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Subject principles for GCSE Mathematics

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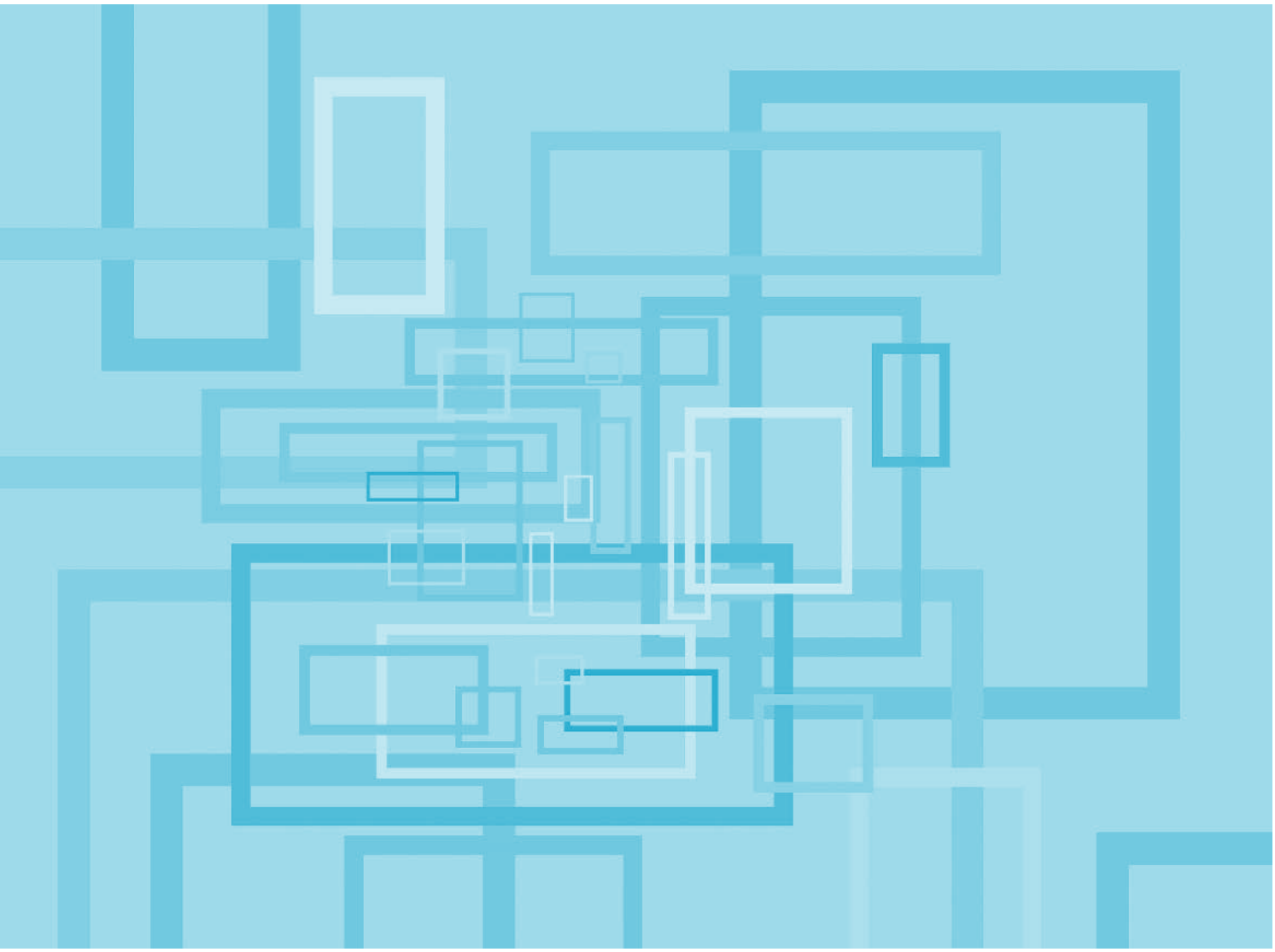

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Subject principles for GCSE Mathematics

Audience Awarding organisations and those delivering GCSE qualifications.

