Contents

WJEC GCSE in MATHEMATICS - LINEAR

For Teaching from 2010
For Award from 2012

This is a linear specification: all assessments must be taken at the end of the course.

MATHEMATICS - LINEAR

SUMMARY OF ASSESSMENT

The assessment of this specification is tiered as follows:

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

All candidates are required to sit two written papers.

Paper 1 (Non-calculator) (50%) **Written Paper: Foundation Tier - $1\frac{3}{4}$ hours; Higher Tier - 2 hours** **Foundation Tier - 100 marks; Higher Tier - 100 marks**
The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions which may be set on any part of the subject content of the specification. A number of questions will assess candidates' understanding of more than one topic from the subject content. A calculator will **not** be allowed in this paper.
Paper 2 (Calculator) (50%) **Written Paper: Foundation Tier - $1\frac{3}{4}$ hours; Higher Tier - 2 hours** **Foundation Tier - 100 marks; Higher Tier - 100 marks**
The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions which may be set on any part of the subject content of the specification. A number of questions will assess candidates' understanding of more than one topic from the subject content. A calculator will be allowed in this paper.

In each paper 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		**June 2012**	**Every November and June thereafter**
	Subject	Option*		
Foundation Tier	4370	01 or W1	✓	✓
Higher Tier	4370	02 or W2	✓	✓

* Option Codes: English Medium 01, Welsh Medium W1

Qualification Accreditation Number: 500/8506/2

This is a linear specification: all assessments must be taken at the end of the course.

MATHEMATICS - LINEAR

1 INTRODUCTION

1.1 Rationale

This specification meets the General Criteria for GCSE and the Subject Criteria for GCSE 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.

This specification sets out to assess what candidates know, understand and can do, enabling them to demonstrate their full potential at both higher and foundation tiers.

This 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.

This 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. Following this linear course, learners could benefit from having a greater understanding of the links between subject areas, in particular graphical and algebraic representation, which are prevalent through A level mathematics.

At each tier, on both Paper 1 and Paper 2, questions can be set on any part of the subject content for that tier, encouraging a more holistic approach to the teaching of mathematics as a subject.

Centres who offer one-year GCSE qualifications would benefit from this linear specification as they would not be constrained by the division of content present in a unitised GCSE or by preparing for assessments when delivering the course in a short period of time.

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 Mathematics - Linear should encourage students 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. Specifications should prepare learners to make informed decisions about the use of technology, the management of money, further learning opportunities and career choices.

2. GCSE specifications in mathematics must enable learners to:

   - develop knowledge, skills and understanding of mathematical methods and concepts;
   - acquire and use problem-solving strategies;
   - select and apply mathematical techniques and methods in mathematical, everyday and real-world situations;
   - reason mathematically, make deductions and inferences and draw conclusions;
   - interpret and communicate mathematical information in a variety of forms appropriate to the information and context.

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 SPECIFICATION CONTENT

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

The subject content has been grouped into the following topic areas.

- Number
- Algebra
- Geometry and Measure
- Probability and Statistics

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

The content of the Higher Tier subsumes the content of the Foundation Tier.

Examples are highlighted by shading.

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

- develop problem solving skills;
- generate strategies to solve problems that are unfamiliar;
- answer questions that span more than one topic area of the curriculum;
- make mental calculations and calculations without the aid of a calculator;
- make estimates;
- understand 3-D shape;
- use computers;
- collect data.

This linear specification allows for a more holistic approach to teaching and learning, giving teachers flexibility to teach topics in any order and to combine different topic areas.

Foundation Tier - Number

Reading and writing whole numbers of any magnitude expressed in figures or words.

Rounding whole numbers to the nearest 10, 100, 1000, etc.

Understanding place value and decimal places.

Rounding decimals to the nearest whole number or a given number of decimal places.
Rounding numbers to a given number of significant figures.

Equivalences between decimals, fractions, ratios and percentages.

Directed numbers in practical situations.
Ordering directed numbers.

Converting numbers from one form into another.

Write $\frac{1}{4}$ as a percentage.
Write 0·2 as a fraction.
Write 75% as a decimal

Ordering whole numbers, decimals, fractions and percentages.

List in ascending order: 0·25, $\frac{1}{3}$, 10%.

Compare pass rates in fractional and percentage forms.

In class 11X, $\frac{1}{3}$ of the class passed a test. In class 11Y, 25% passed the same test. Which class had the better pass rate?

The use of index notation for positive integral indices.
Writing whole numbers in index form.
$8 = 2^3$, $32 = 2^5$.

Use of the common properties of numbers, including odd, even, multiples, factors, primes.
Use of the rules of indices (positive indices only).
$2^3 \times 2^5 = 2^8$
Write 360 as the product of its prime factors in index form.

Least common multiple. Highest common factor.
Candidates may be required to find the LCM and HCF of numbers written as the product of their prime factors.

Use of the terms square, square root, cube, cube root and reciprocal.
Find 3^2, $\sqrt{25}$, 10^3, the square of 7, $\sqrt[3]{64}$, the reciprocal of 0·7.

Use the facilities of a calculator, including the constant function, memory and brackets, to plan a calculation and evaluate expressions.

