and the findings of this work may be relevant in deciding whether to take this forward.

However, an advantage of a modular *structure* is the capacity for a student to select options to build a suitable Mathematics A-level, and for a school or college to offer a selection that it is able to deliver. AS Mathematics comprises two 'core' pure units and one applied choice – either Statistics, Mechanics or Decision Mathematics, ideally chosen according to how these will complement the rest of a student's study programme (e.g. mechanics for physics, statistics for social sciences, decision mathematics for computing and so on). This flexibility is an essential feature of the current Mathematics and Further Mathematics courses, and the drive against modular assessment should not compromise it.

A second crucial point is the need to retain the relationship between Mathematics and Further Mathematics in terms of these applied mathematics options. The relationship allows for co-teaching of Mathematics and Further Mathematics; if the two were made entirely separate then the viability of Further Mathematics would be compromised in many schools and colleges. The relationship between Mathematics and Further Mathematics in the current system also encourages students to 'have a go' at some Further Mathematics modules, with no personal risk. Removing this would risk undoing the work of the Further Mathematics Support Programme in improving uptake. Again, this relates to the attractiveness of the qualification to the student, and the risk to them in taking it, and so any loss of a modular structure would be very damaging.

For example:

Example 1 - A-level Mathematics with Further Mathematics  
AS Mathematics choices – C1, C2, S1  
A2 Mathematics choices – C3, C4, S2  
AS Further Mathematics choices – FP1, D1, M1 (which can be taught in parallel with AS Mathematics without the need for separate teaching of AS Mathematics to FM students)  
A2 Further Mathematics: FP2, M2, M3 or S3 or D2, which similarly can be taught in parallel with A2 Mathematics

Thirdly, we note that at present Mathematics A-level meets the needs of its users by allowing students to choose an applied unit in a new area in the second year rather than continue to the second module of the area studied in the first year. This is illustrated by the following examples:

Example 2 – Breadth  
AS: C1, C2 + S1  
A2: C3, C4 + M1

Example 3 – Depth  
AS: C1, C2 + M1  
A2: C3, C4 + M2

In practice this may make it appear that mathematics allows for a larger number of 'easier' options than other subjects, but the rationale is that the demand of (say) S2, starting from a

knowledge base of S1, should be comparable with that of starting a different application area from scratch. It is true that such students will have the experience of C1 and C2 to call on, but in the main this does not represent an advantage. Indeed, as Ofqual's research notes:

*While the demand of an A-level made up of three AS plus three A2 units appears to be higher than an A-level comprising four AS plus two A2 units, reviewers judged that the matter of breadth versus depth had to be taken into account. They considered that studying two different AS applications units requiring understanding of significantly different mathematical concepts was of equivalent demand to studying two units (one AS and one A2) in one application, and that this increased demand in terms of breadth offset the reduction caused by doing two AS units instead of one AS and one A2 unit.<sup>5</sup>*

We therefore feel that this flexibility continues to be justified, particularly given the multiple end purposes of Mathematics A-level.

A fourth feature of the current system is the way in which an awarding organisation aggregates the Applications modules taken into more than one mathematics qualification in such a way as to optimise the Mathematics AS or A-level grade, and then the Further Mathematics AS or A-level grade. This means that students do not declare in advance which units are being presented for which qualification. The advantage of this is that there is no tactical decision to be made about which applied options are studied for which qualification. It avoids the situation where a student might miss out on a university place by being awarded a grade C in Mathematics alongside a grade A in Further Mathematics when BB would have been more helpful. The disadvantage is that it makes standardisation across the whole qualification difficult (rather than within each module), as in some cases some A2 FM modules may have actually been assessed in year 1 and then carried forward when the calculation for certification is carried out. Again, change in this area may affect the attractiveness of the qualifications to the student and should be treated with caution. This is a valued aspect of the current system and the disadvantages of any alternative approach would need to be carefully considered – it would appear that this represents the fairest way of accommodating the sharing of components between Mathematics and Further Mathematics. Ofqual should consult further with the community if any change is anticipated here.

#### **Recommendations:**

- **Any new structure should incorporate a choice of applied options in Mathematics and Further Mathematics, as at present.**
- **Any reform must ensure that the sharing of components between Mathematics and Further Mathematics is retained.**
- **The equivalence of Applied combinations such as M1+D1 and M1+M2 should be retained to support a range of pathways and local conditions. Further work may be needed to improve comparability across specifications and assessments.**

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<sup>5</sup> [http://www.ofqual.gov.uk/files/ofqual-09-4155\\_Review\\_of\\_standards\\_maths\\_2004-2007.pdf](http://www.ofqual.gov.uk/files/ofqual-09-4155_Review_of_standards_maths_2004-2007.pdf)

- **Ofqual should give further consideration to combining the AS and A-level Mathematics pure mathematics modules into one component (albeit with the possibility of multiple examination papers) – i.e. C1 and C2, and C3 and C4. This would support greater synthesis of the pure mathematics content, and allow for more valid assessment.**
- **No change is needed to the way in which components are aggregated in awarding Mathematics and Further Mathematics; the present system works well. If, however, any change is envisaged, the needs of students should be paramount in discussions between schools and colleges and the awarding organisations.**

**We support the proposed Condition 5 in the consultation relating to synoptic assessment, as this is already a feature of A-level mathematics courses but could be strengthened further.**

## **8. Weighting of AS and A2**

The Ofqual consultation invites comments on whether AS-level results should carry a lower weighting than those studied at A2. ACME believes that this could be justified on the basis that AS-level is typically one of four subjects studied in the first year, but A2 is typically one of three.

