Contents

WJEC GCSE in METHODS in MATHEMATICS (Pilot)
Revised January 2011
For Teaching from 2010
For Award from 2012

Piloting of a Linked Pair of GCSEs in Mathematics

For the duration of the pilot candidates will be required to enter for both units in GCSE Methods in Mathematics and both units in GCSE Applications of Mathematics.

SUMMARY OF ASSESSMENT

The assessment of units for GCSE in Methods in Mathematics is tiered as follows:

Higher Tier: Grades A* - D
Foundation Tier: Grades C - G

All candidates are required to sit 2 units, both of which are written papers.

Unit 1: Methods (Non-calculator) (50%) **Higher Tier: 2 hours, 100 Marks (100 UMS)** **Foundation Tier: $1\frac{1}{2}$ hours, 80 Marks (100 UMS)**
The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions set on the designated content of this unit. A calculator will **not** be allowed in this unit.
Unit 2: Methods (Calculator) (50%) **Higher Tier: 2 hours, 100 Marks (100 UMS)** **Foundation Tier: $1\frac{1}{2}$ hours, 80 Marks (100 UMS)**
The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions set on the designated content of this unit. A calculator will be allowed in this unit.

Units are tiered, with entry at higher tier or foundation tier presented as options within an examination series i.e. an individual unit may be entered at one tier only in each examination series. The subject award is untiered and will be based on the best performance in each unit.

For each unit the assessment will take into account the quality of written communication (including mathematical communication) used in the answers to specific questions. These questions will be clearly indicated on each question paper.

ASSESSMENT OPPORTUNITIES

	Entry Code		January 2011	June 2011	January 2012	June 2012	January and June 2013 and thereafter
	Subject	Option*					
Unit 1 Foundation	4363	01 or W1	✓	✓	✓	✓	✓
Unit 1 Higher	4363	02 or W2	✓	✓	✓	✓	✓
Unit 2 Foundation	4364	01 or W1				✓	✓
Unit 2 Higher	4364	02 or W2				✓	✓
Subject Award	4365					✓	✓

* Option Codes: English Medium 01, Welsh Medium W1

Qualification Accreditation Number: 500/7914/1

METHODS in MATHEMATICS

1 INTRODUCTION

1.1 Rationale

In combination with GCSE in Applications of Mathematics, this GCSE specification in Methods in Mathematics meets the requirements of the National Curriculum Key Stage 4 Programme of Study for Mathematics.

The principle behind the linked pair is that it is an extension of GCSE Mathematics provision to a double award qualification. This follows the recommendation of Professor Adrian Smith in his report “Making Mathematics Count”.

This specification is designed to assess candidates’ skills and understanding of mathematical methods, techniques and concepts.

This specification meets the General Criteria for GCSE and the Subject Criteria for GCSE Methods in Mathematics. Assessment for this qualification is carried out according to codes of practice published by the regulatory authorities. The qualification may be undertaken either through the medium of English or Welsh.

GCSE qualifications are reported on an eight-point scale from A* to G, where A* is the highest grade. Candidates who fail to reach the minimum standard for a grade to be awarded are recorded as U (unclassified) and do not receive a qualification certificate.

The specification sets out to assess what candidates know, understand and can do, enabling them to demonstrate their full potential.

The specification will encourage the teaching of links between different areas of the curriculum by targeting questions that cover the content from different subject areas within mathematics.

The specification is intended to promote a variety of styles of teaching and learning so that the courses are enjoyable for all participants. It will enable students to progress to higher-level courses of mathematical studies.

For mathematics to be useful, learners must have the skills and confidence to apply, combine and adapt their mathematical knowledge to new situations in their life and work. They need the capacity to identify and understand the role that mathematics plays in the world and use mathematics in ways that enable them to function as effective citizens and benefit them in life and work.

This specification has been designed to allow these skills to be assessed at both higher and foundation tiers.

