

Glenys Stacey  
Chief Regulator



23 December 2014

Mr Nick Gibb MP  
Minister of State for School Reform  
Department for Education  
Sanctuary Building  
20 Great Smith Street  
London, SW1P 3BT

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and Examinations Regulation  
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Dear Minister

Thank you for your letter of 24 November about GCSE maths. We appreciate your interest, and like you, are intent that new maths GCSEs meet Government policy aims: to ensure all students are more confident and competent in basic maths, and to properly stretch more able students. With more content, more stretching content and more assessment, the new GCSEs are significantly more challenging than current ones. They represent a real step change in expectations.

The three specifications accredited so far all meet the policy aims, with each covering the whole of the new and more challenging GCSE maths curriculum. Nevertheless, they each take a different approach to assessment, leading to speculation about how they are equally demanding. You have asked for more information on the expert evaluation of the specifications and we will provide that as asked, of course.

I should say straightaway that although no-one can guarantee that all exam papers in a subject are of identical demand we do not set a pass mark in advance. Instead, once the papers have been sat, grade boundary marks are set by exam boards, based on how the papers performed. In the first awards of the new GCSEs in summer 2017, and following our public consultation on this last summer, decisions about grade boundary marks will be based firmly on statistical predictions derived from national cohort data. That means that the awarding process will compensate for any inevitable variation in demand between different boards' papers so that, with the accreditation process having assured us that the content assessed by each board is the same, grade standards will be comparable across boards.

That said, we strive to be as sure as possible that the new qualifications and planned assessments are comparable. As with all new GCSEs, AS and A levels, we are as confident as anyone can be at this stage that they are of the right level of demand. You appreciate I know that this judgement cannot be made simply by looking at one exam question, or a range of them. Six independent maths experts reviewed the draft specifications, all the sample assessments, the mark schemes and each exam board's assessment strategy, ahead of accreditation. This panel compared the specifications with each other and looked closely at question types,

question style and approach to language. We rejected drafts from each of AQA, OCR and Pearson before accrediting the current published versions.

In the past, the regulator's interest waned once specifications were accredited, but we are taking a different approach. To be sure that the new GCSEs compare well to each other and to see how they compare with current specifications and with similar international qualifications, over 40 independent PHD mathematicians are comparing the demand of questions here with questions from Shanghai, Massachusetts, The Netherlands, Hong Kong, Ontario, Hungary, New Zealand, Japan, Korea, Scotland, and from the Cambridge International GCSE and O level. This will give us more information about the level of demand of each of the specifications and their international counterparts.

We also set out (at accreditation) the issues we expect all exam boards to work on (attached) to make sure that the first live papers in 2017 meet the new standards. We have since met with them as planned to discuss the 'problem solving' requirements, an issue for all boards. The meeting was productive, clarifying further the detailed requirements of some of the assessment objectives - particularly in relation to mathematical problem solving - and we are now issuing amended guidance. I am enclosing our letter to exam boards summarising the discussions. I will be meeting with exam board chief executives in January to press home the requirements, and we will continue of course to give this high priority.

However, it is frustratingly difficult, nigh on impossible to determine the relative difficulty of different assessments precisely at this stage. It is only when exams run that we can see how different specifications actually perform. But what we can do, and are doing, is to run mock exams to test what we can in as near a real environment as we can. Sample students will sit exams made up of questions from the maths specimen assessment materials. We will be looking at how students actually perform; how hard they find the maths in the questions and also how their performance is affected by the presentation of the maths, for example the context in which the maths is set.

In addition, and to see how the different exam boards' assessments work, we will test how the questions from each stimulate deep mathematical understanding. To elicit students' thinking, we will run a research exercise with students working in pairs to solve the questions. Through their discussion and answers to the questions we will capture their thinking. Experts will then judge the quality of the mathematical understanding elicited by different approaches to the assessment of problem solving.

Given the issues common to all boards, and our continuing work, there is no reason to ask any particular exam board to withdraw its sample assessment materials or to agree to amend them at this stage. Instead, there is further work for all that may lead to additional sample assessment materials. We have the power to require exam boards to amend their sample assessment materials if they are misleading and we will not hesitate to do so should our further work show unacceptable differences between the assessments.

In conclusion, we are confident that each of the accredited qualifications will deliver the Government's policy aims, with a significant increase in expectations for all students. They all cover the full extent of the new and more challenging maths content as set out by Government, and provide for more assessment for all.

With the work we have done so far and the work we have in hand and plan to do, we are confident that Government aims will be met.

Yours sincerely

A handwritten signature in black ink, appearing to be 'Glenys Stacey', written in a cursive style.

