Accredited

GCSE (9-1)

Specification

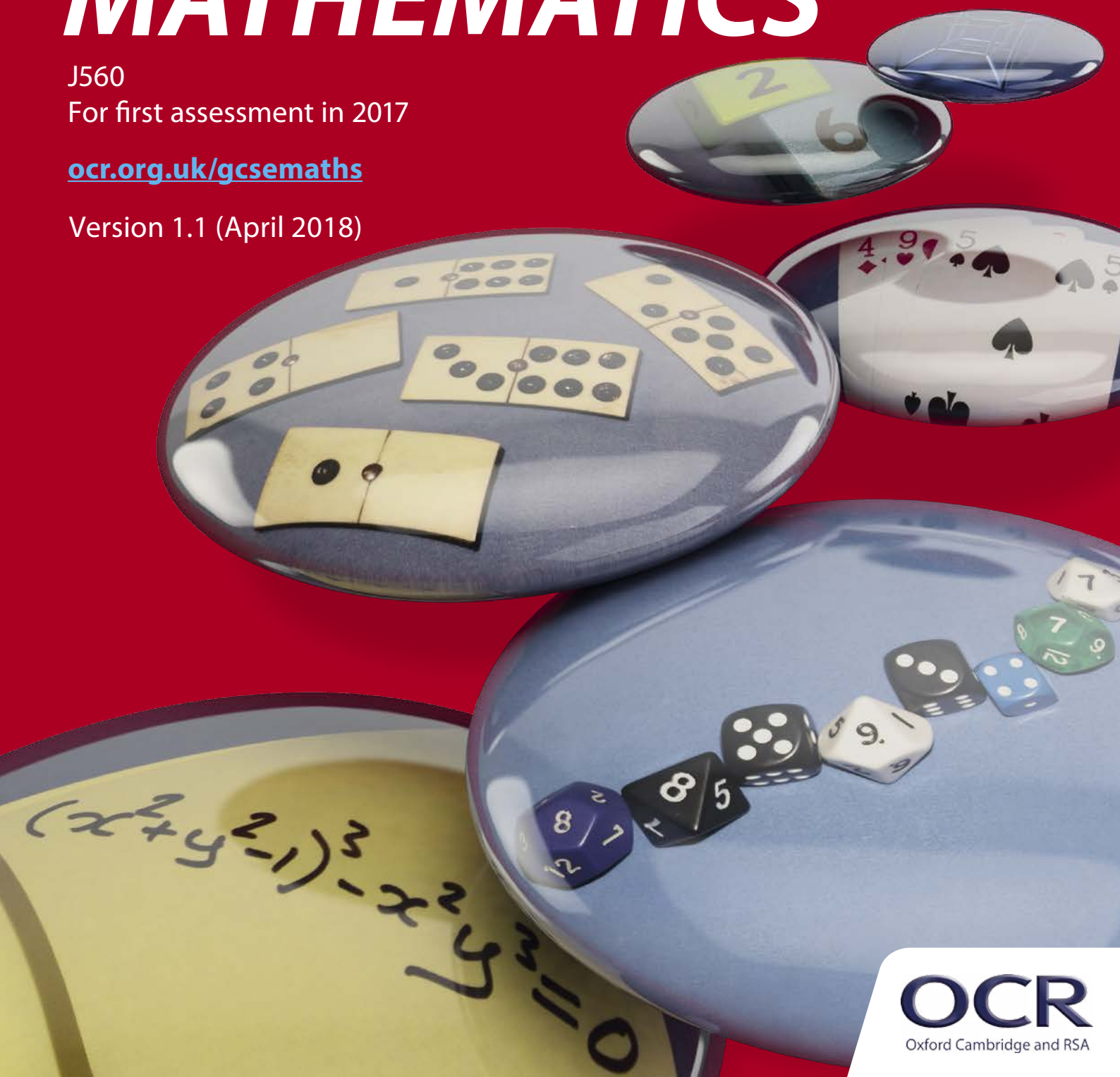
MATHEMATICS

J560

For first assessment in 2017

ocr.org.uk/gcsemaths

Version 1.1 (April 2018)



OCR

Oxford Cambridge and RSA

DISCLAIMER

Specifications are updated over time. Whilst every effort is made to check all documents, there may be contradictions between published resources and the specification, therefore please use the information on the latest specification at all times. Where changes are made to specifications these will be indicated within the document, there will be a new version number indicated, and a summary of the changes. If you do notice a discrepancy between the specification and a resource please contact us at: resources.feedback@ocr.org.uk

We will inform centres about changes to specifications. We will also publish changes on our website. The latest version of our specifications will always be those on our website (ocr.org.uk) and these may differ from printed versions.

Contents

Introducing…
GCSE (9–1) Mathematics (from September 2015)

We've developed an inspiring, motivating and coherent mathematics specification for the entire ability range. It emphasises and encourages:

- Sound understanding of concepts
- Fluency in procedural skill
- Competency to apply mathematical skills in a range of contexts
- Confidence in mathematical problem solving.

Meet the team

We have a dedicated team of Mathematics Subject Advisors working on our mathematics qualifications.

If you need specialist advice, guidance or support, get in touch as follows:

01223 553998

maths@ocr.org.uk

@OCR_Maths

Teaching and learning resources

We recognise that the introduction of a new specification can bring challenges for implementation and teaching. Our aim is to help you at every stage and we're working hard to provide a practical package of support in close consultation with teachers and other experts, so we can help you to make the change.

Designed to support progression for all

Our resources are designed to provide you with a range of teaching activities and suggestions so you can select the best approach for your particular students. You are the experts on how your students learn and our aim is to support you in the best way we can.

We want to…

- Support you with a body of knowledge that grows throughout the lifetime of the specification
- Provide you with a range of suggestions so you can select the best activity, approach or context for your particular students
- Make it easier for you to explore and interact with our resource materials, in particular to develop your own schemes of work
- Create an ongoing conversation so we can develop materials that work for you.

Plenty of useful resources

You'll have four main types of subject-specific teaching and learning resources at your fingertips:

- Delivery Guides
- Transition Guides
- Topic Exploration Packs
- Lesson Elements.

Along with subject-specific resources, you'll also have access to a selection of generic resources that focus on skills development and professional guidance for teachers.

Skills Guides – we've produced a set of Skills Guides that are not specific to Mathematics, but each covers a topic that could be relevant to a range of qualifications – for example, communication, legislation and research. Download the guides at **ocr.org.uk/skillsguides**

Active Results – a free online results analysis service to help you review the performance of individual students or your whole school. It provides access to detailed results data, enabling more comprehensive analysis of results in order to give you a more accurate measurement of the achievements of your centre and individual students. For more details refer to **ocr.org.uk/activeresults**

Professional Development

Take advantage of our improved Professional Development Programme, designed with you in mind. Whether you want to come to events, look at our new digital training or search for training materials, you can find what you're looking for all in one place at the CPD Hub.

An introduction to the new specifications

We'll be running events to help you get to grips with our GCSE Mathematics qualification.

These events are designed to help prepare you for first teaching and to support your delivery at every stage.

Watch out for details at **cpdhub.ocr.org.uk**.

To receive the latest information about the training we'll be offering, please register for GCSE email updates at **ocr.org.uk/updates**.

1 Why choose an OCR GCSE (9–1) in Mathematics?

1a. Why choose an OCR qualification?

Choose OCR and you've got the reassurance that you're working with one of the UK's leading exam boards. Our new GCSE (9–1) in Mathematics course has been developed in consultation with teachers, employers and Higher Education to provide students with a qualification that's relevant to them and meets their needs.

We're part of the Cambridge Assessment Group, Europe's largest assessment agency and a department of the University of Cambridge. Cambridge Assessment plays a leading role in developing and delivering assessments throughout the world, operating in over 150 countries.

We work with a range of education providers, including schools, colleges, workplaces and other institutions in both the public and private sectors. Over 13,000 centres choose our A levels, GCSEs and vocational qualifications including Cambridge Nationals and Cambridge Technicals.

Our Specifications

We believe in developing specifications that help you bring the subject to life and inspire your students to achieve more.

We've created teacher-friendly specifications based on extensive research and engagement with the teaching community. They're designed to be straightforward and accessible so that you can tailor the delivery of the course to suit your needs. We aim to encourage learners to become responsible for their own learning, confident in discussing ideas, innovative and engaged.