1.2 Aims and Learning Outcomes

1. Following a course in GCSE Methods in Mathematics should encourage learners to be inspired, moved and changed by following a broad, coherent, satisfying and worthwhile course of study. The course should help learners to develop confidence in, and a positive attitude towards, mathematics and to recognise the importance of mathematics in their own lives and to society. The course should enable learners to make informed judgements about the use of technology. Specifications should enable learners to appreciate the coherence, creativity, elegance and power of mathematics. They should prepare learners to make informed decisions about further learning opportunities and career choices.

2. GCSE specifications in Methods in Mathematics must enable learners to:

   - develop knowledge, skills and understanding of mathematical methods, techniques and concepts;
   - make connections between different areas of mathematics;
   - select and apply mathematical methods in mathematical contexts;
   - reason mathematically, construct arguments and simple proofs, and make logical deductions and inferences;
   - develop and refine strategies for solving a range of mathematical problems;
   - communicate mathematical information in a variety of forms.

1.3 Prior Learning and Progression

Although there is no specific requirement for prior learning, this specification builds upon the knowledge, skills and understanding developed in the Key Stage 3 Programmes of Study in Mathematics.

This specification provides a basis for the study of mathematics and related subjects at Advanced Subsidiary and Advanced GCE and also for further study leading to other qualifications.

1.4 Equality and Fair Assessment

GCSEs often require assessment of a broad range of competences. This is because they are general qualifications and, as such, prepare candidates for a wide range of occupations and higher-level courses.

The revised GCSE qualification and subject criteria have been reviewed to identify whether any of the competences required by the subject presented a potential barrier to any disabled candidates. If this was the case, the situation was reviewed again to ensure that such competences were included only where essential to the subject. The findings of this process were discussed with disability groups and with disabled people.

Reasonable adjustments are made for disabled candidates in order to enable them to access the assessments. For this reason, very few candidates will have a complete barrier to any part of the assessment. Information on reasonable adjustments is found in the Joint Council for Qualifications document *Regulations and Guidance Relating to Candidates who are eligible for Adjustments in Examinations.* This document is available on the JCQ website (www.jcq.org.uk).

Candidates who are still unable to access a significant part of the assessment, even after exploring all possibilities through reasonable adjustments, may still be able to receive an award. They would be given a grade on the parts of the assessment they have taken and there would be an indication on their certificate that not all of the competences have been addressed. This will be kept under review and may be amended in future.

1.5 Classification Codes

Every specification is assigned a national classification code indicating the subject area to which it belongs. The classification code for this specification is 2210.

Centres should be aware that candidates who enter for more than one GCSE qualification with the same classification code will have only one grade (the highest) counted for the purpose of the School and College Performance Tables.

Centres may wish to advise candidates that, if they take two specifications with the same classification code, schools and colleges are very likely to take the view that they have achieved only one of the two GCSEs. The same view may be taken if candidates take two GCSE specifications that have different classification codes but have significant overlap of content. Candidates who have any doubts about their subject combinations should check with the institution to which they wish to progress before embarking on their programmes.

2 CONTENT for METHODS IN MATHEMATICS

The subject content for each unit at each tier is listed in the following pages.

Column 1 shows the content that will be assessed in Unit 1.
Column 2 shows the content that is assessed in Unit 2.

The content of the Higher tier which is not included in the Foundation tier appears in bold.

The content which is common to both GCSE Methods in Mathematics and GCSE Applications of Mathematics appears in italics.

Appropriate examples are highlighted by shading.

It is important that, during the course, candidates should be given opportunities to:

- use mathematics in a wide range of contexts
- make mental calculations and calculations without the aid of a calculator;
- make estimates;
- understand 3-D shape;
- use computers;
- collect data.