**Glenys Stacey**  
Chief Regulator



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12 December 2014

Ms Lesley Davies  
Responsible Officer  
Pearson  
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WC1V 7BH

Dear Lesley

Thank you for your colleagues' attendance at the meeting on 10 December to discuss the assessment of mathematical problem solving in the new GCSE mathematics specifications. I hope your colleagues found it a useful meeting. We addressed the points made in the generic feedback to boards in September, a copy of which is attached to this letter.

In relation to point 2, we agreed that decision making is central to mathematical problem solving as recorded in the Subject Level Guidance for Mathematics. This decision making means that the procedures to be used for a task or question should not be clear to students. This, of course, includes ensuring that the instructions given to students do not make clear the procedures to be used to solve the problem. Crucially, though, it also means that due regard must be given to the content requirements for a given tier. In other words, if there is a reasonable expectation that a student has been taught the content for that tier, and knowledge of that content would result in the procedures to be used in the question being clear, the question risks becoming routine and may no longer be problem solving. Both these aspects mean that there will be implications for how problem solving questions are designed at foundation and higher tier, which relates to point 6. While these aspects were implicit in the current guidance, we have suggested some alternative phrasing to make them clearer.

In relation to this, we discussed the importance of considering the Assessment Objective first, then Strands and then Elements when considering the allocation of marks to items, to ensure those allocations are accurate. This relates to point 1. Also in terms of mark allocations, we briefly discussed point 3 in the feedback, which relates to allocations of marks to Elements, within Strands. These two points, we feel, are related and can be addressed by carefully considering how well an item addresses the intentions of the overall Assessment Objective.

We agreed that, in relation to points 4 and 5, while aspects of problem solving can be assessed in questions with small numbers of marks, there must be opportunities within each set of assessments for students to be faced with extended, or multi-step, problem solving questions.

This ensures that students are tested on their ability to work through a problem solving cycle as described by AO3. A suggested additional bullet has been added into the guidance to reinforce this point. In order to further emphasise the importance of multi-step questions, we agreed that a sentence should be added to the bullet point describing the balance between Strands to set out more clearly the balance between AO3.1b/3.1d and AO3.1a/3.1c.

In terms of specifically addressing the second part of point 4 (around assessment of AO3.4 and AO3.5), the section on evaluation has been expanded to include methods, results and solutions.

In order to ensure our discussions and agreements are taken forward, we have made suggested amendments to the statutory guidance, as discussed at the meeting. These are enclosed with this letter and we seek your feedback on these amendments.

Should we decide to propose any amendments to the subject level guidance, as we made clear at the meeting, a consultation must be carried out. We will keep you informed of timelines.

Also, as we made clear at the meeting, any future materials you produce to support your GCSE mathematics specifications must pay due regard to any updated guidance.

Lastly, your colleagues sought clarification on two issues. They requested clarification on where and when the term "sample assessment materials" can be used as a title for materials you may develop. We can confirm that there are no specific regulatory requirements relating to the term "sample assessment materials". This means you are free to produce further materials and to give them the title of "sample assessment materials". We would of course expect any SAMs, and indeed the live papers, to reflect the exam boards' assessment strategy.

Your colleagues also asked for clarification on the status of Ofqual guidance, particularly in relation to conditions and requirements. As we said at the meeting, conditions must be followed and you must pay due regard to the guidance. There is a useful explanatory note at the start of the GCSE (9 to 1) guidance which states that "this document constitutes guidance for the purposes of section 153 of the Apprenticeships, Skills, Children and Learning Act 2009 (the '2009 Act') and Condition GCSE2.1(c). An awarding organisation has a legal obligation under the 2009 Act to have regard to this guidance in relation to each GCSE Qualification that it makes available or proposes to make available. Condition GCSE2.1(c) imposes the same obligation in respect of the guidance below which is issued under that Condition. An awarding organisation should use the guidance to help it understand how to comply with the GCSE Qualification Level Conditions and associated requirements."

Should you have a rationale underpinning a different way in which you wish to meet requirements (i.e. different to the guidance), and we are confident that this rationale is sound, you may take a different approach, which must be laid out in your Assessment Strategy.

I wish to thank your colleagues for their contributions to the meeting. Mathematical problem solving is an important aspect of mathematics, both at GCSE and at A level, and a shared understanding of what this means and how it is best assessed is crucial to ensuring assessments are of high quality.

If you have any comments on the suggested changes to the guidance, please send them to Alison Tonkin ([alison.tonkin@ofqual.gov.uk](mailto:alison.tonkin@ofqual.gov.uk)) by noon on 19 December.

Yours sincerely

A handwritten signature in blue ink, appearing to read 'Janet', with a long horizontal flourish extending to the right.