Use of addition, subtraction, multiplication, division, square, square root, power, root, constant, memory, brackets and appropriate statistical functions.

Know how a calculator orders its operations. (Candidates will not be expected to list the key depressions that they have made.)

Read a calculator display correct to a specified number of decimal places or significant figures.

Foundation Tier - Number

Addition, subtraction, multiplication and division of whole numbers, decimals, fractions and negative numbers.

Finding a fraction or percentage of a quantity.

Expressing one number as a fraction or percentage of another.

Fractional and percentage changes. (Increase and decrease.)

Repeated proportional changes; appreciation and depreciation.
The value of a car is £12 000. Each year its value decreases by 10%. Find the value of the car at the end of three years.

Calculating using ratios in a variety of situations, in context.
Proportional division.
Divide £1520 in the ratio 5 : 3 : 2.

Recognise that recurring decimals are exact fractions, and that some exact fractions are recurring decimals.
The following notation may be used for recurring decimals;
$0 \cdot \dot{2} = 0 \cdot 222222......$

Use estimation in multiplication and division problems with whole numbers to obtain approximate answers.
Candidates must show sufficient working in order to demonstrate how they have obtained their estimate.
$\frac{2 \cdot 8 \times 4 \cdot 23}{61} \approx \frac{3 \times 4}{60} = 0 \cdot 2$

Interpretation and use of mathematical information presented in written or visual form when solving problems.
TV programme schedules, bus/rail timetables, distance charts, holiday booking information.

Money: the basic principles of personal and household finance.
e.g. fuel and other bills, hire purchase, VAT, taxation, discount, best buys, wages and salaries.

Simple and compound interest, profit and loss.
(Candidates will not be required to find the original quantity given the result of a proportional change.)

Foreign currencies and exchange rates.

Give solutions in the context of a problem, selecting an appropriate degree of accuracy, interpreting the display on a calculator, and recognising limitations on the accuracy of data and measurements.
When working in £, interpret a calculator display of 49.9 as £49.90.

Knowing whether to round up or down as appropriate.
Find how many 47-seater coaches will be needed for a school trip for a party of 352.

Rounding an answer to a reasonable degree of accuracy in the light of the context.

Recognising that measurement is approximate and that a measurement expressed to a given unit is in possible error of half a unit.
The lower and upper bounds of 140 (to the nearest 10) are 135 and 145 respectively.

The lower and upper bounds of numbers expressed to a given degree of accuracy.

Foundation Tier - Algebra

Recognition, description and continuation of patterns in number.
Description, in words and symbols, of the rule for the next term of a sequence.
Finding the nth term of a sequence where the rule is linear.

Construct and interpret graphs that describe real-life situations.
Construction and interpretation of conversion graphs.
Interpretation of graphical representation used in the media.

Construction and interpretation of travel graphs.

Use of coordinates in 4 quadrants.
Drawing, interpretation and recognition of the graphs of $x = a$, $y = b$, $y = ax + b$.
Knowing that the form $y = mx + c$ represents a straight line and that m is the gradient of the line and c is the value of the y-intercept.

Recognition that $y = 3x$ is steeper than $y = x$ and that the line $y = 2x + 3$ and the line $y = 2x - 1$ are parallel.

Drawing and interpreting of graphs of the form $y = ax^2 + bx + c$, $y = ax^3 + b$.

Draw the curve $y = x^2 - 1$ from $x = -2$ to $x = 4$. Write down the coordinates of the points where the line $y = 2$ meets this curve.

Draw the curve $y = 2x^2 - 3x - 4$ from $x = -2$ to $x = 3$.
Write down the value of x for which $2x^2 - 3x - 4$ is a minimum.
Write down this minimum value.

Substitution of positive and negative whole numbers, fractions and decimals into simple formulae expressed in words and symbols.

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

$v = u + at$
Find v when $u = 20$, $a = -2$ and $t = 3$.

Foundation Tier - Algebra

Understanding the basic conventions of algebra.

$a + a + a = 3a$
$a \times a \times a = a^3$
$a \times b \times 2 = 2ab$
$2(a + b) = 2a + 2b$

Formation and simplification of expressions involving sums, differences, products and powers.

Simplify
(i) $2x^2 \times 3x^3$
(ii) $(3x^2)^3$
(iii) $\frac{6x^5}{3x^2}$

Collection of like terms.

Simplify
(i) $3a - 4b + 4a + 5b$
(ii) $2(3x - 1) - (x - 4)$
(iii) $x(x - 1) + 2(x^2 - 3)$

Extraction of common factors.

$6x + 4 = 2(3x + 2)$

Changing the subject of a formula when the subject appears in one term only.

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

Formation and manipulation of linear equations.
Formation and manipulation of simple linear inequalities.

A number n multiplied by 3, 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.

Solution of linear equations and simple linear inequalities with whole number and fractional coefficients.

Solve $3(1 - x) = 5(2 + x)$.
Solve $3 = \frac{12}{x}$.
Solve $4 - x \geq 5$.
Solve $\frac{1}{2}(x - 1) = 3x + 1$.