The content for GCSE Methods in Mathematics is divided into four areas:

- Number
- Algebra
- Geometry
- Probability

Foundation Tier - Number

Methods Unit 1	Methods Unit 2
• *Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations.* • Arithmetic of real numbers. • *Numbers and their representations including powers, roots, indices (integers).* • *Approximate to specified or appropriate degrees of accuracy including a given power of ten, number of decimal places and significant figures.* • *Use the concepts and vocabulary of factor (divisor), multiple, common factor, common multiple,* highest common factor, least common multiple, prime number and prime factor decomposition. Write 360 as the product of its prime factors in index form. Candidates may be required to find the LCM and HCF of numbers written as the product of their prime factors. • Understand that factors of a number can be derived from its prime factorisation. • Understand and use the relationship between fractions and decimal representations, including recurring and terminating decimals. • *Divide a quantity in a given ratio.* Divide £1520 in the ratio 5 : 3 : 2. • Understand and use Venn diagrams to solve problems.	• *Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations.* • Arithmetic of real numbers. • *Approximate to specified or appropriate degrees of accuracy including a given power of ten, number of decimal places and significant figures.* • *Understand that 'percentage' means 'number of parts per 100' and use this to compare proportions.* • *Use multipliers for percentage change.* • *Interpret fractions, decimals and percentages as operators.* • Understand and use the relationship between ratio and fractions. • *Find proportional change*, using fractions, decimals and percentages. • *Understand and use direct proportion.* • *Use calculators effectively and efficiently.*

Foundation Tier - Algebra

Methods Unit 1	Methods Unit 2
• Distinguish between the different roles played by letter symbols in algebra, using the correct notation. • Distinguish in meaning between the words equation, inequality, formula, and expression. • *Manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, taking out common factors.* Simplify $3a - 4b + 4a + 5b$. Expand $7(x - 3)$. Simplify $2(3x - 1) - (x - 4)$. Simplify $x(x - 1) + 2(x^2 - 3)$. Factorise $6x + 4$.	• *Set up, and solve simple equations and inequalities.* The angles of a quadrilateral are x°, 49°, $3x^\circ$ and 111°. Form an equation in x, and use your equation to find the value of x. Three times a number n plus 6 is less than 27. Write down an inequality which is satisfied by n and rearrange it in the form $n < a$ where a is a rational number. Solve $x + 6 = 15$, $3 = \frac{12}{x}$, $x = \frac{12}{3}$, $5x + 2 = 17$, $10x + 9 = 6x + 11$, $3(1 - x) = 5(2 + x)$, $\frac{1}{2}(x - 1) = 3x + 1$.
• Solve quadratic equations approximately using a graph. • *Derive a formula, substitute numbers into a formula* and change the subject of a formula. Wage earned = hours worked × rate her hour. Find the wage earned if a man worked for 30 hours and was paid at the rate of £4.50 per hour. Find the value of $6f + 7g$ when $f = -3$ and $g = 2$. • Generate terms of a sequence using term-to-term and position-to-term definitions. • Form linear expressions to describe the n^{th} term of a sequence.	
• *Use the conventions for coordinates in the plane and plot points in all four quadrants.* • *Recognise and plot equations that correspond to straight-line graphs in the co-ordinate plane.* • Use geometric information to complete diagrams on a co-ordinate grid. Find the coordinates of the fourth vertex of a parallelogram with vertices at (2, 1), (– 7, 3) and (5, 6). • Recognise and use equivalence in numerical, algebraic and graphical representations.	• Use algebra to support and construct arguments.

Foundation Tier - Geometry

Methods Unit 1	Methods Unit 2
• *Recall and use properties of angles at a point, angles at a point on a straight line (including right angles), perpendicular lines, and vertically opposite angles.* • *Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals.* • *Recall the properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus.* • Calculate and use the sums of the interior and exterior angles of polygons. • Solve problems in the context of tiling patterns and tessellation.	• *Recognise reflection and rotation symmetry of 2D shapes.* • Describe and transform 2D shapes using single or combined rotations, reflections, translations, or enlargements by a positive scale factor and distinguish properties that are preserved under particular transformations. • Use 2D vectors to describe translations. • *Understand congruence and similarity, including the relationship between lengths, in similar figures.* • *Use Pythagoras' theorem in 2D.* • *Distinguish between centre, radius, chord, diameter, circumference, tangent, arc, sector and segment.* • *Find circumferences of circles and areas enclosed by circles.* • *Calculate perimeters and areas of shapes made from triangles and rectangles.* • *Calculate volumes of right prisms and of shapes made from cubes and cuboids.*