**Janet Holloway**

Associate Director Standards for Design, Development and Evaluation of  
General Qualifications

## Generic feedback to exam boards from the GCSE mathematics accreditation process

1. When considering the allocation of marks to items, this should be by Assessment Objective (AO) first, then Strand, then Element. In this way, items will have broad fit to the AO. This can apply for AO2 items but is particularly important for AO3 where marks should only be awarded if the question is about problem solving. [See the first point under Agreements and Definitions for AO3: "*These tasks must require candidates to solve problems without the procedures that should be used being clear: there is therefore an emphasis here on decision-making*".]
2. Across the exam boards, there is further work necessary to reach a clear and shared understanding on what constitutes AO3 (and AO2) and on the appropriate division of marks between AO1 and AO3 (or AO2) on such questions.
3. There are allocations within Strands that need reconsidering in order to be accurate (e.g. 2.3a & 2.3b, 2.4a & 2.4b).
4. The Strands of AO3 reflect the problem solving cycle and as such could be considered as parts of a continuum rather than as independent Strands. There is potential for developing better extended problem solving questions. This would increase opportunities for better assessment of AO3.4 and 3.5.
5. If assessment of AO3 is dominated by questions that are allocated 1 or 2 marks, there is limited potential for candidates to demonstrate effective mathematical problem solving.
6. It would be helpful to consider further whether there is any difference between what can be considered problem solving at Foundation tier and at Higher tier.

September 2014

Proposed changes to Ofqual Subject Level Guidance on GCSE mathematics AO3

AO3: Solve problems within mathematics and in other contexts			30% (Higher Tier) 25% (Foundation Tier)
Strands	Elements	Coverage	Agreements and definitions
<b>1 – Translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes</b>	1a – Translate problems in mathematical contexts into a process	<ul style="list-style-type: none"> <li>▪ Full coverage over the shortest possible time period (but not in each set of assessments)</li> <li>▪ Each series should include problems in both mathematical and non-mathematical contexts, as well as both translation into a process and a series of processes – but this may be done in any combination</li> </ul>	<ul style="list-style-type: none"> <li>▪ The Strands of AO3 reflect a problem solving cycle and as such could be considered as parts of a continuum rather than as independent Strands. Each set of assessments should provide opportunities for Learners to undertake extended, or multi-step, problem solving questions.</li> <li>▪ In problem solving tasks, there should be an emphasis on decision-making. This means that tasks should require Learners to solve problems without the procedures that should be used being clear from the question or task.</li> <li>▪ It is possible to have tasks where all the marks are allocated to AO3 but, in such situations, each mark must be awarded against the AO3 strands and elements. It will often be the case that, within a problem-solving question, where one or more marks are awarded for procedure and accuracy, such marks must be allocated to AO1.</li> <li>▪ Responses should not require explanation or justification as this is the focus in AO2, but working must usually be indicated to ensure that partially</li> </ul>
	1b – Translate problems in mathematical contexts into a series of processes		
	1c – Translate problems in non-mathematical contexts into a process		
	1d – Translate problems in non-mathematical contexts into a series of processes		
<b>2 – Make and use connections between different parts of mathematics</b>	<i>The strand is a single element</i>	Full coverage in each set of assessments (but not in every assessment)	
<b>3 – Interpret results in the context of the given problem</b>	<i>The strand is a single element</i>	Full coverage in each set of assessments (but not in every assessment)	
<b>4 – Evaluate methods used and results obtained</b>	4a – Evaluate methods used	Full coverage in each set of assessments (but not in every assessment)	
	4b – Evaluate results obtained	Full coverage in each set of assessments (but not in every assessment)	



		every assessment)	correct AO3 responses can still be credited. However, it may be appropriate in some cases that partial credit can still be given even where working is not shown – this would be reflected in mark schemes.
<b>5 – Evaluate solutions to identify how they may have been affected by assumptions made</b>	<i>The strand is a single element</i>	Full coverage in each set of assessments (but not in every assessment)	<ul style="list-style-type: none"> <li>▪ Where relevant, responses must be presented such that they are within the frame of the original problem rather than in the abstract.</li> <li>▪ There will be a greater emphasis for both tiers on strands 1/2/3 rather than on strands 4/5. Within Strand 1, there will be a greater emphasis on 1b and 1d than 1a and 1c to ensure an appropriate amount of multi-step problem-solving tasks within each set of assessments.</li> <li>▪ <b>Make and use connections</b> – these linkages must be generated by the Learner rather than being explicit in the task.</li> <li>▪ <b>Evaluate methods, results and solutions</b> – this could relate to methods used, results obtained and/or solutions and assumptions generated by the Learner or provided to the Learner; it should not be understood as pertaining solely to mathematical modelling.</li> </ul>

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