We provide a range of support services designed to help you at every stage, from preparation through to the delivery of our specifications. This includes:

- A wide range of high-quality creative resources including:
  - Delivery Guides
  - Transition Guides
  - Topic Exploration Packs
  - Lesson Elements
  - …and much more.
- Access to Subject Advisors to support you through the transition and throughout the lifetimes of the specifications.
- CPD/Training for teachers to introduce the qualifications and prepare you for first teaching.
- Active Results – our free results analysis service helps you review the performance of individual students or across your whole school.
- ExamBuilder – our new free online past papers service that enables you to build your own test papers from past OCR exam questions. **http://www.ocr.org.uk/exambuilder**

All GCSE (9–1) qualifications offered by OCR are accredited by Ofqual, the Regulator for qualifications offered in England. The QN for this qualification is QN 601/4606/0.

1b. Why choose an OCR GCSE (9–1) in Mathematics?

OCR's GCSE (9–1) in Mathematics provides a broad, coherent, satisfying and worthwhile course of study. It encourages 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. It also provides a strong mathematical foundation for learners who go on to study mathematics at a higher level, post-16.

Aims and learning outcomes

OCR's GCSE (9–1) in Mathematics enables learners to:

- develop fluent knowledge, skills and understanding of mathematical methods and concepts
- acquire, select and apply mathematical techniques to solve problems
- reason mathematically, make deductions and inferences and draw conclusions
- comprehend, interpret and communicate mathematical information in a variety of forms appropriate to the information and context.

OCR's GCSE (9–1) in Mathematics is:

Worthwhile

- Research, international comparisons and engagement with both teachers and the wider education community have been used to enhance the reliability, validity and appeal of our assessment tasks in mathematics.
- It will encourage the teaching of interesting mathematics, aiming for mastery leading to positive exam results.

Learner-focused

- OCR's specification and assessment will consist of mathematics fit for the modern world and presented in authentic contexts.
- It will allow learners to develop mathematical independence built on a sound base of conceptual learning and understanding.
- OCR will target support and resources to develop fluency, reasoning and problem solving skills.
- It will be a springboard for future progress and achievement in a variety of qualifications across subjects along with employment.

Teacher-centred

- OCR will provide an extensive teacher support package, including high-quality flexible resources, particularly for the new GCSE (9–1) subject areas and assessment objectives.
- OCR's support and resources will focus on empowering teachers, exploring teaching methods and classroom innovation alongside more direct content-based resources.
- OCR's assessment will be solid and dependable, recognising positive achievement in candidate learning and ability.

Dependable

- OCR's high-quality assessments are backed up by sound educational principles and a belief that the utility, richness and power of mathematics should be made evident and accessible to all learners.
- An emphasis on learning and understanding mathematical concepts underpinned by a sound, reliable and valid assessment.

1c. What are the key features of this specification?

- A simple assessment model, featuring 3 papers at each tier, of equal length with identical mark allocations and identical weightings of Assessment Objectives and subject content.
- A specification developed by teachers specifically for teachers, laying out the required content clearly in terms of both topic area and difficulty, facilitating learners' progression through the content.
- An exciting package of free resources, developed in conjunction with teachers and through research by Cambridge Assessment, taking learners from Key Stage 3 right the way through GCSE, which can be adapted as required by teachers and shaped to their learners' needs.
- A flexible support package for teachers formed through listening to teachers' needs, allowing teachers to easily understand the requirements of the qualification and present the qualification to learners.
- A team of OCR Subject Advisors, who centres can contact for subject and assessment queries.
- Part of a wide range of OCR mathematics assessments, allowing progression into a range of further qualifications, from A and AS Level Mathematics and Further Mathematics to Free Standing Mathematics Qualifications, Core Maths, Level 3 certificates and more.
- A mock exams package to assess the progression of learners and easily pick up on topics requiring further teaching.

1d. How do I find out more information?

If you are already using OCR specifications you can contact us at: **www.ocr.org.uk**

If you are not already a registered OCR centre then you can find out more information on the benefits of becoming one at: **www.ocr.org.uk**

Find out more?

Get in touch with one of our Subject Advisors:

Email: **maths@ocr.org.uk**

Customer Contact Centre: 01223 553998

Teacher support: **www.ocr.org.uk**

2 The specification overview

2a. OCR's GCSE (9–1) in Mathematics (J560)

Learners are entered for either Foundation tier (Paper 1, Paper 2 and Paper 3) **or** Higher tier (Paper 4, Paper 5 and Paper 6).

Qualification Overview	Assessment Overview	
Foundation tier, grades 5 to 1 • Paper 1 (Foundation tier) J560/01	Written paper 100 marks 1 hour 30 minutes Calculator permitted	$33\frac{1}{3}\%$ of total GCSE
• Paper 2 (Foundation tier) J560/02	Written paper 100 marks 1 hour 30 minutes Calculator **not** permitted	$33\frac{1}{3}\%$ of total GCSE
• Paper 3 (Foundation tier) J560/03	Written paper 100 marks 1 hour 30 minutes Calculator permitted	$33\frac{1}{3}\%$ of total GCSE
Higher tier, grades 9 to 4 • Paper 4 (Higher tier) J560/04	Written paper 100 marks 1 hour 30 minutes Calculator permitted	$33\frac{1}{3}\%$ of total GCSE
• Paper 5 (Higher tier) J560/05	Written paper 100 marks 1 hour 30 minutes Calculator **not** permitted	$33\frac{1}{3}\%$ of total GCSE
• Paper 6 (Higher tier) J560/06	Written paper 100 marks 1 hour 30 minutes Calculator permitted	$33\frac{1}{3}\%$ of total GCSE

2b. Content of GCSE (9–1) in Mathematics (J560)

The content of this specification.

- This is a linear qualification. The content is arranged by topic area and exemplifies the level of demand for different tiers, but centres are free to teach the content for the appropriate tier in the order most appropriate to their learners' needs.
- Any topic area may be assessed on any component, as relevant at that tier.
- The content of this specification is presented in three columns, representing a progression within the content strands.
- The columns are cumulative so that the expectation of a Foundation tier learner is exemplified by the first two columns and that of a Higher tier learner is the sum of the statements in all three columns.
- Many higher tier learners will already be confident and competent with the content of the first column when they begin their GCSE (9–1) course. It may therefore not be necessary to cover this content explicitly with all learners, though all learners will be assessed on this content at an appropriate level of demand.
- Learners should build on all of the content from earlier key stages. Knowledge of the content of Key Stages 1 and 2 is therefore assumed, but will not be assessed directly.

The division of content into three columns is intended to give an indication of the progression in conceptual and procedural difficulty in each content strand.

This structure:

- helps teachers to target teaching appropriately
- promotes assessment for learning by presenting the content as a progression not simply the end point
- allows teachers to start this GCSE (9–1) course at a level which is appropriate to their learners, without feeling that they have to spend time on content with which their learners are familiar
- allows for easier movement from Foundation tier to Higher tier by showing how the required content for the former progresses to the latter

All exemplars contained in the specification are for illustration only and do not constitute an exhaustive list.

Where content in one column is not further exemplified in the column(s) to its right, that content may be assessed at a higher level of demand than given, as appropriate for learners attaining a higher grade. The expectation is that themes will be developed further and connections explored even when not explicitly stated.

Formulae

The assessment for this specification will not include a formula sheet. All formulae which learners are required to know are given in the specification under 6.02d.

All other formulae required will be given in the assessment.

Units and measures

Learners should be familiar with and calculate with appropriate units: 24-hour and 12-hour clock; seconds (s), minutes (min), hours (h), days, months and years including the relation between consecutive units (1 year = 365 days); £ and pence; $ and cents; € and cents; degrees; standard units of mass, length, area, volume and capacity, and related compound units. Learners should be able to convert between units efficiently. Learners should be able to use rulers and protractors to measure the lengths of lines and the sizes of angles.

Calculators

If no reference is made in the specification to calculator use then learners are expected to be able to use both calculator and non-calculator methods. All content may be assessed on either the calculator or non-calculator papers.

Sketching and plotting curves

This specification makes a distinction between sketching and plotting curves.

- A **sketch** shows the most important features of a curve. It does not have to be to scale, though axes should be labelled and the graph should interact with the axes correctly. A sketch should fall within the correct quadrants and show the correct long-term behaviour. A sketch only needs to be labelled with x-intercepts, y-intercepts, turning points or other features when requested in the assessment. A sketch does not require graph or squared paper. The assessment for this specification will expect a sketch to be drawn freehand.
- A **plot** is drawn on squared or graph paper for a given range of values by calculating the coordinates of points on the curve and connecting them as appropriate. Where a table of values is given it will include sufficient points to determine the curve. Where such a table is not given, the number of points required is left to the discretion of the learner.

Statement References

Individual references for the statements of this specification are included in the column headed 'GCSE (9–1) Content Ref.'. Corresponding statements from the Department for Education (DfE) *Mathematics – GCSE subject content and assessment objectives* document are included in the column headed 'DfE Ref.'.