Overview This document provides the framework for the development of the specification for GCSE Mathematics in Wales for first teaching from September 2015.

Action required Awarding organisations must use this document as the framework and criteria within and against which to create the detail of the specification for GCSE Mathematics for Wales.

Further information

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Introduction

This document outlines the rationale, aims and learning outcomes, content, assessment objectives and scheme of assessment for the GCSE specification in Mathematics.

It provides the framework and criteria within and against which an awarding organisation or awarding organisations create the detail of the specification.

Subject principles are intended to:

- ensure that the rigour of GCSE is maintained
- ensure that the specification builds on the knowledge, understanding and skills established by the national curriculum for Wales and the National Literacy and Numeracy Framework (LNF) and facilitates progression to higher-level qualifications in mathematics.

An accredited specification must meet the requirements of the GCSE qualification principles as well as the relevant subject principles.

Rationale

1. GCSE Mathematics will be a new mathematics specification for use in Wales from September 2015 – developed in response to recommendation 19 of the *Review of Qualifications for 14 to 19-year-olds in Wales* (Welsh Government, 2012).

2. Recommendation 19 stated that:

   'The Welsh Government should introduce, for teaching from 2015, two new mathematics GCSEs, one covering numeracy and the other covering aspects of mathematics techniques. The GCSE in Numeracy should build explicitly on the levels of numeracy that are expected to be developed by the end of Key Stage 3 in response to the Literacy and Numeracy Framework.

   Both GCSEs should be:

   - full, single-award GCSEs covering the full GCSE grade range
   - assessed through externally marked examinations that are consistent across Wales.'

3. Reasons given for the recommendation included:

   - 'the levels of numeracy demonstrated by many learners are not high enough
   - GCSEs in Mathematics are widely expected to be, but are not, reliable indicators of appropriate levels of Numeracy
   - some employers and universities consider that grade C, or even above, does not guarantee sufficient numeracy.'

4. GCSE in Mathematics should normally be taken alongside GCSE – Numeracy.

5. GCSE Mathematics will build on and progress from the levels of mathematics expected at the end of KS3 through the National Curriculum Programme of Study for Mathematics.

6. Whilst GCSE in Mathematics – Numeracy will assess the mathematics that learners will need in their everyday lives, in the world of work, and in other general curriculum areas, GCSE Mathematics will extend to aspects of mathematics needed for progression to scientific, technical or further mathematical study.

7. The GCSE specification in Mathematics should encourage learners to be inspired, moved and challenged by following a broad, coherent, satisfying and worthwhile course of study. It should help learners to develop confidence in, and a positive attitude towards, mathematics and to recognise the importance and relevance of mathematics to their everyday lives and to society.

8. GCSE Mathematics should enable learners to appreciate the coherence, creativity, elegance and power of mathematics. It should prepare learners to make informed decisions about further learning opportunities and career choices.

9. GCSE Mathematics will have an emphasis on those aspects of mathematics required for progression into mathematics or mathematically-related disciplines or employment routes. It will feature problems set both in real-world contexts and within mathematics itself and will encourage learners to employ and evaluate different mathematical techniques.

10. GCSE Mathematics will be consistent with the National Curriculum Key Stage 3 and 4 Programmes of Study requirements for Mathematics in Wales and the expectations set out for numeracy as part of the National Literacy and Numeracy Framework in Key Stages 3 and 4.

11. By having a greater focus on the mathematics described above, the new GCSE in Mathematics will provide employers and others with a more reliable indicator of learners' level of achievement in the more technical aspects of mathematics.

Aims and learning outcomes

12. The GCSE specification in Mathematics should enable learners to:

- develop knowledge, skills and understanding of mathematical methods, techniques and concepts required for progression into mathematics or mathematically-related disciplines or employment routes
- make connections between different areas of mathematics
- select and apply mathematical methods in both mathematical and real-world contexts

- reason mathematically, construct arguments and simple proofs, and make logical deductions and inferences
- develop and refine strategies for solving a range of mathematical and real-world problems
- interpret mathematical results and draw and justify conclusions that are relevant to the context
- communicate mathematical information in a variety of forms.