Solve a range of quadratic and cubic equations by trial and improvement methods.

Find, by trial and improvement, the solution of the equation $x^3 - 5x = 80$ which lies between 4 and 5. Give your answer correct to one decimal place.

Distinguish in meaning between the words equation, formula and expression.

Foundation Tier - Geometry and Measure

The geometrical terms: point, line, plane, parallel, right angle, clockwise and anticlockwise turns, acute, obtuse and reflex angles, perpendicular, horizontal, vertical, face, edge and vertex.

Vocabulary of triangles, quadrilaterals, other polygons and circles.
Isosceles, equilateral, scalene, exterior/interior angle, diagonal, square, rectangle, parallelogram, rhombus, kite, trapezium, polygon (including pentagon, hexagon and octagon), radius, diameter, chord, tangent, arc, circumference, sector.

Simple solid figures: cube, cuboid, cylinder, prism, pyramid, tetrahedron, cone and sphere.

Interpretation and drawing of nets.

Use and draw 2D representations of 3D shapes. Use of isometric paper.

Accurate use of ruler, pair of compasses and protractor. (Lengths accurate to 2mm and angles accurate to 2°)
Construction of triangles, quadrilaterals and circles.
Use of ruler and pair of compasses to do constructions.
Bisect a given line, bisect a given angle, construct angles of 60°, 30°, 90° and 45°.
The identification of congruent shapes.

Knowledge that, in similar figures, corresponding sides are in the same ratio.

Essential properties of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus; classify quadrilaterals by their geometric properties.

Simple description of symmetry in terms of reflection in a line/plane or rotation about a point.
Order of rotational symmetry.

Angles at a point. Angles at a point on a straight line. Opposite angles at a vertex. Parallel lines. Corresponding and alternate angles.

Angle properties of triangles.
Use the fact that the angle sum of a triangle is 180°.
Use the fact that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices.
Use angle properties of equilateral, isosceles and right-angled triangles, understand congruence; explain why the angle sum of any quadrilateral is 360°.

Understand and use the properties of parallelograms.

Regular and irregular polygons.
Sum of the interior and sum of the exterior angles of a polygon.

Pythagoras' theorem. (2-D only, including reverse problems.)

Use of Cartesian coordinates in 4 quadrants.
Locating points with given coordinates.

Finding the coordinates of points identified by geometrical information.
Find the coordinates of the fourth vertex of a parallelogram with vertices at (2, 1), (–7, 3) and (5, 6).

Finding the coordinates of the mid-point of the line segment *AB*, given points *A* and *B*.

Location determined by distance from a given point and angle made with a given line.

Foundation Tier - Geometry and Measure

Reflection.

Rotations through 90°, 180°, 270°. Clockwise or anticlockwise rotations.
Centre of rotation.

Enlargements with positive scale factors, centre of enlargement.
Scaling with positive scale factors.

Translation.

Candidates will be expected to draw the image of a shape under a transformation.

Interpretation and construction of scale drawings.
Scales may be written in the form
1 cm represents 5 m, or 1:500.
Use of bearings. (Only three figure bearings will be used. e.g. 065°, 237°.)

Constructing the locus of a point which moves such that it is
(i) a given distance from a fixed point or line,
(ii) equidistant from two fixed points or lines.

Solving problems involving intersecting loci in two dimensions.
Questions on loci may involve inequalities.

Tessellations.

Standard metric units of length, mass and capacity.
The standard units of time; the 12- and 24- hour clock.
(The notation for the 12- and 24- hour clock will be 1:30 p.m. and 13:30.)

The use of common measures of time, length, mass, capacity and temperature in the solution of practical problems.

Knowledge and use of the relationship between metric units.

Conversion between the following metric and Imperial units:
km - miles; cm, m - inches, feet; kg - lb; litres - pints, gallons.
Candidates will be expected to know the following approximate equivalences.
8km ≈ 5 miles; 1kg ≈ 2.2 lb; 1 litre ≈ 1·75 pints.

Reading and interpreting scales, including decimal scales.

Use compound measures including speed and density.

Use of compound measures such as m/s, km/h, mph, mpg, kg/m^3, g/cm^3.

Perimeter and area of a square, rectangle, triangle, parallelogram, trapezium, circle, semicircle and composite shapes.

The use of perimeter and area in practical contexts.

Estimation of the area of an irregular shape drawn on a square grid.

Volumes of cubes, cuboids, prisms, cylinders, and composite solids.