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
OCR 1	**Number Operations and Integers**				
1.01	**Calculations with integers**				
1.01a	Four rules	Use non-calculator methods to calculate the sum, difference, product and quotient of positive and negative whole numbers.			N2
1.02	**Whole number theory**				
1.02a	Definitions and terms	Understand and use the terms odd, even, prime, factor (divisor), multiple, common factor (divisor), common multiple, square, cube, root. Understand and use place value.			N2, N4, N6
1.02b	Prime numbers	Identify prime numbers less than 20. Express a whole number as a product of its prime factors. e.g. $24 = 2 \times 2 \times 2 \times 3$ Understand that each number can be expressed as a product of prime factors in only one way.	Identify prime numbers. Use power notation in expressing a whole number as a product of its prime factors. e.g. $600 = 2^3 \times 3 \times 5^2$		N4, N6

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
1.02c	Highest Common Factor (HCF) and Lowest Common Multiple (LCM)	Find the HCF and LCM of two whole numbers by listing.	Find the HCF and LCM of two whole numbers from their prime factorisations.		N4
1.03	**Combining arithmetic operations**				
1.03a	Priority of operations	Know the conventional order for performing calculations involving brackets, four rules and powers, roots and reciprocals.			N3
1.04	**Inverse operations**				
1.04a	Inverse operations	Know that addition and subtraction, multiplication and division, and powers and roots, are inverse operations and use this to simplify and check calculations, for example, in reversing arithmetic in "I'm thinking of a number" or "missing digit" problems. e.g. $223 - 98 = 223 + 2 - 100 = 125$ $25 \times 12 = 50 \times 6 = 100 \times 3 = 300$ *[see also Calculation and estimation of powers and roots, 3.01b]*			N3, N6

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
OCR 2	**Fractions, Decimals and Percentages**				
2.01	**Fractions**				
2.01a	Equivalent fractions	Recognise and use equivalence between simple fractions and mixed numbers. e.g. $\frac{2}{6}=\frac{1}{3}$ $2\frac{1}{2}=\frac{5}{2}$			N3
2.01b	Calculations with fractions	Add, subtract, multiply and divide simple fractions (proper and improper), including mixed numbers and negative fractions. e.g. $1\frac{1}{2}+\frac{3}{4}$ $\frac{5}{6}\times\frac{3}{10}$ $^{-}3\times\frac{4}{5}$	Carry out more complex calculations, including the use of improper fractions. e.g. $\frac{2}{5}+\frac{5}{6}$ $\frac{2}{3}+\frac{1}{2}\times\frac{3}{5}$	*[see also Algebraic fractions, 6.01g]*	N2, N8
2.01c	Fractions of a quantity	Calculate a fraction of a quantity. e.g. $\frac{2}{5}$ of £3.50 Express one quantity as a fraction of another. *[see also Ratios and fractions, 5.01c]*	Calculate with fractions greater than 1.		N12, R3, R6

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
2.02	**Decimal fractions**				
2.02a	Decimals and fractions	Express a simple fraction as a terminating decimal or vice versa, without a calculator. e.g. $0.4 = \frac{2}{5}$ Understand and use place value in decimals.	Use division to convert a simple fraction to a decimal. e.g. $\frac{1}{6} = 0.16666\ldots$	Convert a recurring decimal to an exact fraction or vice versa. e.g. $0.\dot{4}\dot{1} = \frac{41}{99}$	N10, N2
2.02b	Addition, subtraction and multiplication of decimals	Add, subtract and multiply decimals including negative decimals, without a calculator.			N2
2.02c	Division of decimals	Divide a decimal by a whole number, including negative decimals, without a calculator. e.g. $0.24 \div 6$	Without a calculator, divide a decimal by a decimal. e.g. $0.3 \div 0.6$		N2
2.03	**Percentages**				
2.03a	Percentage conversions	Convert between fractions, decimals and percentages. e.g. $\frac{1}{4} = 0.25 = 25\%$ $1\frac{1}{2} = 150\%$			R9

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
2.03b	Percentage calculations	Understand percentage is 'number of parts per hundred'. Calculate a percentage of a quantity, and express one quantity as a percentage of another, with or without a calculator.			R9, N12
2.03c	Percentage change	Increase or decrease a quantity by a simple percentage, including simple decimal or fractional multipliers. Apply this to simple original value problems and simple interest. e.g. Add 10% to £2.50 by either finding 10% and adding, or by multiplying by 1.1 or $\frac{110}{100}$ Calculate original price of an item costing £10 after a 50% discount.	Express percentage change as a decimal or fractional multiplier. Apply this to percentage change problems (including original value problems). *[see also Growth and decay, 5.03a]*		R9, N12
2.04	**Ordering fractions, decimals and percentages**				
2.04a	Ordinality	Order integers, fractions, decimals and percentages. e.g. $\frac{4}{5}$, $\frac{3}{4}$, 0.72, $^{-}0.9$			N1, N2, R9
2.04b	Symbols	Use $<$, $>$, $\leqslant$, $\geqslant$, $=$, $\neq$			N1

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
OCR 3	**Indices and Surds**				
3.01	**Powers and roots**				
3.01a	Index notation	Use positive integer indices to write, for example, $2 \times 2 \times 2 \times 2 = 2^4$	Use negative integer indices to represent reciprocals.	Use fractional indices to represent roots and combinations of powers and roots.	N6, N7
3.01b	Calculation and estimation of powers and roots	Calculate positive integer powers and exact roots. e.g. $2^4 = 16$ $\sqrt{9} = 3$ $\sqrt[3]{8} = 2$ Recognise simple powers of 2, 3, 4 and 5. e.g. $27 = 3^3$ *[see also Inverse operations, 1.04a]*	Calculate with integer powers. e.g. $2^{-3} = \frac{1}{8}$ Calculate with roots.	Calculate fractional powers. e.g. $16^{-\frac{3}{4}} = \frac{1}{\left(\sqrt[4]{16}\right)^3} = \frac{1}{8}$ Estimate powers and roots. e.g. $\sqrt{51}$ to the nearest whole number	N6, N7
3.01c	Laws of indices	*[see also Simplifying products and quotients, 6.01c]*	Know and apply: $a^m \times a^n = a^{m+n}$ $a^m \div a^n = a^{m-n}$ $\left(a^m\right)^n = a^{mn}$ *[see also Calculations with numbers in standard form, 3.02b, Simplifying products and quotients, 6.01c]*		N7, A4

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
3.02	**Standard form**				
3.02a	Standard form	Interpret and order numbers expressed in standard form. Convert numbers to and from standard form. e.g. $1320 = 1.32 \times 10^3$, $0.00943 = 9.43 \times 10^{-3}$			N9
3.02b	Calculations with numbers in standard form	Use a calculator to perform calculations with numbers in standard form.	Add, subtract, multiply and divide numbers in standard form, without a calculator. *[see also Laws of indices, 3.01c]*		N9
3.03	**Exact calculations**				
3.03a	Exact calculations	Use fractions in exact calculations without a calculator.	Use multiples of π in exact calculations without a calculator.	Use surds in exact calculations without a calculator.	N2, N8
3.03b	Manipulating surds			Simplify expressions with surds, including rationalising denominators. e.g. $\sqrt{12} = 2\sqrt{3}$ $\frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3}$ $\frac{1}{\sqrt{3}+1} = \frac{\sqrt{3}-1}{2}$	N8

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
OCR 4	Approximation and Estimation				
4.01	Approximation and estimation				
4.01a	Rounding	Round numbers to the nearest whole number, ten, hundred, etc. or to a given number of significant figures (sf) or decimal places (dp).	Round answers to an appropriate level of accuracy.		N15
4.01b	Estimation	Estimate or check, without a calculator, the result of a calculation by using suitable approximations. e.g. Estimate, to one significant figure, the cost of 2.8 kg of potatoes at 68p per kg.	Estimate or check, without a calculator, the result of more complex calculations including roots. Use the symbol ≈ appropriately. e.g. $\sqrt{\frac{2.9}{0.051 \times 0.62}} \approx 10$		N14

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
4.01c	Upper and lower bounds		Use inequality notation to write down an error interval for a number or measurement rounded or truncated to a given degree of accuracy. e.g. If $x = 2.1$ rounded to 1 dp, then $2.05 \leqslant x < 2.15$. If $x = 2.1$ truncated to 1 dp, then $2.1 \leqslant x < 2.2$. Apply and interpret limits of accuracy.	Calculate the upper and lower bounds of a calculation using numbers rounded to a known degree of accuracy. e.g. Calculate the area of a rectangle with length and width given to 2 sf. Understand the difference between bounds of discrete and continuous quantities. e.g. If you have 200 cars to the nearest hundred then the number of cars n satisfies: $150 \leqslant n < 250$ and $150 \leqslant n \leqslant 249$.	N15, N16
OCR 5	**Ratio, Proportion and Rates Of Change**				
5.01	**Calculations with ratio**				
5.01a	Equivalent ratios	Find the ratio of quantities in the form $a : b$ and simplify. Find the ratio of quantities in the form $1 : n$. e.g. 50 cm : 1.5 m = 50 : 150 = 1 : 3			R4, R5