Subject content

13. The content of GCSE specification in Mathematics must reflect the aims and learning outcomes.

14. The GCSE specification in Mathematics – Numeracy in combination with GCSE in Mathematics must meet the National Curriculum Key Stage 3 and 4 Programmes of Study requirements for Mathematics in Wales in full.

15. GCSE Mathematics will be primarily taken by 15 and 16-year-olds and the assessments will take into account the characteristics of these students including the need for age-appropriate content, language and contexts.

Assessment objectives and their weightings

16. The assessment objectives for GCSE Mathematics and their relative weightings will be as follows:

Assessment objectives		Weighting
AO1	Recall and use their knowledge of the prescribed content	50%–60%*
AO2	Select and apply mathematical methods	10%–20%*
AO3	Interpret and analyse problems and generate strategies to solve them	25%–35%*

AO1 Recall and use their knowledge of the prescribed content

- Recall and use mathematical facts and concepts.
- Recall and use standard mathematical methods.
- Follow direct instructions to solve problems involving routine procedures *(e.g. factorise an algebraic expression, solve a cubic equation using trial and improvement, express a number as the product of its prime factors, calculate the volume of a cone, calculate compound interest).*

AO2 Select and apply mathematical methods

- Select and use the mathematics and resources needed to solve a problem.
- Select and apply mathematical methods to solve non-standard or unstructured, multi-step problems.

- Make decisions when tackling a given task, for example, choosing how to display given information.

AO3 Interpret and analyse problems and generate strategies to solve them

- Devise strategies to solve non-routine or unfamiliar problems, breaking them into smaller, more manageable tasks, where necessary.
- Communicate mathematically, using a wide range of mathematical language, notation and symbols to explain their reasoning and express mathematical ideas unambiguously.
- Construct arguments and proofs using logical deduction.
- Interpret findings or solutions in the context of the original problem.
- Use inferences and deductions made from mathematical information to draw conclusions.
- Reflect on results and evaluate the methods employed.

Scheme of assessment

17. The GCSE Mathematics specification must allocate a weighting of 100 per cent to external assessment.

18. GCSE Mathematics will be a linear specification: all assessments must be taken at the end of the course, which will usually be in May or June.

19. There will be a resit opportunity in November each year.

20. The assessment of GCSE Mathematics will be tiered as follows:

Higher	**A***	**A**	**B**	**C**				
Intermediate			**B**	**C**	**D**	**E**		
Foundation				**(C)**	**D**	**E**	**F**	**G**

21. The C grade may be awarded at the Foundation Tier for those candidates who have performed exceptionally well and may have been inappropriately entered at this tier. Candidates who have a realistic chance of obtaining a C grade should be entered for the Intermediate or Higher Tier and must be made aware of this.

22. It is expected that only a very small number of candidates, if any, will achieve a C grade on the Foundation Tier.

23. Question papers in Mathematics must be targeted at one of the three tiers.

24. Two marks will be awarded on each examination paper, at each tier, for the assessment of 'Communicating, organising and writing accurately'. These marks will be in addition to the marks allocated to the mathematics. One mark will be awarded for communicating and organising. The other mark will be

awarded for writing accurately (incorporating language, grammar, punctuation, spelling and mathematical notation).

25. Each tier will consist of two papers that are equally weighted.

26. At each tier, a calculator will be permitted on one paper and not permitted on the other.

27. Indicative total assessment times for GCSE Mathematics are set out below.

Tier	Hours	Minutes
Higher	3	30
Intermediate	3	30
Foundation	3	–

Grade descriptions

28. The Welsh Government/Qualifications Wales will be giving further consideration to the role of grade descriptions within the context of awarding arrangements for GCSE Mathematics.