Foundation Tier - Probability

Methods Unit 1	Methods Unit 2
Probability • *Understand and use the vocabulary of probability and the probability scale.* • *Understand and use theoretical models for probabilities including the model of equally likely outcomes.* • *Understand and use estimates of probability from relative frequency.* • Use of sample spaces for situations where outcomes are single events and for situations where outcomes are two successive events. • Identify different mutually exclusive and exhaustive outcomes and know that the sum of the probabilities of all these outcomes is 1. • Understand and use set notation to describe events and compound events. • Use Venn diagrams to represent the number of possibilities and hence find probabilities. • Compare experimental data and theoretical probabilities, and make informal inferences about the validity of the model giving rise to the theoretical probabilities. • *Understand that when a statistical experiment or survey is repeated there will usually be different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics.*	

Higher Tier - Number

Methods Unit 1	Methods Unit 2
• *Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations.* • *Arithmetic of real numbers, including* ***exact calculation with surds and pi****.* • *Numbers and their representations including powers, roots, indices (integers,* ***fractional and negative)****, and* ***standard index form****.* Simplify $81^{\frac{3}{4}}$, $8^{-\frac{2}{3}}$.	• *Understand and use number operations and the relationships between them, including inverse operations and hierarchy of operations.* • Arithmetic of real numbers, including **exact calculation with pi**. • ***Standard index form****.*
• *Approximate to specified or appropriate degrees of accuracy including a given power of ten, number of decimal places and significant figures.* • *Use the concepts and vocabulary of factor (divisor), multiple, common factor, common multiple,* highest common factor, least common multiple, prime number and prime factor decomposition. Write 360 as the product of its prime factors in index form. Candidates may be required to find the LCM and HCF of numbers written as the product of their prime factors. • Understand that factors of a number can be derived from its prime factorisation.	• *Approximate to specified or appropriate degrees of accuracy including a given power of ten, number of decimal places and significant figures.*
	• *Understand that 'percentage' means 'number of parts per 100' and use this to compare proportions.* • *Use multipliers for percentage change****; work with repeated percentage change; solve reverse percentage problems****.* Given that a meal in a restaurant costs £36 with VAT at 17·5%, its price before the VAT is calculated as $£\frac{36}{1{\cdot}175}$.
• Understand and use the relationship between fractions and decimal representations including recurring and terminating decimals. $0.\dot{1}\dot{2} = 0.12121212.....$ $0.\dot{1}2\dot{3} = 0.123123.....$ $0.142857142857 = \frac{1}{7}$ $0.121212 = \frac{12}{99}$ 0.101001000 1.... cannot be expressed as a fraction	• *Interpret fractions, decimals and percentages as operators.* • Understand and use the relationship between ratio and fractions.
	• *Find proportional change and* ***repeated proportional change,*** using fractions, decimals and percentages. • *Understand and use direct and* ***inverse*** *proportion.*
• *Divide a quantity in a given ratio.* *Divide £1520 in the ratio 5 : 3 : 2.*	
	• *Use calculators effectively and efficiently, including* ***trigonometric*** *functions.*
• Understand and use Venn diagrams to solve problems.	

Higher Tier - Algebra

Methods Unit 1

- Distinguish the different roles played by letter symbols in algebra, using the correct notation.
- Distinguish in meaning between the words equation, inequality, formula, **identity** and expression.
- *Manipulate algebraic expressions by collecting like terms, by multiplying a single term over a bracket, taking out common factors,* **multiplying two linear expressions, factorising quadratic expressions including the difference of two squares, and simplifying rational expressions**.