Foundation Tier - Statistics

Sorting, classification and tabulation of qualitative (categorical) data, discrete or continuous quantitative data. Grouping of discrete or continuous data into class intervals of equal widths. (The class intervals will be given.) Understanding and using tallying methods. Multistage practical problems in familiar and unfamiliar contexts.
Designing and criticising questions for a questionnaire, including the notion of fairness. Testing an hypothesis such as ‘Girls tend to do better than boys in biology tests’.
Construct and interpret pictograms, bar charts and pie charts for qualitative data. Construct and interpret vertical line diagrams for discrete data. Temperature charts. Construct and interpret scatter diagrams for paired variable data. Construct and interpret grouped frequency diagrams and frequency polygons.
Selecting and using an appropriate measure of central tendency. Mean, median and mode for a discrete (ungrouped) frequency distribution. Comparison of two distributions using one measure of central tendency (i.e. the mean or the median) and/or the range. Modal category for qualitative data. Modal class for grouped data. Estimates for the mean of grouped frequency distributions and the identification of the class containing the median.
Recognising that graphs may be misleading. Drawing of conclusions from scatter diagrams using terms such as positive correlation, negative correlation, little or no correlation. Drawing 'by eye' a line of 'best fit' on a scatter diagram. In questions where the mean point has been given, calculated or plotted, candidates will be expected to draw the line of 'best fit' through that point.
The vocabulary of probability, leading to understanding and using the probability scale from 0 to 1. The terms 'fair', 'evens', 'certain', 'likely', 'unlikely ' and 'impossible'. Use of: the probability of an event not occurring is one minus the probability that it occurs. (Probabilities must be expressed as fractions, decimals or percentages.)
Estimating the probability of an event as the proportion of times it has occurred.
Relative frequency. Graphical representation of relative frequency against the number of trials. Comparing an estimated probability from experimental results with a theoretical probability. An understanding of the long-term stability of relative frequency is expected. Calculate theoretical probabilities based on equally likely outcomes. Estimating probabilities based on experimental evidence.
Identify all the outcomes of a combination of two experiments, *e.g. throwing two dice;* use tabulation or other diagrammatic representations of compound events.
Recognise the conditions when the addition of probabilities for mutually exclusive events and the multiplication of probabilities for two independent events apply, and make the appropriate calculations. 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 $P(A) \times P(B)$. Knowledge that the total probability of all the possible outcomes of an experiment is 1.

Higher Tier - Number

Reading and writing whole numbers of any magnitude expressed in figures or words.

Understanding place value and decimal places.

Rounding whole numbers to the nearest 10, 100, 1000, etc.
Rounding decimals to the nearest whole number or a given number of decimal places.
Rounding numbers to a given number of significant figures.

Equivalences between decimals, fractions, ratios and percentages.

Directed numbers in practical situations.
Ordering directed numbers.

Converting numbers from one form into another.
Write $\frac{1}{4}$ as a percentage.
Write 0·2 as a fraction.
Write 75% as a decimal.

Ordering whole numbers, decimals, fractions and percentages.
List in ascending order: 0·25, $\frac{1}{3}$, 10%.

Compare pass rates in fractional and percentage forms.
In class 11X, $\frac{1}{3}$ of the class passed a test. In class 11Y, 25% passed the same test. Which class had the better pass rate?

The use of index notation for positive integral indices.
Writing whole numbers in index form.
$8 = 2^3$, $32 = 2^5$.

The use of index notation for negative, zero and fractional indices.
Simplify $81^{\frac{3}{4}}$ **,** $8^{-\frac{2}{3}}$**.**

Use of the common properties of numbers, including odd, even, multiples, factors, primes.

Use of the rules of indices.
$2^3 \times 2^5 = 2^8$
Write 360 as the product of its prime factors in index form.

Least common multiple. Highest common factor.
Candidates may be required to find the LCM and HCF of numbers written as the product of their prime factors.

Use of the terms square, square root, cube, cube root and reciprocal.
Find 3^2, $\sqrt{25}$, 10^3, the square of 7, $\sqrt[3]{64}$, the reciprocal of 0·7.

Expressing and using numbers in standard form with positive and negative powers of 10.

Direct and inverse proportion.

Use the facilities of a calculator, including the constant function, memory and brackets, to plan a calculation and evaluate expressions.

Use of addition, subtraction, multiplication, division, square, square root, power, root, constant, memory, brackets and appropriate trigonometric and statistical functions.

Know how a calculator orders its operations.
(Candidates will not be expected to list the key depressions that they have made.)
Read a calculator display correct to a specified number of decimal places or significant figures.

Higher Tier - Number

Addition, subtraction, multiplication and division of whole numbers, decimals, fractions and negative numbers.

Finding a fraction or percentage of a quantity.

Expressing one number as a fraction or percentage of another.

Fractional and percentage changes. (Increase and decrease.)

Repeated proportional changes; appreciation and depreciation.
The value of a car is £12 000. Each year its value decreases by 10%. Find the value of the car at the end of three years.

Calculating using ratios in a variety of situations, in context.
Proportional division.
Divide £1520 in the ratio 5 : 3 : 2.

Distinguish between rational and irrational numbers.
Classify as rational or irrational √2, π, √64,
$(1 + \sqrt{2})^2$, $(\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2})$.

Use surds and π in exact calculations.

Recognise that recurring decimals are exact fractions, and that some exact fractions are recurring decimals.

The following notation may be used for recurring decimals:
$0\cdot\dot{2} = 0\cdot222222$......... .

Converting recurring decimals to fractional form.
The following notation may be used for recurring decimals:

$\mathbf{0\cdot\dot{1}\dot{2} = 0\cdot121212......}$

$\mathbf{0\cdot\dot{1}2\dot{3} = 0\cdot123123123....}$

$\mathbf{0\cdot1428571428\ ... = \frac{1}{7}}$

$\mathbf{0\cdot1212121212\ ... = \frac{12}{99}}$

0·1010010001….   Cannot be expressed as a fraction.

