AS and A Level Mathematics and Further Mathematics

Introduction

AS and A Level Mathematics and Further Mathematics are being reformed in Wales for first teaching from September 2017. The reformed A Levels will be produced and delivered by WJEC, and will be the only versions of the qualifications available to learners on state funded programmes in Wales, as no other exam board has decided to develop these qualifications for use in Wales. As part of the reform process we are asking for views on the proposed content, structure and assessment of the reformed qualification.

We have developed the proposals in this questionnaire through consultation with a number of stakeholders including the awarding body, WJEC, school and college practitioners, universities, Estyn and the Welsh Government. The outcomes of this questionnaire will help inform the development of approval criteria and conditions for the new A Level Mathematics and A Level Further Mathematics. The specifications and sample assessment materials of these new qualifications will be developed and approved on the basis of the approval criteria published by Qualifications Wales.

Subject aims and content

Subject aims and objectives

The current subject criteria for AS and A Level Mathematics and Further Mathematics can be found at the link below:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/371173/11-10-18-gce-maths.pdf

We propose that the current subject aims and learning outcomes are used for the subject aims and objectives in the reformed AS and A Level Mathematics and Further Mathematics qualifications in Wales.

Q1: To what extent do you agree/disagree that the current subject aims should be used in the reformed A Level Mathematics and Further Mathematics?

- ○ I strongly agree
- ○ I agree
- ○ I neither agree nor disagree
- ○ I disagree
- ○ I strongly disagree
- ○ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Subject content

A Level Mathematics and A Level Further Mathematics are one of a number of qualifications that have been reviewed by the A Level Content Advisory Board (ALCAB). The full report can be found at the link below:

https://alevelcontent.files.wordpress.com/2014/07/alcab-report-on-mathematics-and-further-mathematics-july-2014.pdf

The ALCAB Mathematics and Further Mathematics Panel made a number of recommendations in regards to subject content. These recommendations are listed below:

Recommendation 1: 100 per cent of the content for the single A Level in mathematics should be fully prescribed centrally

Recommendation 5: For [the A Level in] Further Mathematics the panel considers that a core of 50% should be prescribed

Recommendation 6: For the AS in Further Mathematics a minimum of 30% of the content must be drawn from the prescribed material of the A Level in Further Mathematics and must include matrices and complex numbers

Recommendation 7: The content currently contained in modules entitled “Decision Mathematics” should be completely removed from A Level Mathematics

The Department for Education (DfE) in England has prescribed the content for all of A Level Mathematics and 50% of the A Level Further Mathematics. This content must be used by all awarding bodies in the reformed A Level Mathematics and A Level Further Mathematics in England. This means that, within A Level Mathematics there are no optional units and all learners must study core mathematics, mechanics and statistics within their A Level Mathematics study. By adopting the ALCAB recommendations in Wales, we are also proposing that the A Level Mathematics and A Level Further Mathematics in Wales will use the content specified by the DfE. The prescribed content from the DfE can be found at the links below:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/513764/GCE_AS_and_A_level_subject_content_for_mathematics_with_appendices.pdf
https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/513769/GCE_AS_and_A_level_subject_content_for_further_mathematics.pdf

We propose adopting the ALCAB recommendations, and therefore the subject content prescribed by the DfE, but with minor alterations to the subject content (namely in the statistics content of AS and A Level Mathematics and moving topics such as simple harmonic motion from the AS content to the optional A2 Level content in A Level Further Mathematics). This approach would provide alignment to A Level Mathematics and A Level Further Mathematics in England, but also provide clearer alignment of content between the two qualifications in Wales allowing them to be delivered in sequence or in parallel.

Q2a: To what extent do you agree/disagree with the proposal described for A Level Mathematics in Wales?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Q2b: To what extent do you agree/disagree with the proposal described for A Level Further Mathematics in Wales?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Assessment structure

The current A Level Mathematics comprises six equally weighted units across the qualification. Four units are compulsory (Core 1, Core 2, Core 3 and Core 4) and two units are optional which can include mechanics, statistics or decision mathematics units.

The A Level Further Mathematics currently builds on units undertaken in A Level Mathematics. Students must take a total of six units where two Pure Mathematics units are compulsory with a further four units that can cover any combination of pure mathematics, mechanics, statistics or decision mathematics.