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
5.01b	Division in a given ratio	Split a quantity into two parts given the ratio of the parts. e.g. £2.50 in the ratio 2 : 3 Express the division of a quantity into two parts as a ratio. Calculate one quantity from another, given the ratio of the two quantities.	Split a quantity into three or more parts given the ratio of the parts.		R5, R6
5.01c	Ratios and fractions	Interpret a ratio of two parts as a fraction of a whole. e.g. £9 split in the ratio 2 : 1 gives parts $\frac{2}{3} \times$ £9 and $\frac{1}{3} \times$ £9. *[see also Fractions of a quantity, 2.01c]*			N11, R5, R6, R8
5.01d	Solve ratio and proportion problems	Solve simple ratio and proportion problems. e.g. Adapt a recipe for 6 for 4 people. Understand the relationship between ratio and linear functions.			R5, R8

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
5.02	**Direct and inverse proportion**				
5.02a	Direct proportion	Solve simple problems involving quantities in direct proportion including algebraic proportions. e.g. Using equality of ratios, if $y \propto x$, then $\frac{y_1}{y_2} = \frac{x_1}{x_2}$ or $\frac{y_1}{x_1} = \frac{y_2}{x_2}$. Currency conversion problems. *[see also Similar shapes, 9.04c]*	Solve more formal problems involving quantities in direct proportion (i.e. where $y \propto x$). Recognise that if $y = kx$, where k is a constant, then y is proportional to x.	Formulate equations and solve problems involving a quantity in direct proportion to a power or root of another quantity.	R7, R10, R13
5.02b	Inverse proportion	Solve simple word problems involving quantities in inverse proportion or simple algebraic proportions. e.g. speed–time contexts (if speed is doubled, time is halved).	Solve more formal problems involving quantities in inverse proportion (i.e. where $y \propto \frac{1}{x}$). Recognise that if $y = \frac{k}{x}$, where k is a constant, then y is inversely proportional to x.	Formulate equations and solve problems involving a quantity in inverse proportion to a power or root of another quantity.	R10, R13

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
5.03	**Discrete growth and decay**				
5.03a	Growth and decay	Calculate simple interest including in financial contexts.	Solve problems step-by-step involving multipliers over a given interval, for example, compound interest, depreciation, etc. e.g. A car worth £15 000 new depreciating by 30%, 20% and 15% respectively in three years. *[see also Percentage change, 2.03c]*	Express exponential growth or decay as a formula. e.g. Amount £A subject to compound interest of 10% p.a. on £100 as $A = 100 \times 1.1^n$. Solve and interpret answers in growth and decay problems. *[see also Exponential functions, 7.01d, Formulate algebraic expressions, 6.02a]*	R9, R16
OCR 6	**Algebra**				
6.01	**Algebraic expressions**				
6.01a	Algebraic terminology and proofs	Understand and use the concepts and vocabulary of expressions, equations, formulae, inequalities, terms and factors.	Recognise the difference between an equation and an identity, and show algebraic expressions are equivalent. e.g. show that $(x+1)^2 + 2 = x^2 + 2x + 3$ Use algebra to construct arguments.	Use algebra to construct proofs and arguments. e.g. prove that the sum of three consecutive integers is a multiple of 3.	A3, A6
6.01b	Collecting like terms in sums and differences of terms	Simplify algebraic expressions by collecting like terms. e.g. $2a + 3a = 5a$			A1, A3, A4

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
6.01c	Simplifying products and quotients	Simplify algebraic products and quotients. e.g. $a \times a \times a = a^3$ $2a \times 3b = 6ab$ $a^2 \times a^3 = a^5$ $3a^3 \div a = 3a^2$ *[see also Laws of indices, 3.01c]*		Simplify algebraic products and quotients using the laws of indices. e.g. $a^{\frac{1}{2}} \times 2a^{-3} = 2a^{-\frac{5}{2}}$ $2a^2b^3 \div 4a^{-3}b = \frac{1}{2}a^5b^2$	N3, A1, A4
6.01d	Multiplying out brackets	Simplify algebraic expressions by multiplying a single term over a bracket. e.g. $2(a+3b) = 2a+6b$ $2(a+3b)+3(a-2b) = 5a$	Expand products of two binomials. e.g. $(x-1)(x-2) = x^2-3x+2$ $(a+2b)(a-b) = a^2+ab-2b^2$	Expand products of more than two binomials. e.g. $(x+1)(x-1)(2x+1)$ $= 2x^3+x^2-2x-1$	A1, A3, A4
6.01e	Factorising	Take out common factors. e.g. $3a-9b = 3(a-3b)$ $2x+3x^2 = x(2+3x)$	Factorise quadratic expressions of the form x^2+bx+c. e.g. $x^2-x-6 = (x-3)(x+2)$ $x^2-16 = (x-4)(x+4)$ $x^2-3 = (x-\sqrt{3})(x+\sqrt{3})$	Factorise quadratic expressions of the form ax^2+bx+c (where $a \neq 0$ or 1) e.g. $2x^2+3x-2 = (2x-1)(x+2)$	A1, A3, A4
6.01f	Completing the square			Complete the square on a quadratic expression. e.g. $x^2+4x-6 = (x+2)^2-10$ $2x^2+5x+1 = 2\left(x+\frac{5}{4}\right)^2-\frac{17}{8}$	A11, A18

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6.01g	Algebraic fractions			Simplify and manipulate algebraic fractions. e.g. Write $\frac{1}{n-1}+\frac{n}{n+1}$ as a single fraction. Simplify $\frac{n^2+2n}{n^2+n-2}$.	A1, A4
6.02	**Algebraic formulae**				
6.02a	Formulate algebraic expressions		Formulate simple formulae and expressions from real-world contexts. e.g. Cost of car hire at £50 per day plus 10p per mile. The perimeter of a rectangle when the length is 2 cm more than the width.	*[See, for example, Direct proportion, 5.02a, Inverse proportion, 5.02b, Growth and decay, 5.03a]*	A3, A5, A21, R10
6.02b	Substitute numerical values into formulae and expressions	Substitute positive numbers into simple expressions and formulae to find the value of the subject. e.g. Given that $v = u + at$, find v when $t = 1$, $a = 2$ and $u = 7$	Substitute positive or negative numbers into more complex formulae, including powers, roots and algebraic fractions. e.g. $v=\sqrt{u^2+2as}$ with $u = 2.1, s = 0.18, a = {}^{-}9.8$.		A2, A5

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6.02c	Change the subject of a formula	Rearrange formulae to change the subject, where the subject appears once only. e.g. Make d the subject of the formula $c = \pi d$. Make x the subject of the formula $y = 3x - 2$.	Rearrange formulae to change the subject, including cases where the subject appears twice, or where a power or reciprocal of the subject appears. e.g. Make t the subject of the formulae (i) $s = \frac{1}{2}at^2$ (ii) $v = \frac{x}{t}$ (iii) $2ty = t + 1$	*[Examples may include manipulation of algebraic fractions, 6.01g]*	A4, A5
6.02d	Recall and use standard formulae	Recall and use: Circumference of a circle $2\pi r = \pi d$ Area of a circle πr^2	Recall and use: Pythagoras' theorem $a^2 + b^2 = c^2$ Trigonometry formulae $\sin\theta = \frac{o}{h}$, $\cos\theta = \frac{a}{h}$, $\tan\theta = \frac{o}{a}$	Recall and use: The quadratic formula $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ Sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ Cosine rule $a^2 = b^2 + c^2 - 2bc\cos A$ Area of a triangle $\frac{1}{2}ab\sin C$	A2, A3, A5

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6.02e	Use kinematics formulae	Use: $v = u + at$ $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$ where a is constant acceleration, u is initial velocity, v is final velocity, s is displacement from position when $t = 0$ and t is time taken.			A2, A3, A5
6.03	**Algebraic equations**				
6.03a	Linear equations in one unknown	Solve linear equations in one unknown algebraically. e.g. Solve $3x - 1 = 5$	Set up and solve linear equations in mathematical and non-mathematical contexts, including those with the unknown on both sides of the equation. e.g. Solve $5(x - 1) = 4 - x$ Interpret solutions in context.	*[Examples may include manipulation of algebraic fractions, 6.01g]*	A3, A17, A21
6.03b	Quadratic equations		Solve quadratic equations with coefficient of x^2 equal to 1 by factorising. e.g. Solve $x^2 - 5x + 6 = 0$. Find x for an x cm by $(x + 3)$ cm rectangle of area 40cm^2.	Know the quadratic formula. Rearrange and solve quadratic equations by factorising, completing the square or using the quadratic formula. e.g. $2x^2 = 3x + 5$ $\frac{2}{x} - \frac{2}{x+1} = 1$	A18