Use estimation in multiplication and division problems with whole numbers to obtain approximate answers.
Candidates must show sufficient working in order to demonstrate how they have obtained their estimate.

$$\frac{2\cdot8\times4\cdot23}{61} \approx \frac{3\times4}{60} = 0\cdot2$$

Simplify numerical expressions involving surds; understand and use indices with negative and fractional values.
Simplification of expressions involving surds.
$(\sqrt{3} + \sqrt{2})^2 - (\sqrt{3} - \sqrt{2})^2 = 4\sqrt{6}$

Excluding the rationalisation of the denominator of a fraction such as $\frac{1}{(2-\sqrt{3})}$.

Higher Tier - Number

Interpretation and use of mathematical information presented in written or visual form when solving problems.
TV programme schedules, bus/rail timetables, distance charts, holiday booking information.

Money: The basic principles of personal and household finance.
e.g. fuel and other bills, hire purchase, VAT, taxation, discount, best buys, wages and salaries.

Simple and compound interest, profit and loss.

Candidates may be required to find the original quantity given the result of a proportional change.

Foreign currencies and exchange rates.

Give solutions in the context of a problem, selecting an appropriate degree of accuracy, and recognising limitations on the accuracy of data and measurements.

Interpreting the display on a calculator.
When working in £, interpret a calculator display of 49.9 as £49.90.

Knowing whether to round up or down as appropriate.
Find how many 47-seater coaches will be needed for a school trip for a party of 352.

Rounding an answer to a reasonable degree of accuracy in the light of the context.

Recognising that measurement is approximate and that a measurement expressed to a given unit is in possible error of half a unit.
The lower and upper bounds of 140 (to the nearest 10) are 135 and 145 respectively.

The lower and upper bounds of numbers expressed to a given degree of accuracy.

Calculating the lower and upper bounds in the addition and subtraction of numbers expressed to a given degree of accuracy.

Calculate the upper and lower bounds of numerical solutions, particularly in the context of measurement. Calculating the upper and lower bounds in calculations involving multiplication and division of numbers expressed to given degrees of accuracy.

Higher Tier - Algebra

Recognition, description and continuation of patterns in number.

Description, in words and symbols of the rule for the next term of a sequence.

Finding the *n*th term of a sequence where the rule is linear **or quadratic**.

Construct and interpret graphs that describe real-life situations.

Construction and interpretation of conversion graphs.

Interpretation of graphical representation used in the media.

Construction and interpretation of travel graphs.

Use of coordinates in 4 quadrants.
Drawing, interpretation and recognition **and sketching** of the graphs of $x = a$, $y = b$, $y = ax + b$.
Knowing that the form $y = mx + c$ represents a straight line and that m is the gradient of the line and c is the value of the y-intercept.
Recognition that $y = 3x$ is steeper than $y = x$ and that the line $y = 2x + 3$ and the line $y = 2x - 1$ are parallel.

Use of the form $y = mx + c$ to represent a straight line where m is the gradient of the line, and c is the value of the y-intercept.
Find the equation of the straight line which has gradient 2 and passes through the point (1,1).
Draw graphs when y is given implicitly in terms of x.
Draw $2x + y = 7$.
The gradients of parallel lines.

Drawing, interpretation, recognition and sketching the graphs of $y = ax^2 + b$, $y = \frac{a}{x}$, $y = ax^3$.

Drawing and interpretation of graphs of $y = ax^2 + bx + c$, $y = ax^3 + b$.
Draw the curve $y = x^2 - 1$ from $x = -2$ to $x = 4$. Write down the coordinates of the points where the line $y = 2$ meets this curve.
Draw the curve $y = 2x^2 - 3x - 4$ from $x = -2$ to $x = 3$.
Write down the value of x for which $2x^2 - 3x - 4$ is a minimum.
Write down this minimum value.

Drawing and interpretation of graphs of the form $y = ax^2 + bx + \frac{c}{x}$ with x not equal to 0,

$y = ax^3 + bx^2 + cx + d$, $y = k^x$ for integer values of x and simple positive values of k.

Draw the curve $y = x + \frac{2}{x}$ from $x = 0{\cdot}5$ to $x = 4$.
Using the same axes, draw the line $y = 5 - 2x$.
Write down the values of x at the points of intersection of the line and the curve.

Interpret and apply the transformation of functions in the context of their graphical representation, including $y = f(x + a)$, $y = f(kx)$ and $y = f(x) + a$, applied to $y = f(x)$, $y = k\,f(x)$.

Construct and use tangents to curves to estimate rates of change for non-linear functions, and use appropriate compound measures to express results.

Including finding velocity in distance-time graphs and acceleration in velocity-time graphs.

Use of the trapezium rule to estimate the area under a curve.

Interpret the meaning of the area under a graph.
Area under a velocity-time graph.

Higher Tier - Algebra

Substitution of positive and negative whole numbers, fractions and decimals into simple formulae expressed in words or in symbols.