  Simplify $3a - 4b + 4a + 5b$.
  Expand $7(x - 3)$.
  Simplify $2(3x - 1) - (x - 4)$.
  Simplify $x(x - 1) + 2(x^2 - 3)$.
  Expand and simplify $(2x - y)(3x + 4y)$.
  Expand and simplify $(3x - 2y)^2$.
  Factorise $6x + 4$.
  Factorise
  i) $3x^2 - 6x$,
  ii) $x^2 + 3x + 2$,
  iii) $x^2 - 5x - 6$,
  iv) $x^2 - 9$,
  v) $3m^2 - 48$,
  vi) $3m^2 - 10m + 3$,
  vii) $12d^2 + 5d - 2$.

- Solve quadratic equations approximately using a graph, **exactly by factorising, completing the square**.

  Solve $x^2 + 7x + 12 = 0$.
- *Derive a formula, substitute numbers into a formula* and change the subject of a formula.

  Wage earned = hours worked × rate her hour.
  Find the wage earned if a man worked for 30 hours and was paid at the rate of £4.50 per hour.

  Find the value of $6f + 7g$ when $f = -3$ and $g = 2$.

  Given that $m = 7n - 3$, find n in terms of m.

  Given that $\frac{1}{a} = \frac{1}{b} + \frac{1}{c}$ find b in terms of a and c.
- Generate terms of a sequence using term-to-term and position-to-term definitions.
- Form linear **and quadratic** expressions to describe the n^{th} term of a sequence.

Methods Unit 2

- *Set up, and solve simple equations and inequalities*

  The angles of a quadrilateral are $x°$, 49°, $3x°$ and 111°.
  Form an equation in x, and use your equation to find the value of x.

  Three times a number n plus 6 is less than 27. Write down an inequality which is satisfied by n and rearrange it in the form n < a where a is a rational number.

  Solve $x + 6 = 15$,
  $3 = \frac{12}{x}$,
  $x = \frac{12}{3}$,
  $5x + 2 = 17$,
  $10x + 9 = 6x + 11$,
  $3(1 - x) = 5(2 + x)$,
  $\frac{1}{2}(x - 1) = 3x + 1$.

  Solve $3x + 1 \geq 7$.
  Solve $4 - x \leq 5$.
- **Set up and use equations that describe direct and inverse proportion.**
- **Set up, and solve simultaneous equations in two unknowns where one of the equations might include squared terms in one or both unknowns.**

- Solve quadratic equations **using the formula**.

  Find, correct to 2 decimal places, the roots of the equation $3x^2 - 7x - 2 = 0$.

Higher Tier - Algebra

Methods Unit 1	Methods Unit 2
• *Use the conventions for coordinates in the plane and plot points in all four quadrants.* • *Recognise and plot equations that correspond to straight-line graphs in the co-ordinate plane.* • Use geometric information to complete diagrams on a co-ordinate grid. Find the coordinates of the fourth vertex of a parallelogram with vertices at (2,1), (–7, 3) and (5, 6). • **Use *y* = *mx* + *c* and understand the relationship between gradients of parallel and perpendicular lines.** • **Draw, sketch, recognise graphs of linear, quadratic, simple cubic functions, the reciprocal function $y = \frac{1}{x}$ with $x \neq 0$, the function $y = k^x$ for integer values of *x* and simple positive values of *k*.** • Sketch simple transformations of a given function. • Recognise and use equivalence in numerical, algebraic and graphical representations.	• Use algebra to support and construct arguments **and proofs**. • **Draw, sketch, recognise graphs of the trigonometric functions *y* = sin *x*, *y* = cos *x* and *y* = *tan x*.** • **Understand and use the Cartesian equation of a circle centred at the origin and link to the trigonometric functions.** • **Construct the graphs of simple loci.**