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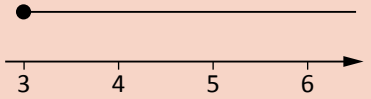
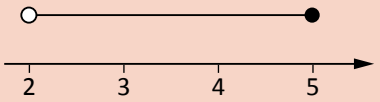
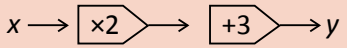
6.03c	Simultaneous equations		Set up and solve two linear simultaneous equations in two variables algebraically. e.g. Solve simultaneously $2x + 3y = 18$ and $y = 3x - 5$	Set up and solve two simultaneous equations (one linear and one quadratic) in two variables algebraically. e.g. Solve simultaneously $x^2 + y^2 = 50$ and $2y = x + 5$	A19, A21
6.03d	Approximate solutions using a graph	Use a graph to find the approximate solution of a linear equation.	Use graphs to find approximate roots of quadratic equations and the approximate solution of two linear simultaneous equations.	Know that the coordinates of the points of intersection of a curve and a straight line are the solutions to the simultaneous equations for the line and curve.	A11, A17, A18, A19
6.03e	Approximate solutions by iteration			Find approximate solutions to equations using systematic sign-change methods (for example, decimal search or interval bisection) when there is no simple analytical method of solving them. Specific methods will not be requested in the assessment.	A20, R16

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
6.04	**Algebraic inequalities**				
6.04a	Inequalities in one variable	Understand and use the symbols $<$, $\leqslant$, $>$ and $\geqslant$	Solve linear inequalities in one variable, expressing solutions on a number line using the conventional notation. e.g $2x + 1 \geqslant 7$  $1 < 3x - 5 \leqslant 10$  	Solve quadratic inequalities in one variable. e.g. $x^2 - 2x < 3$ Express solutions in set notation. e.g. $\{x : x \geqslant 3\}$ $\{x : 2 < x \leqslant 5\}$ *[See also Polynomial and exponential functions, 7.01c]*	N1, A3, A22
6.04b	Inequalities in two variables			Solve (several) linear inequalities in two variables, representing the solution set on a graph. *[See also Straight line graphs, 7.02a]*	A22

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
6.05	**Language of functions**				
6.05a	Functions	Interpret, where appropriate, simple expressions as functions with inputs and outputs. e.g. $y = 2x + 3$ as  		Interpret the reverse process as the 'inverse function'. Interpret the succession of two functions as a 'composite function'. [Knowledge of function notation will not be required] *[see also Translations and reflections, 7.03a]*	A7
6.06	**Sequences**				
6.06a	Generate terms of a sequence	Generate a sequence by spotting a pattern or using a term-to-term rule given algebraically or in words. e.g. Continue the sequences 1, 4, 7, 10, ... 1, 4, 9, 16, ... Find a position-to-term rule for simple arithmetic sequences, algebraically or in words. e.g. 2, 4, 6, … $2n$ 3, 4, 5, … $n + 2$	Generate a sequence from a formula for the nth term. e.g. nth term = $n^2 + 2n$ gives 3, 8, 15, … Find a formula for the nth term of an arithmetic sequence. e.g. 40, 37, 34, 31, … $43 - 3n$	Use subscript notation for position-to-term and term-to-term rules. e.g. $x_n = n + 2$ $x_{n+1} = 2x_n - 3$ Find a formula for the nth term of a quadratic sequence. e.g. 0, 3, 10, 21, … $u_n = 2n^2 - 3n + 1$	A23, A25

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
6.06b	Special sequences	Recognise sequences of triangular, square and cube numbers, and simple arithmetic progressions.	Recognise Fibonacci and quadratic sequences, and simple geometric progressions (r^n where n is an integer and r is a rational number > 0).	Generate and find nth terms of other sequences. e.g. $1,\ \sqrt{2},\ 2,\ 2\sqrt{2},\ \ldots$ $\frac{1}{2},\ \frac{2}{3},\ \frac{3}{4},\ \ldots$	A24
OCR 7	**Graphs of Equations and Functions**				
7.01	**Graphs of equations and functions**				
7.01a	x- and y-coordinates	Work with x- and y-coordinates in all four quadrants.			A8
7.01b	Graphs of equations and functions	Use a table of values to plot graphs of linear and quadratic functions. e.g. $y = 2x + 3$ $y = 2x^2 + 1$	Use a table of values to plot other polynomial graphs and reciprocals. e.g. $y = x^3 - 2x$ $y = x + \frac{1}{x}$ $2x + 3y = 6$	Use a table of values to plot exponential graphs. e.g. $y = 3 \times 1.1^x$	A9, A14
7.01c	Polynomial and exponential functions	Recognise and sketch the graphs of simple linear and quadratic functions. e.g. $y = 2$, $x = 1$, $y = 2x$, $y = x^2$	Recognise and sketch graphs of: $y = x^3$, $y = \frac{1}{x}$. Identify intercepts and, using symmetry, the turning point of graphs of quadratic functions. Find the roots of a quadratic equation algebraically.	Sketch graphs of quadratic functions, identifying the turning point by completing the square.	A11, A12
7.01d	Exponential functions			Recognise and sketch graphs of exponential functions in the form $y = k^x$ for positive k.	A12

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
7.01e	Trigonometric functions			Recognise and sketch the graphs of $y = \sin x$, $y = \cos x$ and $y = \tan x$.	A12
7.01f	Equations of circles			Recognise and use the equation of a circle with centre at the origin.	A16
7.02	**Straight line graphs**				
7.02a	Straight line graphs	Find and interpret the gradient and intercept of straight lines, graphically and using $y = mx + c$.	Use the form $y = mx + c$ to find and sketch equations of straight lines. Find the equation of a line through two given points, or through one point with a given gradient.	Identify the solution sets of linear inequalities in two variables, using the convention of dashed and solid lines.	A9, A10, A22
7.02b	Parallel and perpendicular lines		Identify and find equations of parallel lines.	Identify and find equations of perpendicular lines. Calculate the equation of a tangent to a circle at a given point. *[See also Equations of circles, 7.01f]*	A9, A16

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
7.03	**Transformations of curves and their equations**				
7.03a	Translations and reflections			Identify and sketch translations and reflections of a given graph (or the graph of a given equation). [Knowledge of function notation will not be required] *[see also Functions, 6.05a]* e.g. Sketch the graph of $y = \sin x + 2$ $y = (x+2)^2 - 1$ $y = -x^2$	A13
7.04	**Interpreting graphs**				
7.04a	Graphs of real-world contexts	Construct and interpret graphs in real-world contexts. e.g. distance-time money conversion temperature conversion *[see also Direct proportion, 5.02a, Inverse proportion, 5.02b]*	Recognise and interpret graphs that illustrate direct and inverse proportion.		A14, R10, R14

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7.04b	Gradients	Understand the relationship between gradient and ratio.	Interpret straight line gradients as rates of change. e.g. Gradient of a distance-time graph as a velocity.	Calculate or estimate gradients of graphs, and interpret in contexts such as distance-time graphs, velocity-time graphs and financial graphs. Apply the concepts of average and instantaneous rate of change (gradients of chords or tangents) in numerical, algebraic and graphical contexts.	A14, A15, R8, R14, R15
7.04c	Areas			Calculate or estimate areas under graphs, and interpret in contexts such as distance-time graphs, velocity-time graphs and financial graphs.	A15
OCR 8	**Basic Geometry**				
8.01	**Conventions, notation and terms** Learners will be expected to be familiar with the following geometrical skills, conventions, notation and terms, which will be assessed in questions at both tiers.				
8.01a	2D and 3D shapes	Use the terms points, lines, line segments, vertices, edges, planes, parallel lines, perpendicular lines.			G1
8.01b	Angles	Know the terms acute, obtuse, right and reflex angles. Use the standard conventions for labelling and referring to the sides and angles of triangles. e.g. AB, ∠ABC, angle ABC, a is the side opposite angle A			G1

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
8.01c	Polygons	Know the terms: • regular polygon • scalene, isosceles and equilateral triangle • quadrilateral, square, rectangle, kite, rhombus, parallelogram, trapezium • pentagon, hexagon, octagon.			G1
8.01d	Polyhedra and other solids	Recognise the terms face, surface, edge, and vertex, cube, cuboid, prism, cylinder, pyramid, cone and sphere.			G12
8.01e	Diagrams	Draw diagrams from written descriptions as required by questions.			G1
8.01f	Geometrical instruments	Use a ruler to construct and measure straight lines. Use a protractor to construct and measure angles. Use compasses to construct circles.			G2, G15
8.01g	*x*- and *y*-coordinates	Use *x*- and *y*-coordinates in plane geometry problems, including transformations of simple shapes.			G7, G11
8.02	**Ruler and compass constructions**				
8.02a	Perpendicular bisector		Construct the perpendicular bisector and midpoint of a line segment.		G2
8.02b	Angle bisector		Construct the bisector of an angle formed from two lines.		G2