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

$v = u + at$
Find v when $u = 20$, $a = -2$ and $t = 3$.

Direct and inverse proportion.

Understanding the basic conventions of algebra.
$a + a + a = 3a$
$a \times a \times a = a^3$
$a \times b \times 2 = 2ab$
$2(a + b) = 2a + 2b$

Formation and simplification of expressions involving sums, differences, products and powers.
Simplify
(i) $2x^2 \times 3x^3$,
(ii) $(3x^2)^3$,
(iii) $\frac{6x^5}{3x^2}$,
(iv) $\frac{2(x+1)^2}{(x+1)}$.

Collection of like terms.
Simplify
(i) $3a - 4b + 4a + 5b$,
(ii) $2(3x - 1) - (x - 4)$,
(iii) $x(x - 1) + 2(x^2 - 3)$.

Multiplication of two linear expressions.
Expand $(ax + by)(cx + dy)$ and $(ax + by)^2$ where a, b, c, d are integers.
$(2x - y)(3x + 4y) = 6x^2 + 5xy - 4y^2$
$(3x - 2y)^2 = 9x^2 - 12xy + 4y^2$

Changing the subject of a formula when the subject appears in one term **or more.**
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.

Formation and manipulation of linear equations.

Formation and manipulation of simple linear inequalities.
A number n multiplied by 4, minus 3 is less than twice the number n plus 5. Write down an inequality which is satisfied by n and arrange it in the form $an < b$ where a and b are integers.

Extraction of common factors.
$6x + 4$
$= 2(3x + 2)$.

Factorisation of quadratic expressions of the form $ax^2 + bx + c$.
Factorise (i) $3x^2 - 6x$ (ii) $x^2 + 3x + 2$ (iii) $x^2 - 5x - 6$ (iv) $x^2 - 9$ (v) $3x^2 - 48$ (vi) $3m^2 - 10m + 3$ (vii) $12d^2 + 5d - 2$.

Formation and manipulation of quadratic equations.
A rectangle has longer side $(x + 3)$ m and shorter side $(x + 1)$ m. Its area is 24 m^2.
Write down a quadratic equation which is satisfied by x and arrange it in the form $x^2 + ax + b = 0$ where a and b are integers.

Higher Tier - Algebra

Solution of linear equations and simple linear inequalities with whole number and fractional coefficients.

Solve $3(1 - x) = 5(2 + x)$.

Solve $3 = \frac{12}{x}$,

Solve $4 - x \geq 5$.

Solve $\frac{1}{2}(x - 1) = 3x + 1$.

Solve $\frac{x-2}{2} - \frac{2x-1}{3} = 1$.

Solve $3x + 1 < x + 9$.

Solve $4 - x < 2x - 1$.

The formation and solution of two linear simultaneous equations with whole number coefficients by graphical and algebraic methods.
Both equations may be of the form $ax + by = c$.

Solve the simultaneous equations

$2x + 3y = 1$.

$5x - 4y = 37$.

The use of straight line graphs to locate regions given by linear inequalities.

Indicate by shading the region defined by $x > 0$, $y > 0$, $2x + 3y \leq 15$, $3x + y \leq 12$.

Find the points with integer coordinates which lie within the region defined by $x > 0$, $y > 0$, $2x + 3y \leq 15$, $3x + y \leq 12$.

The solution by factorisation, graphical methods and formula, of quadratic equations of the form $ax^2 + bx + c = 0$.

Solve $x^2 - 49 = 0$.
Solve $x^2 - 5x + 4 = 0$.
Solve $x^2 + x = 6$.
Solve $x^2 - 7x = 0$.
Solve $x^2 - 2x - 3 = 0$.
Solve $3x^2 + 5x - 28 = 0$.

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

Use the graph of $y = 2x^2 + 5x$ **to solve** $2x^2 + 5x = 7$.
Use the graph of $y = x^2 + 5x + 1$ **to solve** $x^2 + 4x - 7 = 0$.
Use the graphs of $y = 2x^2 + 5x$ **and** $y = x^3$ **to solve** $x^3 - 2x^2 - 5x = 0$.

Solve $\frac{1}{x-3} - \frac{2}{x-2} = \frac{3}{2}$.

Solve a range of quadratic and cubic equations by trial and improvement methods.

Find, by trial and improvement, the solution of the equation $x^3 - 5x = 80$ which lies between 4 and 5. Give your answer correct to one decimal place.

Distinguish in meaning between the words equation, formula, **identity** and expression.

Higher Tier - Geometry and Measure

The geometrical terms: point, line, plane, parallel, right angle, clockwise and anticlockwise turns, acute, obtuse and reflex angles, perpendicular, horizontal, vertical, face, edge and vertex.

Vocabulary of triangles, quadrilaterals, other polygons and circles.
Isosceles, equilateral, scalene, exterior/interior angle, diagonal, square, rectangle, parallelogram, rhombus, kite, trapezium, polygon (including pentagon, hexagon and octagon), radius, diameter, chord, tangent, arc, circumference, sector, **segment**.

Simple solid figures: cube, cuboid, cylinder, prism, pyramid, tetrahedron, cone and sphere.

Interpretation and drawing of nets.