Higher Tier - Geometry

Methods Unit 1	Methods Unit 2
• *Recall and use properties of angles at a point, angles at a point on a straight line (including right angles), perpendicular lines, and vertically opposite angles.* • *Understand and use the angle properties of parallel and intersecting lines, triangles and quadrilaterals.* • *Recall the properties and definitions of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus.* • Calculate and use the sums of the interior and exterior angles of polygons. • Solve problems in the context of tiling patterns and tessellation. • **Understand, prove and use circle theorems, intersecting chords.**	• *Recognise reflection and rotation symmetry of 2D shapes.* • **Understand and use the midpoint and the intercept theorems.** • **Understand and construct geometrical proofs using formal arguments, including proving the congruence, or non congruence of two triangles in all possible cases.** • Describe and transform 2D shapes using single or combined rotations, reflections, translations, or enlargements by a positive scale factor **then use positive fractional and negative scale factors** and distinguish properties that are preserved under particular transformations. • Use 2D vectors to describe translations. • **Use vectors to solve simple geometric problems and construct geometric arguments.** • *Understand congruence and similarity, including the relationship between lengths, **areas and volumes** in similar figures.* • *Use Pythagoras' theorem in 2D **and 3D**.* • ***Use the trigonometric ratios to solve 2D and 3D problems.*** • **Use the sine and cosine rules to solve problems in 2D and 3D.** • *Distinguish between centre, radius, chord, diameter, circumference, tangent, arc, sector and segment.* • *Find circumferences of circles and areas enclosed by circles.* • *Calculate perimeters and areas of shapes made from triangles and rectangles **and other shapes**.* • **Calculate the area of a triangle using $\frac{1}{2}ab\sin C$.** • *Calculate volumes of right prisms and of shapes made from cubes and cuboids.* • ***Solve mensuration problems involving more complex shapes and solids.***

Higher Tier - Probability

Methods Unit 1	Methods Unit 2
• *Understand and use the vocabulary of probability and the probability scale.* • *Understand and use theoretical models for probabilities including the model of equally likely outcomes.* • *Understand and use estimates of probability from relative frequency.* • Use of sample spaces for situations where outcomes are single events and for situations where outcomes are two successive events. • Identify different mutually exclusive and exhaustive outcomes and know that the sum of the probabilities of all these outcomes is 1. • Understand and use set notation to describe events and compound events. • Use Venn diagrams to represent the number of possibilities and hence find probabilities. • **Use tree diagrams to represent outcomes of compound events, recognising when events are independent or dependent.** • **Know when to add or multiply probabilities: if *A* and *B* are mutually exclusive, then the probability of *A* or *B* occurring is P(*A*) + P(*B*); if *A* and *B* are independent events, the probability of *A* and *B* occurring is P(*A*) × P(*B*).** • Compare experimental data and theoretical probabilities, and make informal inferences about the validity of the model giving rise to the theoretical probabilities. • *Understand that when a statistical experiment or survey is repeated there will usually be different outcomes, and that increasing sample size generally leads to better estimates of probability and population characteristics.*	

3 ASSESSMENT – METHODS IN MATHEMATICS

3.1 Scheme of Assessment

Assessment for GCSE Methods in Mathematics is tiered, i.e. externally assessed components/units are targeted at the grade ranges of A*-D (Higher Tier) and C-G (Foundation Tier). Questions will be designed to enable candidates to demonstrate what they know, understand and can do.

An individual unit may be entered at one tier only at each examination series (though candidates may enter different units at different tiers at the same series).

Tier	Grades Available
Higher	A*, A, B, C, D
Foundation	C, D, E, F, G

The scheme of assessment will consist of:

Higher Tier: Unit 1 Methods (Non-calculator)
Duration: 2 hours; weighting: 50%; 100 marks (100 UMS)

Foundation Tier: Unit 1 Methods (Non-calculator)
Duration: $1\frac{1}{2}$ hours; weighting: 50%; 80 marks (100 UMS)

The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions set on the designated content of this unit. A calculator will **not** be allowed in this unit.

Higher Tier: Unit 2 Methods (Calculator)
Duration: 2 hours; weighting: 50%; 100 marks (100 UMS)

Foundation Tier: Unit 2 Methods (Calculator)
Duration: $1\frac{1}{2}$ hours; weighting: 50%; 80 marks (100 UMS)

The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions set on the designated content of this unit. A calculator will be allowed in this unit.

