



Dr Rob Best

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Ms Glenys Stacey
Chief Executive
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27 November, 2012

Dear Ms Stacey

OUTCOME OF A LEVEL REFORM CONSULTATION

I chair the Engineering Professors' Council's Mathematics Working Group which consists of representatives of key interest groups in mathematics education (universities, examination boards, learned societies etc). The Engineering Professors' Council (<http://epc.ac.uk>) represents the majority of academic engineers in the UK, with 77 university members comprising nearly 6,000 academic staff. We welcomed the opportunity to contribute to the A level reform consultation and have now had the opportunity to read with some interest Alpha Plus's analysis and the resulting recommendations. The Group would like to raise the following issues.

While we welcome the increased focus on synoptic assessment and contextual learning, we would urge strongly some further consideration of the following issues:

- There appears to be a continuing assumption that students studying mathematics A level go on to do mathematics degrees. Too little attention appears to be given to the needs of "user" disciplines such as engineering and other subjects (medicine is another that springs to mind) that are not studied at A level.
 - Direct statistics on this are hard to find but, based on university admissions in 2011, the proportion is about 1:2 of university entrants to mathematics (and allied subjects) compared to entrants to engineering and science (excluding medicine) which depend on mathematics.
 - A-level mathematics has a special place like no other A-level subject as the key enabler for a range of university subjects of major economic importance to the UK. It is therefore essential that the A-level curriculum for mathematics should be developed giving high priority to this objective.
- While it is difficult to disagree *per se* with the decision to abolish the January sitting of the examinations, we believe that it may have a profound negative effect on take up of further mathematics. There are several reasons for this, which include:
 - The careful design of syllabuses that enables Further Mathematics (FM) to be taken alongside A level Mathematics (ALM) from day one, which enables students to try out FM without risk to their ALM; the assessment of FM therefore runs alongside the assessment of

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- ALM. Whilst the examinations can be left to the end of the course, it's in no one's best interests to do so.
- Under present arrangements, decisions to take AS FM need not be made at the start of Y12. That is likely to change, reducing take up.
 - Big exams in the summer of each year will put off many students from even starting FM.
 - Growth in FM numbers is substantially the result of candidates doing four or five A levels, taking FM as an additional subject. Many of these will not do the additional subject if they are forced to take all of their examinations in June.
- We therefore believe that a case can be made for mathematics being exempt from the discontinuation of January examinations, at least for some key papers.
 - Again, while we understand the concerns about the emphasis on coursework rather than examination for some subjects, we believe that coursework has a real role to play in the study of mathematics as certain skills can be tested in this way that are not easily tested in exams. Likewise, a modular approach has an important role to play in mathematics as it allows a degree of specialisation within this diverse subject.
 - We would also like to re-iterate that, because of resource limitations in expertise, national subject committees are needed – not one per awarding body per subject – we would urge you to look at how this was handled in development of the engineering Diploma which we believe was an effective and efficient model.

We would be very happy to provide representatives for future working groups or panels on this subject, or to meet to discuss our concerns further if you would find that helpful.

Yours sincerely

Dr Rob Best
Mathematics Working Group Chair
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Glenys Stacey
Chief Regulator



16 May 2013

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Dear Dik

Thank you for your letter summarising our discussions from when we met in April. I am pleased that you found our meeting valuable. From our side it is always helpful to hear about the concerns of users of the qualifications we regulate. As we discussed, the wide range of different courses at higher education that a subject like A level mathematics supports means that it is very important that we understand the views of all the representative groups involved, not just those specifically associated with the study of the 'pure' subject.

As you know, we have asked the exam boards to review the content requirements of the current A level subject criteria for a range of subjects including mathematics. The content requirements of the subject criteria are a means of ensuring that qualifications bearing the same title, such as A level mathematics, have a common core. We are not intending to leave the development of the content to each exam board as we recognise the risks involved in such an approach, as you have identified. The review will be carried out by the exam boards jointly and their qualifications will have to continue to meet the requirements of the subject criteria.

This review will include consideration of the appropriate content for an AS qualification in that subject. As you note, this could result in the curriculum for the AS qualification being consistent with the first part of the A level course in subjects where that is appropriate, but it need not if that would not be appropriate. If this review concludes that substantial changes are needed which could not be achieved by 2015, then we will delay the timetable and allow more time for a review. If you have any comments on the content requirements of the current A level course, please could I encourage you to share them with the exam boards. Roy Strachan of AQA is organising the review on behalf of the exam boards.

Should we decide that changes are needed to the subject criteria, on the basis of the evidence from the above reviews, we will have to consider what consultation arrangements are required and whether they can be completed in good time to allow exam boards to develop new qualifications. If, as you suggest, it is decided that there is the need for a root-and-branch review of mathematics then it will not be possible for this to be completed for teaching from September 2015 and a later implementation date will be required. However, we have asked the exam boards to approach their review with an open mind and with a focus on the production of



the best possible reformed qualifications and we must step back and let them get on with the work.