Use and draw 2D representations of 3D shapes. Use of isometric paper.

Accurate use of ruler, pair of compasses and protractor. (Lengths accurate to 2mm and angles accurate to 2°.)

Construction of triangles, quadrilaterals and circles.

Use of ruler and pair of compasses to do constructions.
Bisect a given line, bisect a given angle, construct angles of 60°, 30°, 90° and 45°.

The identification of congruent shapes.

Proving the congruence of triangles using formal arguments.
Reasons may be required in the solution of problems involving congruent triangles.

Knowledge that, in similar figures, corresponding sides are in the same ratio.

Essential properties of special types of quadrilateral, including square, rectangle, parallelogram, trapezium, kite and rhombus; classify quadrilaterals by their geometric properties.

Simple description of symmetry in terms of reflection in a line/plane or rotation about a point.
Order of rotational symmetry.

Angles at a point. Angles at a point on a straight line. Opposite angles at a vertex. Parallel lines. Corresponding and alternate angles.

Angle properties of triangles.
Use the fact that the angle sum of a triangle is 180°.
Use the fact that the exterior angle of a triangle is equal to the sum of the interior angles at the other two vertices.
Use angle properties of equilateral, isosceles and right-angled triangles, understand congruence; explain why the angle sum of any quadrilateral is 360°.

Understand and use the properties of parallelograms.

Regular and irregular polygons.
Sum of the interior and sum of the exterior angles of a polygon.

Pythagoras' theorem. (2-D **and 3-D**, including reverse problems.)

Use trigonometric relationships in right-angled triangles to solve problems.
Calculating a side or an angle of a right-angled triangle in 2-D and 3-D.
Problems including bearings. (Only three figure bearings will be used. e.g. 065°, 237°.)
Angles of elevation and depression.

Higher Tier - Geometry and Measure

Extend trigonometry to angles of any size.
The graphs and behaviour of trigonometric functions.
The application of these to the solution of problems in 2-D or 3-D, including appropriate use of the sine and cosine rules.
Sketching of trigonometric graphs.
Use of the formula: Area of a triangle = $\frac{1}{2}ab\sin C$.

Use angle and tangent properties of circles.

Understand that the tangent at any point on a circle is perpendicular to the radius at that point.

Use the facts that the angle subtended by an arc at the centre of a circle is twice the angle subtended at any point on the circumference, the angle subtended at the circumference by a semicircle is a right angle, that angles in the same segment are equal, and that opposite angles of a cyclic quadrilateral sum to 180°.

Use the alternate segment theorem.

Understand and use the fact that tangents from an external point are equal in length.

Understand and construct geometrical proofs using circle theorems.

Use of Cartesian coordinates in 4 quadrants.

Locating points with given coordinates.

Finding the coordinates of points identified by geometrical information.
Find the coordinates of the fourth vertex of a parallelogram with vertices at (2, 1), (−7, 3) and (5, 6).

Finding the coordinates of the mid-point of the line segment *AB*, given points *A* and *B*.

Location determined by distance from a given point and angle made with a given line.

Reflection.

Rotations through 90°, 180°, 270°. Clockwise or anticlockwise rotations.
Centre of rotation.

Enlargements with positive **and negative** scale factors, **including fractional scale factors;** centre of enlargement.
Scaling with positive scale factors.

Translation.

Questions may involve two successive transformations.
Candidates will be expected to draw the image of a shape under transformation.

Interpretation and construction of scale drawings.
Scales may be written in the form
1 cm represents 5 m, or 1:500.
Use of bearings. (Only three figure bearings will be used e.g. 065°, 237°.)

Constructing the locus of a point which moves such that it is
(i) a given distance from a fixed point or line,
(ii) equidistant from two fixed points or lines.

Solving problems involving intersecting loci in two dimensions.
Questions on loci may involve inequalities.

Higher Tier - Geometry and Measure

Standard metric units of length, mass and capacity.

The standard units of time; the 12- and 24- hour clock.
(The notation for the 12- and 24- hour clock will be 1:30 p.m. and 13:30.)

The use of common measures of time, length, mass, capacity and temperature in the solution of practical problems.

Knowledge and use of the relationship between metric units.

Conversion between the following metric and Imperial units:
km - miles; cm, m - inches, feet; kg - lb; litres - pints, gallons.
Candidates will be expected to know the following approximate equivalences.
8km ≈ 5 miles; 1kg ≈ 2.2 lb; 1 litre ≈ 1·75 pints

Reading and interpreting scales, including decimal scales.

Tessellations.

Use compound measures including speed and density.

Use of compound measures such as m/s, km/h, mph, mpg, kg/m^3, g/cm^3.

Perimeter and area of a square, rectangle, triangle, parallelogram, trapezium, circle, semicircle and composite shapes.

The use of perimeter and area in practical contexts.

Estimation of the area of an irregular shape drawn on a square grid.

Volumes of cubes, cuboids, prisms, cylinders, and composite solids.

Volumes of spheres, cones and pyramids.
Lengths of circular arcs.
Areas of sectors and segments of circles.
Relationships between the ratios of lengths, areas and volumes of similar solids.