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8.02c	Perpendicular from a point to a line		Construct the perpendicular from a point to a line. Construct the perpendicular to a line at a point. Know that the perpendicular distance from a point to a line is the shortest distance to the line.		G2
8.02d	Loci		Apply ruler and compass constructions to construct figures and identify the loci of points, to include real-world problems. Understand the term 'equidistant'.		G2
8.03	**Angles**				
8.03a	Angles at a point	Know and use the sum of the angles at a point is 360°.	Apply these angle facts to find angles in rectilinear figures, and to justify results in simple proofs. e.g. The sum of the interior angles of a triangle is 180°.	Apply these angle properties in more formal proofs of geometrical results.	G3, G6
8.03b	Angles on a line	Know that the sum of the angles at a point on a line is 180°.			G3, G6
8.03c	Angles between intersecting and parallel lines	Know and use: vertically opposite angles are equal alternate angles on parallel lines are equal corresponding angles on parallel lines are equal.			G3, G6

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
8.03d	Angles in polygons	Derive and use the sum of the interior angles of a triangle is 180°. Derive and use the sum of the exterior angles of a polygon is 360°. Find the sum of the interior angles of a polygon. Find the interior angle of a regular polygon.	Apply these angle facts to find angles in rectilinear figures, and to justify results in simple proofs. e.g. The sum of the interior angles of a triangle is 180°.	Apply these angle properties in more formal proofs of geometrical results.	G3, G6
8.04	**Properties of polygons**				
8.04a	Properties of a triangle	Know the basic properties of isosceles, equilateral and right-angled triangles. Give geometrical reasons to justify these properties.	Use these facts to find lengths and angles in rectilinear figures and in simple proofs.	Use these facts in more formal proofs of geometrical results, for example circle theorems.	G4, G6
8.04b	Properties of quadrilaterals	Know the basic properties of the square, rectangle, parallelogram, trapezium, kite and rhombus. Give geometrical reasons to justify these properties.	Use these facts to find lengths and angles in rectilinear figures and in simple proofs.	Use these facts in more formal proofs of geometrical results, for example circle theorems.	G4, G6
8.04c	Symmetry	Identify reflection and rotation symmetries of triangles, quadrilaterals and other polygons.			G1, G4

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8.05	**Circles**				
8.05a	Circle nomenclature	Understand and use the terms centre, radius, chord, diameter and circumference.	Understand and use the terms tangent, arc, sector and segment.		G9
8.05b	Angles subtended at centre and circumference			Apply and prove: the angle subtended by an arc at the centre is twice the angle at the circumference.	G10
8.05c	Angle in a semicircle			Apply and prove: the angle on the circumference subtended by a diameter is a right angle.	G10
8.05d	Angles in the same segment			Apply and prove: two angles in the same segment are equal.	G10
8.05e	Angle between radius and chord			Apply and prove: a radius or diameter bisects a chord if and only if it is perpendicular to the chord.	G10
8.05f	Angle between radius and tangent			Apply and prove: for a point P on the circumference, the radius or diameter through P is perpendicular to the tangent at P.	G10

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
8.05g	The alternate segment theorem			Apply and prove: for a point P on the circumference, the angle between the tangent and a chord through P equals the angle subtended by the chord in the opposite segment.	G10
8.05h	Cyclic quadrilaterals			Apply and prove: the opposite angles of a cyclic quadrilateral are supplementary.	G10
8.06	**Three-dimensional shapes**				
8.06a	3-dimensional solids	Recognise and know the properties of the cube, cuboid, prism, cylinder, pyramid, cone and sphere.			G12
8.06b	Plans and elevations	Interpret plans and elevations of simple 3D solids.	Construct plans and elevations of simple 3D solids, and representations (e.g. using isometric paper) of solids from plans and elevations.		G1, G13
OCR 9	**Congruence and Similarity**				
9.01	**Plane isometric transformations**				
9.01a	Reflection	Reflect a simple shape in a given mirror line, and identify the mirror line from a shape and its image.	Identify a mirror line $x = a$, $y = b$ or $y = \pm x$ from a simple shape and its image under reflection.		G7

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
9.01b	Rotation	Rotate a simple shape clockwise or anti-clockwise through a multiple of 90° about a given centre of rotation.	Identify the centre, angle and sense of a rotation from a simple shape and its image under rotation.		G7
9.01c	Translation	Use a column vector to describe a translation of a simple shape, and perform a specified translation.			G7, G24
9.01d	Combinations of transformations			Perform a sequence of isometric transformations (reflections, rotations or translations), on a simple shape. Describe the resulting transformation and the changes and invariance achieved.	G8
9.02	**Congruence**				
9.02a	Congruent triangles	Identify congruent triangles.	Prove that two triangles are congruent using the cases: 3 sides (SSS) 2 angles, 1 side (ASA) 2 sides, included angle (SAS) Right angle, hypotenuse, side (RHS).		G5, G7
9.02b	Applying congruent triangles		Apply congruent triangles in calculations and simple proofs. e.g. The base angles of an isosceles triangle are equal.		G6, G19

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
9.03	**Plane vector geometry**				
9.03a	Vector arithmetic		Understand addition, subtraction and scalar multiplication of vectors.	Use vectors in geometric arguments and proofs.	G25
9.03b	Column vectors		Represent a 2-dimensional vector as a column vector, and draw column vectors on a square or coordinate grid.		G25
9.04	**Similarity**				
9.04a	Similar triangles	Identify similar triangles.	Prove that two triangles are similar.		G6, G7
9.04b	Enlargement	Enlarge a simple shape from a given centre using a whole number scale factor, and identify the scale factor of an enlargement.	Identify the centre and scale factor (including fractional scale factors) of an enlargement of a simple shape, and perform such an enlargement on a simple shape.	Perform and recognise enlargements with negative scale factors.	R2, R12, G7
9.04c	Similar shapes	Compare lengths, areas and volumes using ratio notation and scale factors.	Apply similarity to calculate unknown lengths in similar figures. *[see also Direct proportion, 5.02a]*	Understand the relationship between lengths, areas and volumes of similar shapes. *[see also Direct proportion, 5.02a]*	R12, G19

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
OCR 10	**Mensuration**				
10.01	**Units and measurement**				
10.01a	Units of measurement	Use and convert standard units of measurement for length, area, volume/capacity, mass, time and money.	Use and convert standard units in algebraic contexts.		N13, R1, G14
10.01b	Compound units	Use and convert simple compound units (e.g. for speed, rates of pay, unit pricing). Know and apply in simple cases: speed = distance ÷ time	Use and convert other compound units (e.g. density, pressure). Know and apply: density = mass ÷ volume Use and convert compound units in algebraic contexts.		N13, R1, R11, G14
10.01c	Maps and scale drawings	Use the scale of a map, and work with bearings. Construct and interpret scale drawings.			R2, G15
10.02	**Perimeter calculations**				
10.02a	Perimeter of rectilinear shapes	Calculate the perimeter of rectilinear shapes.			G17
10.02b	Circumference of a circle	Know and apply the formula circumference = $2\pi r = \pi d$ to calculate the circumference of a circle.	Calculate the arc length of a sector of a circle given its angle and radius.		G17, G18

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
10.02c	Perimeter of composite shapes	Apply perimeter formulae in calculations involving the perimeter of composite 2D shapes.			G17, G18
10.03	**Area calculations**				
10.03a	Area of a triangle	Know and apply the formula: area = $\frac{1}{2}$ base × height.		Know and apply the formula: area = $\frac{1}{2}ab\sin C$.	G16, G23
10.03b	Area of a parallelogram	Know and apply the formula: area = base × height. [Includes area of a rectangle]			G16
10.03c	Area of a trapezium	Calculate the area of a trapezium.			G16
10.03d	Area of a circle	Know and apply the formula area = πr^2 to calculate the area of a circle.	Calculate the area of a sector of a circle given its angle and radius.		G17, G18
10.03e	Area of composite shapes	Apply area formulae in calculations involving the area of composite 2D shapes.			G17, G18
10.04	**Volume and surface area calculations**				
10.04a	Polyhedra	Calculate the surface area and volume of cuboids and other right prisms (including cylinders).			G16