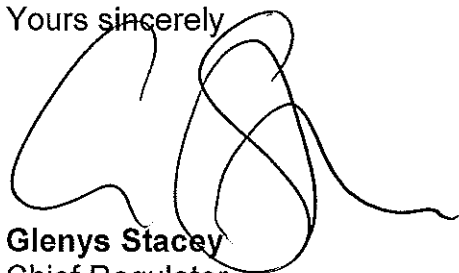
I appreciate your concerns about the question types that are currently used in A level mathematics assessments. We will be reviewing the assessment arrangements, including the assessment objectives, of the current subject criteria and we will take your views into account when carrying out this review. However, I would emphasise that the structure of future A levels is in practice a policy decision and the Secretary of State has confirmed that these qualifications should be assessed in a linear, terminal way, which means that all the assessment will take place at the end of the course of study.

We consulted last year on the qualification conditions that would apply to all A levels and in the light of that consultation we intend to apply the relevant conditions to the new A levels for teaching from September 2015 in those subjects where the exam board review has concluded that this timetable can be met. Therefore, there will be requirements for synoptic assessment, a variety of question types and a limit on the use of single mark or low mark tariff questions in each examination paper. I believe that this will go some way to addressing your concerns over the current assessment arrangements.

Finally, thank you for sharing your views on GCSE mathematics assessment. We will be starting our consultation on our regulatory requirements for new GCSE qualifications in the next few weeks, including the arrangements for tiering. Please do make sure that you respond.

I would be happy to meet with you again once we have further clarity over the arrangements for the reform of A level and GCSE qualifications in mathematics. In the meantime thank you for taking the time to write to me and share your views.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Glenys Stacey', with a long, sweeping tail extending to the right.

Glenys Stacey
Chief Regulator



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12 April, 2013

Dear Ms Stacey

ENGINEERING PROFESSORS' COUNCIL VISIT

Thank you for taking the time to see the delegation (myself, Dr Rob Best and Dr Geoff Parks) from the Engineering Professors' Council (EPC) last week. We found the meeting very valuable indeed.

We thought it would be useful to summarise our discussion and the concerns of the EPC regarding the proposed changes to the A Level and GCSE assessments.

- We welcome the recognition that the majority of students of A Level Mathematics do not go on to undertake a degree course in mathematics and that other subjects in HE such as engineering, the natural sciences and economics are important stakeholders with an interest in the standards and content of A/AS Level Mathematics and Further Mathematics. The Maths Working Group chaired by EPC includes representatives from the mathematics, physics and science communities in addition to engineering. Our experience is that there is a very high degree of agreement as to the required content of A/AS Level Mathematics courses across these disciplines.
- We agree that changes are necessary to A Levels to restore standards and avoid the current resit and learn-test-forget cultures. However, we feel that the modular structure is being made something of a scapegoat for this situation. Just as important is the predictable, highly structured "party trick" nature of the examinations at present. This is especially true in mathematics.
- We would advocate that the final synoptic assessment contains more in-depth questions requiring problem-solving skills and the ability to apply and combine the mathematical principles learnt. In order to best achieve this, we would suggest that there is a middle way between a highly modular

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assessment process and a single assessment point at the end of the second year. We are concerned that, while depth could be assessed at the end of the course, the sheer time constraints make it difficult to cover the required breadth in the assessment. For mathematics, a two-stage assessment process has much to commend itself. The first stage (usually taken at the end of Year 12) could measure a wide range of mathematical skills. This would free up assessment time at the end for the in-depth assessment of knowledge and the abilities to exercise this knowledge. The net assessment challenge would actually be more demanding than having only a single assessment point.

- There has not been any substantial change to the content and structure of A Level Mathematics since 2004. We feel that it is high time for a root-and-branch review of both its content and structure. Such a review should also include the mathematical content of other A Level subjects. For example, in many other jurisdictions' assessment schemes, mechanics is considered to be part of physics and not mathematics. We are fearful that there could be a merely superficial review of the content and an opportunity for improving and updating the curriculum would be missed. If it turns out that a full review cannot be completed in time for a 2015 start, we would advocate delaying the implementation until the content and subsequent assessment style are fully fit-for-purpose. Indeed, there is something to be said for delaying a review of A Level Mathematics until other related A Level subjects have been reviewed. If, for instance, the review of Physics A Level concluded that mathematically rigorous mechanics should be included in the specification for that subject, there would be little reason for Mathematics A Level to include mechanics options.
- Part of the review of A Level Mathematics should consider the balance between core and optional components. In general, we in HE would advocate a high proportion of the assessment being core as only the most highly selective university departments can specify which optional components must be taken. Most universities can only assume prior knowledge of the material covered in the core. We would suggest that it is time to review the traditional assumption of the pure mathematics being the core, while the applied mathematics represents the options. We believe that applications should be interspersed within the core to provide examples of the pure mathematical principles. This not only contributes to enlightenment but also helps to motivate the students.
- In the two-stage assessment process for mathematics proposed above, we believe that there would be agreement among the different HE subject stakeholders that the first stage need not have any options. This would free up one third to one half of the second assessment to be targeted to different application areas which would be especially suitable for in-depth problem-solving questions.
- We are very concerned that leaving the development of content to the individual awarding organisations could lead to significant differences in the same subject offered by different boards.