3.2 Assessment Objectives

The specification requires candidates to demonstrate their knowledge, skills and understanding in the following assessment objectives. These relate to the knowledge, skills and understanding in the relevant programme of study.

AO1 Recall and use their knowledge of the prescribed content.

AO2 Select and apply mathematical methods.

AO3 Interpret and analyse problems and use mathematical reasoning to solve them.

The written papers will assess all assessment objectives.

The weightings of assessment objectives in each unit will be within the following ranges.

ASSESSMENT OBJECTIVES		Weighting (%)
AO1	**Recall and use their knowledge of the prescribed content**	**50 – 60**
AO2	**Select and apply mathematical methods**	**15 – 25**
AO3	**Interpret and analyse problems and use mathematical reasoning to solve them**	**20 – 30**

3.3 Quality of Written Communication

For each unit the assessment will take into account the quality of written communication (including mathematical communication) used in the answers to specific questions. These questions will be clearly indicated on each question paper.

Mark schemes for all components include the following specific criteria for the assessment of written communication (including mathematical communication):

- legibility of text; accuracy of spelling, punctuation and grammar; clarity of meaning;
- selection of a form and style of writing appropriate to purpose and to complexity of subject matter;
- organisation of information clearly and coherently; use of specialist vocabulary where appropriate.

4 AWARDING, REPORTING AND RE-SITTING

GCSE qualifications are reported on an eight point scale from A* to G, where A* is the highest grade. The attainment of pupils who do not succeed in reaching the lowest possible standard to achieve a grade is recorded as U (unclassified) and they do not receive a certificate.

This is a unitised specification which allows for an element of staged assessment. Units may be re-taken once only (with the better result counting) before aggregation for the subject award. At least 40% of the assessment must be taken at the end of the course, to satisfy the requirement for terminal assessment, and the results from that terminal assessment must contribute to the subject award. Therefore, any previous results for the unit(s) that are being used to satisfy the requirement for 40% terminal assessment cannot contribute to the subject award, even if they are better than the results achieved at the end of the course.

Results for a unit have a shelf-life limited only by the shelf-life of the specification. A candidate may retake the whole qualification more than once.

Individual unit results are reported on a uniform mark scale (UMS) with the following grade equivalences:

GRADE	MAX.	A*	A	B	C	D	E	F	G
Unit 1	100	90	80	70	60	50	40	30	20
Unit 2	100	90	80	70	60	50	40	30	20
Subject Award	200	180	160	140	120	100	80	60	40

5 GRADE DESCRIPTIONS

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates awarded particular grades. The descriptions must be interpreted in relation to the content specified by the specification; they are not designed to define that content. The grade awarded will depend in practice upon the extent to which the candidate has met the assessment objectives overall. Shortcomings in some aspects of the examination may be balanced by better performances in others.

Grade F

Candidates use some mathematical techniques, terminology, diagrams and symbols from the foundation tier consistently, appropriately and accurately. Candidates use some different representations effectively and can select information from them. They complete straightforward calculations competently with and without a calculator. They use simple fractions and percentages, simple formulae and some geometric properties, including symmetry.

Candidates work mathematically in everyday and meaningful contexts. They make use of diagrams and symbols to communicate mathematical ideas. Sometimes, they check the accuracy and reasonableness of their results.

Candidates test simple hypotheses and conjectures based on evidence. Candidates are able to use data to look for patterns and relationships. They state a generalisation arising from a set of results and identify counter-examples. They solve simple problems, some of which are non-routine.

Grade C

Candidates use a range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately. Candidates are able to use different representations effectively and they recognise some equivalent representations e.g. numerical, graphical and algebraic representations of linear functions; percentages, fractions and decimals. Their numerical skills are sound and they use a calculator accurately. They apply ideas of proportionality to numerical problems and use geometric properties of angles, lines and shapes.
Candidates identify relevant information, select appropriate representations and apply appropriate methods and knowledge. They are able to move from one representation to another, in order to make sense of a situation. Candidates use different methods of mathematical communication.