In reformed A Levels in Wales the assessment weightings of the full A Level are split with outcomes from the AS Level assessments and the A2 Level assessments contributing 40% and 60% to the full A Level, respectively.

Taking into account the recommendations from ALCAB, and the change in assessment weightings across the full A Level, we propose that the AS Level Mathematics and AS Level Further Mathematics will consist of two units and the A2 Level Mathematics and A2 Level Further Mathematics must consist of a minimum of two units and a maximum of three units.

Q3a: To what extent do you agree/disagree with the proposed assessment structure for A Level Mathematics in Wales?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Q3b: To what extent do you agree/disagree with the proposed assessment structure for A Level Further Mathematics in Wales?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Assessment objectives

The assessment objectives and their weightings in the current A Level Mathematics and Further Mathematics are:

Objective	Requirements
AO1	recall, select and use their knowledge of mathematical facts, concepts and techniques in a variety of contexts;
AO2	construct rigorous mathematical arguments and proofs through use of precise statements, logical deduction and inference and by the manipulation of mathematical expressions, including the construction of extended arguments for handling substantial problems presented in unstructured form;
AO3	recall, select and use their knowledge of standard mathematical models to represent situations in the real world; recognise and understand given representations involving standard models; present and interpret results from such models in terms of the original situation, including discussion of the assumptions made and refinement of such models;
AO4	comprehend translations of common realistic contexts into Mathematics; use the results of calculations to make predictions, or comment on the context; and, where appropriate, read critically and comprehend longer mathematical arguments or examples of applications;
AO5	use contemporary calculator technology and other permitted resources (such as formulae booklets or statistical tables) accurately and efficiently; understand when not to use such technology, and its limitations; give answers to appropriate accuracy.

The following assessment objectives are currently proposed for reformed A Level Mathematics and Further Mathematics qualifications in England:

Objective	Requirements
AO1	**Use and apply standard techniques** Learners should be able to: • select and correctly carry out routine procedures; and • accurately recall facts, terminology and definitions
AO2	**Reason, interpret and communicate mathematically** Learners should be able to: • Construct rigorous mathematical arguments (including proofs); • Make deductions and inference; • Assess the validity of mathematical arguments; • Explain their reasoning; and • Use mathematical language correctly. *Where questions/tasks targeting this assessment objective will also credit Learners for the ability to 'use and apply standard techniques' (AO1) and/or to 'solve problems within mathematical and other contexts' (AO3) an appropriate portion of the marks for the question/task must be attributed to the corresponding assessment objective(s).*
AO3	**Solve problems with mathematics and in other contexts** Learners should be able to: • Translate problems in mathematical and non-mathematical contexts into mathematical processes; • Interpret solution in the context of a problem, and, where appropriate, evaluate their accuracy ad limitations; • Translate situations in context into mathematical models; • Use mathematical models; and • Evaluate the outcomes of modelling in context, recognise the limitations of models and, where appropriate, explain how to refine them. *Where questions/tasks targeting this assessment objective will also credit Learners for the ability to 'use and apply standard techniques' (AO1) and/or to 'reason, interpret and communicate mathematically' (AO2) an appropriate portion of the marks for the question/task must be attributed to the corresponding assessment objective(s).*

In line with other AS and A Levels reformed in Wales, we propose that the reformed A Level Mathematics and A Level Further Mathematics should have the same assessment objectives as those proposed in England.

Q4: To what extent do you agree/disagree that the proposed assessment objectives in England should apply in Wales?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Assessment objective weightings

The following assessment objective weightings have been proposed for reformed A Level Mathematics and Further Mathematics in England:

Objective	Requirements	Mathematics		Further Mathematics	
		AS Level	**A Level**	**AS Level**	**A Level**
AO1	Use and apply standard techniques	60%	50%	60%	60%
AO2	Reason, interpret and communicate mathematically	20%	25%	At Least 10%	At least 15%
AO3	Solve problems with mathematics and in other contexts	20%	25%	At Least 10%	At least 15%

**Ofqual is proposing to apply accepted tolerances to the prescribed assessment objective weightings.*

The difference in the A Level qualification structures between Wales and England (the decoupling of the AS Level to the A Level in England) are reflected in the assessment objective weightings being proposed for Wales to ensure comparability between AS Level and A Level qualifications in England and Wales. With this is mind we propose the following assessment objectives weightings for the reformed A Level Mathematics and A Level Further Mathematics in Wales:

Objective	Requirements	Mathematics			Further Mathematics		
		AS Level	**A2 Level**	**Full A Level**	**AS Level**	**A2 Level**	**Full A Level**
AO1	Use and apply standard techniques	50%	50%	50%	50%	50%	50%
AO2	Reason, interpret and communicate mathematically	25%	25%	25%	At Least 10%	At least 15%	At least 15 %
AO3	Solve problems with mathematics and in other contexts	25%	25%	25%	At Least 10%	At least 15%	At least 15 %

**Like Ofqual we propose to apply accepted tolerances to the prescribed assessment objective weightings to support assessment production.*

Q5: To what extent do you agree/disagree that these assessment objectives weightings should apply in Wales?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Non examination assessment (NEA)

In reformed qualifications in Wales, non examination assessment is only used where it is the most suitable form of assessment, for example, to carry out a field study or a musical performance. Non examination assessment is therefore only used when written examinations cannot provide valid assessment of specific skills or knowledge. Currently A Level Mathematics and Further Mathematics is fully assessed through written examinations. We propose that the reformed A Level Mathematics and Further Mathematics in Wales should be assessed fully through written examinations.

Q6: To what extent do you agree/disagree that A Level Mathematics and Further Mathematics should be fully assessed through written examinations?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Use of large datasets in statistics

The A Level Content Advisory Board Mathematics and Further Mathematics Panel had two recommendations in regards to large datasets:

Recommendation 8: The use of real, large data sets should permeate the teaching, learning and assessment of statistics in AS and A Level mathematics and further mathematics

Recommendation 9: Assessment items in statistics should place more emphasis upon understanding, interpretation of data and making inferences from data than is found in the current content

We propose that the A Level Mathematics and A Level Further Mathematics will incorporate the use of large data sets in teaching and learning and learners will be assessed on the skills obtained from such activities through examinations.

Q7: To what extent do you agree/disagree that the use of large datasets should be assessed in A Level Mathematics and Further Mathematics?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Calculators

Currently there are restrictions on the type of calculator that can be used within A Level Mathematics and Further Mathematics examinations, for example, calculators with mathematical formula functionality cannot be used in examinations. We propose that the use of scientific calculators should be permitted in assessments. To ensure transparency and fairness for all candidates we propose that the specification should make clear which types of calculators will be permitted for any given assessment component, together with any restrictions on functionality.

Q8: To what extent do you agree/disagree that scientific calculators should be permitted in A Level Mathematics and Further Mathematics assessments?

- ◯ I strongly agree
- ◯ I agree
- ◯ I neither agree nor disagree
- ◯ I disagree
- ◯ I strongly disagree
- ◯ I don't know

Comments (we would encourage you to make a comment, particularly if you disagree with the proposal)

Continuing professional development/resources

Q9: What support and resources do you feel centres and teachers may require to achieve maximum readiness to deliver the revised specification?

Please provide comments

Equality impact

The Equality Act 2010 states that public bodies must have 'due regard', when making decisions, to ensure there is no discrimination, harassment or victimisation of individuals or groups, to ensure equality and to foster good relations in relation to protected characteristics (age, sex, disability, sexual orientation, race, religion, marriage and civil partnership, pregnancy and maternity and sexual reassignment).

Q10: With this is mind, please highlight below if you feel any of this proposal has the potential to have a positive or negative impact on individuals with protected characteristics and whether any of the proposal would cause accessibility issues for learners in Wales.

Personal details

Participants under the age of 16 are requested NOT to fill in this section

If you supply contact details, we may contact you for clarification of your answers. Qualifications Wales (QW) will not share these details, or details of your answers with any third party.

Personal details

Name

Company

Email Address

Are you responding as an individual or on behalf of your organisation?

- ◯ Individual
- ◯ Organisation

Please select the type of organisation or choose 'not applicable' if responding as an individual

- ◯ School
- ◯ College
- ◯ University
- ◯ Qualification Awarding Body
- ◯ Government (Local, National, UK or EU)
- ◯ Non-Applicable
- ◯ Other (please specify)

Are you a: (please select as appropriate)

- [ ] Teacher
- [ ] College Lecturer
- [ ] University Lecturer
- [ ] Student
- [ ] Parent
- [ ] Other (please specify)