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
10.04b	Cones and spheres		Calculate the surface area and volume of spheres, cones and simple composite solids (formulae will be given).		N8, G17
10.04c	Pyramids		Calculate the surface area and volume of a pyramid (the formula $\frac{1}{3}$ area of base × height will be given).		G17
10.05	**Triangle mensuration**				
10.05a	Pythagoras' theorem		Know, derive and apply Pythagoras' theorem $a^2 + b^2 = c^2$ to find lengths in right-angled triangles in 2D figures.	Apply Pythagoras' theorem in more complex figures, including 3D figures.	G6, G20
10.05b	Trigonometry in right-angled triangles		Know and apply the trigonometric ratios, $\sin\theta$, $\cos\theta$ and $\tan\theta$ and apply them to find angles and lengths in right-angled triangles in 2D figures. *[see also Similar shapes, 9.04c]*	Apply the trigonometry of right-angled triangles in more complex figures, including 3D figures.	R12, G20
10.05c	Exact trigonometric ratios		Know the exact values of $\sin\theta$ and $\cos\theta$ for $\theta = 0°$, $30°$, $45°$, $60°$ and $90°$. Know the exact value of $\tan\theta$ for $\theta = 0°$, $30°$, $45°$ and $60°$.		R12, G21

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
10.05d	Sine rule			Know and apply the sine rule, $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$, to find lengths and angles.	G22
10.05e	Cosine rule			Know and apply the cosine rule, $a^2 = b^2 + c^2 - 2bc\cos A$, to find lengths and angles.	G22
OCR 11	**Probability**				
11.01	**Basic probability and experiments**				
11.01a	The probability scale	Use the 0-1 probability scale as a measure of likelihood of random events, for example, 'impossible' with 0, 'evens' with 0.5, 'certain' with 1.			P3
11.01b	Relative frequency	Record, describe and analyse the relative frequency of outcomes of repeated experiments using tables and frequency trees.			P1
11.01c	Relative frequency and probability	Use relative frequency as an estimate of probability.	Understand that relative frequencies approach the theoretical probability as the number of trials increases.		P3, P5

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
11.01d	Equally likely outcomes and probability	Calculate probabilities, expressed as fractions or decimals, in simple experiments with equally likely outcomes, for example flipping coins, rolling dice, etc. Apply ideas of randomness and fairness in simple experiments. Calculate probabilities of simple combined events, for example rolling two dice and looking at the totals. Use probabilities to calculate the number of expected outcomes in repeated experiments.			P2, P7
11.02	**Combined events and probability diagrams**				
11.02a	Sample spaces	Use tables and grids to list the outcomes of single events and simple combinations of events, and to calculate theoretical probabilities. e.g. Flipping two coins. Finding the number of orders in which the letters E, F and G can be written.	Use sample spaces for more complex combinations of events. e.g. Recording the outcomes for sum of two dice. Problems with two spinners.	Recognise when a sample space is the most appropriate form to use when solving a complex probability problem. Use the most appropriate diagrams to solve unstructured questions where the route to the solution is less obvious.	N5, P6, P7

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
11.02b	Enumeration	Use systematic listing strategies.		Use the product rule for counting numbers of outcomes of combined events.	N5
11.02c	Venn diagrams and sets	Use a two-circle Venn diagram to enumerate sets, and use this to calculate related probabilities. Use simple set notation to describe simple sets of numbers or objects. e.g. A = {even numbers} B = {mathematics learners} C = {isosceles triangles}	Construct a Venn diagram to classify outcomes and calculate probabilities. Use set notation to describe a set of numbers or objects. e.g. D = $\{x : 1 < x < 3\}$ E = $\{x : x \text{ is a factor of } 280\}$	Construct tree diagrams, two-way tables or Venn diagrams to solve more complex probability problems (including conditional probabilities; structure for diagrams may not be given).	P6, P9
11.02d	Tree diagrams		Use tree diagrams to enumerate sets and to record the probabilities of successive events (tree frames may be given and in some cases will be partly completed).		P6, P9
11.02e	The addition law of probability	Use the addition law for mutually exclusive events. Use p(A) + p(*not* A) = 1	Derive or informally understand and apply the formula p(A *or* B) = p(A) + p(B) – p(A *and* B)		P4

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
11.02f	The multiplication law of probability and conditional probability		Use tree diagrams and other representations to calculate the probability of independent and dependent combined events.	Understand the concept of conditional probability, and calculate it from first principles in known contexts. e.g. In a random cut of a pack of 52 cards, calculate the probability of drawing a diamond, given a red card is drawn. Derive or informally understand and apply the formula p(A *and* B) = p(A *given* B)p(B). Know that events A and B are independent if and only if p(A *given* B) = p(A).	P8, P9
OCR 12	**Statistics**				
12.01	**Sampling**				
12.01a	Populations and samples		Define the population in a study, and understand the difference between population and sample. Infer properties of populations or distributions from a sample. Understand what is meant by simple random sampling, and bias in sampling.		S1

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
12.02	**Interpreting and representing data**				
12.02a	Categorical and numerical data	Interpret and construct charts appropriate to the data type; including frequency tables, bar charts, pie charts and pictograms for categorical data, vertical line charts for ungrouped discrete numerical data. Interpret multiple and composite bar charts.	Design tables to classify data. Interpret and construct line graphs for time series data, and identify trends (e.g. seasonal variations).		S2
12.02b	Grouped data			Interpret and construct diagrams for grouped data as appropriate, i.e. cumulative frequency graphs and histograms (with either equal or unequal class intervals).	S3 S4

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
12.03	**Analysing data**				
12.03a	Summary statistics	Calculate the mean, mode, median and range for ungrouped data. Find the modal class, and calculate estimates of the range, mean and median for grouped data, and understand why they are estimates. Describe a population using statistics. Make simple comparisons. Compare data sets using 'like for like' summary values. Understand the advantages and disadvantages of summary values.		Calculate estimates of mean, median, mode, range, quartiles and interquartile range from graphical representation of grouped data. Draw and interpret box plots. Use the median and interquartile range to compare distributions.	S4, S5
12.03b	Misrepresenting data	Recognise graphical misrepresentation through incorrect scales, labels, etc.			S4

GCSE (9–1) content Ref.	Subject content	Initial learning for this qualification will enable learners to…	Foundation tier learners should also be able to…	Higher tier learners should additionally be able to…	DfE Ref.
12.03c	Bivariate data	Plot and interpret scatter diagrams for bivariate data. Recognise correlation.	Interpret correlation within the context of the variables, and appreciate the distinction between correlation and causation. Draw a line of best fit by eye, and use it to make predictions. Interpolate and extrapolate from data, and be aware of the limitations of these techniques.		S6
12.03d	Outliers	Identify an outlier in simple cases.	Appreciate there may be errors in data from values (outliers) that do not 'fit'. Recognise outliers on a scatter graph.		S4

2c. Prior knowledge, learning and progression

Learners in England who are beginning a GCSE (9–1) course are likely to have followed a Key Stage 3 programme of study and should have achieved a general educational level equivalent to National Curriculum Level 3.

There are no prior qualifications required in order for learners to enter for a GCSE (9–1) in Mathematics, nor is any prior knowledge or understanding required for entry onto this course.

GCSEs (9–1) are qualifications that enable learners to progress to further qualifications either Vocational or General.

There are a number of mathematics specifications available from OCR.

Find out more at **www.ocr.org.uk**.

3 Assessment of OCR GCSE (9–1) in Mathematics

3a. Forms of assessment

- The GCSE (9–1) in Mathematics is a linear qualification with 100% external assessment.
- This qualification consists of six examined components. Three are Foundation tier and three are Higher tier, all are externally assessed by OCR. Each carries an equal weighting of one third of the marks for that tier of the GCSE (9–1) qualification. Each examination has a duration of 1 hour and 30 minutes.
- Learners must take all three papers for the appropriate tier in the same series.
- Learners answer **all** questions on each paper.
- Learners are **not** permitted to use a calculator for Paper 2 on the Foundation tier or Paper 5 on the Higher tier.
- Learners are permitted to use a scientific or graphical calculator for Paper 1 and Paper 3 on the Foundation tier or Paper 4 and Paper 6 on the Higher tier. Calculators are subject to the rules in the document *Instructions for Conducting Examinations*, published annually by JCQ **(www.jcq.org.uk)**.
- In each question paper, learners are expected to support their answers with appropriate working.
- Some questions will require an extended response to allow learners to demonstrate the ability to construct and develop a sustained line of mathematical reasoning.
- Learners should have the usual geometric instruments available. Tracing paper may also be used to aid with transformations and other mathematical functions.

3b. Assessment availability

There will be:

- one examination series available each year in May/June to all learners
- one examination series in November each year available **only** to learners who have reached at least the age of 16 on or before 31st August of that calendar year.

Learners must take all three papers for the appropriate tier in the same series.

This specification will be certificated from the June 2017 examination series onwards.