Candidates tackle problems that bring aspects of mathematics together. They identify evidence that supports or refutes conjectures and hypotheses. They understand the limitations of evidence and sampling, and the difference between a mathematical argument and conclusions based on experimental evidence.

They identify strategies to solve problems involving a limited number of variables. They communicate their chosen strategy, making changes as necessary. They construct a mathematical argument and identify inconsistencies in a given argument or exceptions to a generalisation.

Grade A

Candidates use a wide range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately. Candidates are able to use different representations effectively and they recognise equivalent representations for example numerical, graphical and algebraic representations. Their numerical skills are sound, they use a calculator effectively and they demonstrate algebraic fluency. They use trigonometry and geometrical properties to solve problems.

Candidates identify and use mathematics accurately in a range of contexts. They evaluate the appropriateness, effectiveness and efficiency of different approaches. Candidates choose methods of mathematical communication appropriate to the context. They are able to state the limitations of an approach or the accuracy of results. They use this information to inform conclusions within a mathematical or statistical problem.

Candidates make and test hypotheses and conjectures. They adopt appropriate strategies to tackle problems (including those that are novel or unfamiliar), adjusting their approach when necessary. They tackle problems that bring together different aspects of mathematics and may involve multiple variables. They can identify some variables and investigate them systematically; the outcomes of which are used in solving the problem.

Candidates communicate their chosen strategy. They can construct a rigorous argument, making inferences and drawing conclusions.

They produce simple proofs and can identify errors in reasoning.

6 THE WIDER CURRICULUM

6.1 Key Skills, Functional Skills and Essential Skills (Wales)

GCSE Methods in Mathematics will provide a range of opportunities for developing these skills, whether in preparation for functional skills assessments or to provide contexts in which evidence for key skills or essential skills (Wales) portfolios may be produced. The following key/essential skills can be developed through this specification at levels 1 and 2:

- Communication
- Application of Number
- Information and Communication Technology
- Problem Solving
- Working with Others
- Improving Own Learning and Performance

Mapping of opportunities for the development of these skills against key/essential skills evidence requirements at level 2 is provided in 'Exemplification of Key/Essential Skills for Mathematics', available on WJEC website.

6.2 Opportunities for use of technology

It is expected that candidates will have access to calculators and other appropriate technological aids during the course.

In the examination the following rules will apply.

Calculators must be:

- of a size suitable for use on the desk,
- either battery or solar powered.

Calculators must not:

- be designed or adapted to offer any of these facilities:
  - language translators,
  - symbolic algebra manipulation,
  - symbolic differentiation or integration,
  - communication with other machines or the internet.
- be borrowed from another candidate during an examination for any reason.
- have retrievable information stored in them - this includes:-
  - databanks,
  - dictionaries,
  - mathematical formulae,
  - text.

The candidate is responsible for the following:

- the calculator’s power supply,
- the calculator’s working condition.

6.3 Spiritual, Moral, Ethical, Social and Cultural Issues

This specification will enable centres to provide courses in Mathematics that will allow candidates to discriminate between truth and falsehood. The mathematical models of the real world will naturally raise for discussion moral, social and cultural issues. Candidates will be required to reason logically and to consider the consequences of decisions.

6.4 Citizenship

This specification is designed to make a contribution to the development of the knowledge, skills and understanding of citizenship. Opportunities for addressing citizenship will arise naturally, particularly when candidates address problems in number and statistics.

6.5 Environmental Issues

The study of number, mensuration and statistics will give candidates the opportunity to discuss the various environmental issues facing society.

6.6 Health and Safety Consideration

Aspects of the work included in the study of statistics and on the use of ICT will allow candidates the opportunity to consider a variety of health and safety issues.

6.7 The European Dimension

Relevant examples are chosen by the teacher/student to illustrate mathematical concepts. This will have a global, European and/or national context, e.g. the study of suitable financial systems.