Higher Tier - Statistics

Sorting, classification and tabulation of qualitative (categorical) data, discrete or continuous quantitative data. Grouping of discrete or continuous data into class intervals of equal **or unequal** widths. (The class intervals will be given.) Understanding and using tallying methods. Multistage practical problems in familiar and unfamiliar contexts.
Designing and criticising questions for a questionnaire, including notion of fairness. Testing an hypothesis such as 'Girls tend to do better than boys in biology tests'.
Construct and interpret pictograms, bar charts and pie charts for qualitative data. Construct and interpret vertical line diagrams for discrete data. Temperature charts. Construct and interpret scatter diagrams for paired variable data. Construct and interpret grouped frequency diagrams and frequency polygons. **Construct and interpret cumulative frequency tables and diagrams using the upper boundaries of the class intervals.**
Selecting and using an appropriate measure of central tendency. Mean, median and mode for a discrete (ungrouped) frequency distribution. Comparison of two distributions using one measure of central tendency (i.e. the mean or the median) and/or the range. Modal category for qualitative data. Modal class for grouped data. Estimates for the **median** and mean of grouped frequency distributions**, including estimating the median from a cumulative frequency diagram**.
Select and calculate or estimate appropriate measures of spread, including the range and interquartile range applied to discrete, grouped and continuous data.
Recognising that graphs may be misleading. Drawing of conclusions from scatter diagrams using terms such as positive correlation, negative correlation, little or no correlation. Drawing 'by eye' a line of 'best fit' on a scatter diagram. In questions where the mean point has been given, calculated or plotted, candidates will be expected to draw the line of 'best fit' through that point.
Extend skills in handling data into constructing and interpreting histograms. **Frequency density.** **Emphasis will be placed on unequal class intervals.** **Interpreting shapes of histograms representing distributions (with reference to mean and dispersion).**

Higher Tier - Statistics

The vocabulary of probability, leading to understanding and using the probability scale from 0 to 1. The terms 'fair', 'evens', 'certain', 'likely', 'unlikely ' and 'impossible'. Use of: the probability of an event not occurring is one minus the probability that it occurs. (Probabilities must be expressed as fractions, decimals or percentages.)
Estimating the probability of an event as the proportion of times it has occurred.
Relative frequency. Graphical representation of relative frequency against the number of trials. Comparing an estimated probability from experimental results with a theoretical probability. An understanding of the long-term stability of relative frequency is expected. Calculate theoretical probabilities based on equally likely outcomes. Estimating probabilities based on experimental evidence.
Identify all the outcomes of a combination of two experiments, *e.g. throwing two dice;* use tabulation, **tree diagrams**, or other diagrammatic representations of compound events
Recognise the conditions when the addition of probabilities for mutually exclusive events and the multiplication of probabilities for two independent events apply, and make the appropriate calculations. 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 $P(A) \times P(B)$. Knowledge that the total probability of all the possible outcomes of an experiment is 1.
Understand when and how to estimate conditional probabilities. The multiplication law for dependent events. Sampling without replacement.

3 ASSESSMENT

3.1 Scheme of Assessment

Assessment for GCSE Mathematics is tiered, i.e. externally assessed papers 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.

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

The scheme of assessment will consist of:

Paper 1 (Non-calculator) (50%)
Written Paper:

Duration: Foundation Tier - 1$\frac{3}{4}$ hours; Higher Tier - 2 hours
Marks: Foundation Tier - 100 marks; Higher Tier - 100 marks
Weighting: 50%

The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions which may be set on any part of the subject content of the specification.
A number of questions will assess candidates' understanding of more than one topic from the subject content.
A calculator will **not** be allowed in this paper.

Paper 2 (Calculator) (50%)
Written Paper:

Duration: Foundation Tier - 1$\frac{3}{4}$ hours; Higher Tier - 2 hours
Marks: Foundation Tier - 100 marks; Higher Tier - 100 marks
Weighting: 50%

The written paper for each tier will comprise a number of short and longer, both structured and unstructured questions which may be set on any part of the subject content of the specification.
A number of questions will assess candidates' understanding of more than one topic from the subject content.
A calculator will be allowed in this paper.

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 in a range of contexts.

AO3 Interpret and analyse problems and generate strategies to solve them.

The written papers will assess all assessment objectives.

The weightings of assessment objectives at each tier will be within the following ranges.

ASSESSMENT OBJECTIVES		Weighting (%)
AO1	**Recall and use their knowledge of the prescribed content.**	**45 – 55**
AO2	**Select and apply mathematical methods in a range of contexts**	**25 – 35**
AO3	**Interpret and analyse problems and generate strategies to solve them.**	**15 – 25**

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.

3.4 Functional Elements of Mathematics

The specification allocates the following weightings to the functional elements of mathematics.

Foundation Tier	30% – 40%
Higher Tier	20% – 30%

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 linear examination. The written papers must both be re-taken if a candidate wishes to re-enter with the aim of improving their grade.

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

Key Skills, Functional Skills and Essential Skills (Wales)

GCSE 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 the WJEC website.

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.

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.

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.

Environmental Issues

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

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.

The European Dimension

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