However, the need to retain flexibility of options in mathematics means that the differential weighting could only apply to the Core units at AS and A2. These would have to be sufficiently highly weighted to allow the applied options to carry the same weighting as at present in order to produce a 40-60 balance overall between AS and A2.

A description of how this could work in practice for Mathematics is included in Appendix A. However, it would not be sensible to implement this for Further Mathematics without compromising the essential features referred to in section 7; as a result it is worth considering whether changing the weighting for one qualification but not the other would be worthwhile.

## **9. The A\* grade in mathematics**

The consultation invites comments on the A-level grading system. ACME has argued in the past that the current criteria for awarding an A\* grade in mathematics does not reward or recognise the right thing, and does not reliably identify the best students. In other subjects, very high marks on a standard set of questions can be a genuine indicator of quality, but in mathematics, although high levels of accuracy are desirable, genuinely exceptional ability at this level is normally manifested in an ability to tackle deeper questions and more extended problems.

It is difficult to incorporate these in a paper designed for over 80,000 people. In English it is possible for weaker candidates to answer an open-ended question in a very limited way and achieve some marks, but in mathematics this is much more difficult. The risk is that the majority of candidates would score very low marks on some questions, which compromises assessment validity and reliability.

There are two possible approaches to incorporating this style of question for high-performing candidates – either through a connected extension paper for those seeking an A\* grade (which risks mathematics being seen as harder than other subjects and increases the burden of assessment), or through a separate qualification along the lines of the current Advanced Extension Award in mathematics (access to which is not universal). ACME's position paper on this issue is available from <http://www.acme-uk.org/news/news-items-repository/2010/2/stretch-and-challenge-in-level-3-mathematics>

## **10. Timescale and phasing of reform**

The current fragmentation of curriculum and qualification development risks a lack of coherence across the curriculum. In particular, GCSEs are currently being reviewed, and it is not at present clear how the Key Stage 4 curriculum or GCSE syllabus will be developed, or how Ofqual and the Department plan to ensure A-levels build on the GCSE syllabus.

ACME is therefore very concerned about the timetable for curriculum and qualification development. A-level Mathematics has not been reviewed for some time, but a rush to introduce a new A-level syllabus for 2014 seriously risks producing a low quality product and a mismatch between the new GCSE and A-level specifications.

Time is needed to:

- Set up subject committees
- Create the culture of Awarding Organisations working together
- Connect with the outcomes of the National Curriculum review
- Conduct risk assessments given the potential impact on uptake
- Provide schools and colleges with new specifications one year before teaching
- Produce and field-test new textbooks.

In particular it should be noted that for first teaching in 2014 the reformed A-level specification would need to be in schools and colleges by September 2013 – this leaves very little time for major reforms to be agreed in the first few months of 2013. Planning implementation from 2016 would mean any change would be synchronised with, and could be designed to build on, the new GCSE qualifications.

We recognise the desirability of further improving A-level mathematics qualifications, but feel strongly that changes should not be made without carefully considered analysis and discussion. The first steps towards reform could be made by 2014 in setting up appropriate structures for reform and agreeing improvements needed in assessment validity.

There is also a risk of introducing some subjects before others. The new A-levels are likely to be perceived as 'more difficult', and there is a real risk that students will choose to study those A-levels they think are easier. Mathematics is already perceived to be a difficult A-level, and reform should not be out of phase with other subjects.

Mathematics is clearly a 'priority' subject in the sense that it is important to achieve a good outcome, but not in the sense that reform should be rushed or that mathematics should be used as the guinea pig.

**Recommendation:** ACME recommends that all the syllabuses for key subjects are introduced at the same time, with at least two years' delay to 2016 in order to allow for quality development and coherent progression from the new GCSEs. However, this would mean that the 2014 GCSE cohort would be the first to take these exams, and for this reason 2017 might be a better date.

## Appendix A: Introducing a 40-60 weighting in AS/A-level Mathematics

One way of achieving this is as follows.

All modules carry 100 uniform marks except C1, C2, C3 and C4.

C1 and C2 carry 70 each, C3 and C4 130 each.

AS Mathematics is awarded on C1, C2 and one applied module:  $70 + 70 + 100 = 240$

A2 Mathematics consists of C3, C4 and another applied module:  $130 + 130 + 100 = 360$

A-level Mathematics thus has 600 uniform marks of which 240 are from AS.

### Notes

1. This approach would not work for Further Mathematics. AS Further Mathematics would be, as now weighted at 50% of A-level Further Mathematics, recognising that it is rather different from other AS levels.
2. There is such a large difference between the 70 marks for C1 and 2 and the 130 for C3 and C4, that a student would be very ill advised to spend time mark-grubbing while resitting C1 or C2 at the expense of the much higher scoring C3 and C4.
3. This method can be applied to other weightings of AS and A2. If the AS is weighted at  $(50 - n)\%$  of the A-level, then C1 and C2 each carry  $(100 - 3n)$  uniform marks and C3 and C4 carry  $(100 + 3n)$  uniform marks.