This would cause problems for university departments with confusion as to what, and what has not, been covered. Furthermore, we imagine that it would make it more difficult for Ofqual to compare and maintain standards across the awarding organisations. We strongly believe that subject-specialist advisory boards, independent of the awarding organisations, should be set up to coordinate subject content development.

- We welcome the retention of AS Level assessments and the decision to allow awarding organisations to have the same curriculum for the AS Level as for the first part of the A Level course. For students this does give the opportunity for those starting with the intention of only doing an AS Level qualification to continue to a full A Level, and vice versa. For schools and colleges, this is much more practical as many could not afford to have separate classes for AS and A Level courses, especially for the less popular subjects. For universities, this is a much more reliable and independent estimate of students' abilities than predicted A Level grades. We understand that a number of universities are now considering requiring potential applicants to take AS Levels in subjects they intend to continue to A Level so that AS grade information is available to them at the point of selection.
- The revival in the popularity of AS and A Level Further Mathematics has been a great success story in the last decade. In no small part, this can be owed to the work of the Further Mathematics Support Programme (formerly the Further Mathematics Network) managed by Mathematics in Education and Industry (MEI). In particular, the provision of an AS Further Mathematics, which can be taken either during Year 12 or Year 13, has been very popular. The content in the core of the AS programme is a great preparation for an engineering degree course accredited to meet the educational requirements for becoming a Chartered Engineer. Consequently, EPC is concerned that these reforms could have the unintended consequence of reducing the take-up of Further Mathematics. It is often taken as a fourth A Level subject. With the concentration of assessments into a few weeks at the end of the two years, we suspect that many students will be advised by their school not to take more than three A Levels. This could impact the take-up of both A Level and AS Level Further Mathematics in Year 13. Our proposal for a two-stage assessment of Mathematics would help to alleviate this problem by reducing the end of Year 13 examination load of those taking Mathematics A Level.
- We are dismayed that the Government proposes to have only a single assessment tier for GCSE Mathematics and strongly recommend the retention of two tiers. Perhaps more than in any other subject, there is a very wide range of ability in mathematics. Consequently, we do not believe that it is possible to design one programme of study that can provide both a coherent progression to A Level study and challenge for the more able students on the one hand, while also providing the reinforcement necessary to give the less mathematically able students a grasp of the basic principles. Neither type of student would be well served by a one-size-fits-all curriculum. The A and A* grades

would end up as rewards for not making many careless mistakes rather than a measure of in-depth mathematical abilities. It is important to distinguish between mathematics and numeracy. Arguably, in an ideal world, they would be assessed as two distinct subjects. For sure, a higher tier Mathematics GCSE should measure mathematical skills and knowledge.

- The Government's suggestion of introducing extension papers, in its response to the Stage 4 Qualifications Consultation, would seem to be reintroducing a higher tier by the back door. It is highly likely that fewer learners would sit these papers than sat the higher tier and there is no guarantee that all schools would give them the opportunity. Since the extension papers would become the *de facto* required transition route to A Level study, this would narrow down the number of learners prepared for A Level Mathematics. In turn, this would result in fewer students taking A Level Mathematics and would be an even tighter cap on ambition than supposedly imposed by having two tiers.

In summary, our *dream* scenario would be:

- A higher tier GCSE in Mathematics that provides excellent progression onto A Level study leading to more students taking A Level Mathematics.
- An extensive revision of the content and assessment of AS and A Level Mathematics and Further Mathematics that results in a better blend of pure and applied mathematics with final assessments really challenging students' deep understanding of mathematics and their ability to apply it in unfamiliar situations. We believe that a minimum of two stages of assessment would facilitate this.
- Compatibility in both content and standards between the awarding organisations.
- Numbers taking both Mathematics and Further Mathematics increase.
- Students entering university are more able to use their mathematical skills and better prepared to continue with their mathematical education whether they are following a course in mathematics, engineering, physics or any other subject that builds on A Level Mathematics.

In contrast, our *nightmare* scenario would be:

- A single-tier GCSE in Mathematics that fails to provide a good progression to A Level Mathematics.
- An extension paper for GCSE Mathematics is introduced but few learners take it, leading to a catastrophic fall in the numbers studying for A Level Mathematics.
- Only superficial content reviews of the AS and A Level curricula for Mathematics and Further Mathematics that are rushed through in time for implementation in 2015 resulting in a poorly designed programme of study.
- First-year students at university who have different mathematical prior knowledge and skills due to content differences between the awarding organisations.

- The number of students taking A Level Mathematics falls as a result of the single terminal assessment point.
- The numbers taking AS and A Level Further Mathematics fall due to the reduction in the number of A Level subjects studied.

We hope that, with the good offices of all concerned, the dream rather than the nightmare becomes reality.

Again, we thank you for the fruitful discussions and advice and we look forward to a continuing dialog between Ofqual and the Engineering Professors' Council.

Yours sincerely



Professor Dik Morling
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