3c. Retaking the qualification

Learners can retake the qualification as many times as they wish. They retake all components of the qualification.

3d. Assessment objectives (AOs)

There are three Assessment objectives in the OCR GCSE (9–1) in Mathematics. These are detailed in the table below:

	Assessment Objectives	Weighting	
		Higher	Foundation
AO1	**Use and apply standard techniques** Learners should be able to: • accurately recall facts, terminology and definitions • use and interpret notation correctly • accurately carry out routine procedures or set tasks requiring multi-step solutions.	40%	50%
AO2	**Reason, interpret and communicate mathematically** Learners should be able to: • make deductions, inferences and draw conclusions from mathematical information • construct chains of reasoning to achieve a given result • interpret and communicate information accurately • present arguments and proofs • assess the validity of an argument and critically evaluate a given way of presenting information. Where problems require learners to 'use and apply standard techniques' or to independently 'solve problems' a proportion of those marks should be attributed to the corresponding Assessment objective.	30%	25%
AO3	**Solve problems within mathematics and in other contexts** Learners should be able to: • translate problems in mathematical or non-mathematical contexts into a process or a series of mathematical processes • make and use connections between different parts of mathematics • interpret results in the context of the given problem • evaluate methods used and results obtained • evaluate solutions to identify how they may have been affected by assumptions made. Where problems require learners to 'use and apply standard techniques' or to 'reason, interpret and communicate mathematically' a proportion of those marks should be attributed to the corresponding Assessment objective.	30%	25%

Mark distribution of AO weightings in GCSE (9–1) Mathematics

The relationship between the Assessment objectives and the question papers at each tier in terms of **marks** are shown in the following tables.

Component	AO1	AO2	AO3	Total
Paper 1 (Foundation tier) J560/01	50	25	25	100
Paper 2 (Foundation tier) J560/02	50	25	25	100
Paper 3 (Foundation tier) J560/03	50	25	25	100
	150	75	75	300

Component	AO1	AO2	AO3	Total
Paper 4 (Higher tier) J560/04	40	30	30	100
Paper 5 (Higher tier) J560/05	40	30	30	100
Paper 6 (Higher tier) J560/06	40	30	30	100
	120	90	90	300

3e. Tiers

This scheme of assessment consists of two tiers: Foundation tier and Higher tier. Foundation tier assesses grades 5 to 1 and Higher tier assesses grades 9 to 4. An allowed grade 3 may be awarded on the Higher tier option for learners who are a small number of marks below the grade 3/4 boundary. Learners must be entered for either the Foundation tier or the Higher tier.

3f. Synoptic assessment

Synoptic assessment allows learners to demonstrate their understanding of the connections between different aspects of the subject. Making and understanding connections in this way is intrinsic to learning mathematics.

Synoptic assessment involves the explicit drawing together of knowledge, understanding and skills of different aspects of the GCSE (9–1) course. The emphasis of synoptic assessment is to encourage the understanding of mathematics as a discipline.

In the OCR GCSE (9–1) in Mathematics, topics are taught in progressively greater depth over the course. GCSE (9–1) outcomes may reflect or build upon subject content which is typically taught at Key Stage 3, revisiting earlier learning in a more challenging context.

The assessment for this specification will require learners to demonstrate their knowledge of the full content for their tier and to draw on the knowledge that they have gained from Key Stages 1, 2 and 3.

There is no expectation that teaching of such content should be repeated during the GCSE (9–1) course, but a solid foundation at Key Stage 3 is assumed. This foundation is exemplified by the first column of this specification.

Where a content statement in the first (or second) column is not developed in the second (or third) column, the expectation is that the content given for that strand will be developed further and connections with other parts of the specification explored even when not explicitly stated.

3g. Calculating qualification results

A learner's overall qualification grade for GCSE (9–1) in Mathematics will be calculated by adding together their marks from the three components taken to give their total weighted mark.

This mark will then be compared to the qualification level grade boundaries for the entry option taken by the learner and for the relevant exam series to determine the learner's overall qualification grade.

4 Admin: what you need to know

The information in this section is designed to give an overview of the processes involved in administering this qualification so that you can speak to your exams officer. All of the following processes require you to submit something to OCR by a specific deadline.

More information about the processes and deadlines involved at each stage of the assessment cycle can be found in the Administration area of the OCR website. OCR's *Admin overview* is available on the OCR website at **http://www.ocr.org.uk/administration**

4a. Pre-assessment

Estimated entries

Estimated entries are your best projection of the number of learners who will be entered for a qualification in a particular series. Estimated entries should be submitted to OCR by the specified deadline. They are free and do not commit your centre in any way.

Final entries

Final entries provide OCR with detailed data for each learner, showing each assessment to be taken. It is essential that you use the correct entry code, considering the relevant entry rules and ensuring that you choose the entry option for the assessment tier to be taken.

Final entries must be submitted to OCR by the published deadlines or late entry fees will apply.

All learners taking OCR GCSE (9–1) in Mathematics must be entered for one of the following entry options:

Entry code	Title	Component code	Component title	Assessment type
J560F	Mathematics (Foundation tier)	01	Paper 1 (Foundation tier)	External Assessment
		02	Paper 2 (Foundation tier)	External Assessment
		03	Paper 3 (Foundation tier)	External Assessment
J560H	Mathematics (Higher tier)	04	Paper 4 (Higher tier)	External Assessment
		05	Paper 5 (Higher tier)	External Assessment
		06	Paper 6 (Higher tier)	External Assessment

4b. Accessibility and special consideration

Reasonable adjustments and access arrangements allow learners with special educational needs, disabilities or temporary injuries to access the assessment and show what they know and can do, without changing the demands of the assessment. Applications for these should be made before the examination series. Detailed information about eligibility for access arrangements can be found in the JCQ *Access Arrangements and Reasonable Adjustments*.

Special consideration is a post-assessment adjustment to marks or grades to reflect temporary injury, illness or other indisposition at the time the assessment was taken.

Detailed information about eligibility for special consideration can be found in the JCQ publication, *A guide to the special consideration process*.

4c. External assessment arrangements

Regulations governing examination arrangements are contained in the JCQ *Instructions for conducting examinations*.

Learners are permitted to use a scientific or graphical calculator for components 01, 03, 04 and 06. Calculators are subject to the rules in the document *Instructions for Conducting Examinations* published annually by JCQ (**www.jcq.org.uk**).

Head of Centre Annual Declaration

The Head of Centre is required to provide a declaration to the JCQ as part of the annual NCN update, conducted in the autumn term, to confirm that the centre is meeting all of the requirements detailed in the specification.

Any failure by a centre to provide the Head of Centre Annual Declaration will result in your centre status being suspended and could lead to the withdrawal of our approval for you to operate as a centre.

Private candidates

Private candidates may enter for OCR assessments.

A private candidate is someone who pursues a course of study independently but takes an examination or assessment at an approved examination centre. A private candidate may be a part-time student, someone taking a distance learning course, or someone being tutored privately. They must be based in the UK.

Private candidates need to contact OCR approved centres to establish whether they are prepared to host them as a private candidate. The centre may charge for this facility and OCR recommends that the arrangement is made early in the course.

Further guidance for private candidates may be found on the OCR website: **http://www.ocr.org.uk**

4d. Results and certificates

Grade Scale

GCSE (9–1) qualifications are graded on the scale: 9–1, where 9 is the highest. Learners who fail to reach the minimum standard of 1 will be Unclassified (U). Only subjects in which grades 9 to 1 are attained will be recorded on certificates.

Results

Results are released to centres and learners for information and to allow any queries to be resolved before certificates are issued.

Centres will have access to the following results information for each learner:

- the grade for the qualification
- the raw mark for each component
- the total weighted mark for the qualification.

The following supporting information will be available:

- raw mark grade boundaries for each component
- weighted mark grade boundaries for each entry option.

Until certificates are issued, results are deemed to be provisional and may be subject to amendment. A learner's final results will be recorded on an OCR certificate.

The qualification title will be shown on the certificate as 'OCR Level 1/Level 2 GCSE (9–1) in Mathematics'.

4e. Post-results services

A number of post-results services are available:

- **Enquiries about results** – If you are not happy with the outcome of a learner's results, centres may submit an enquiry about results.
- **Missing and incomplete results** – This service should be used if an individual subject result for a learner is missing, or the learner has been omitted entirely from the results supplied.
- **Access to scripts** – Centres can request access to marked scripts.

4f. Malpractice

Any breach of the regulations for the conduct of examinations and coursework may constitute malpractice (which includes maladministration) and must be reported to OCR as soon as it is detected.

Detailed information on malpractice can be found in *Suspected Malpractice in Examinations and Assessments: Policies and Procedures* published by JCQ.

5 Appendices

5a. Grade descriptors

Grade 8	To achieve grade 8, candidates will be able to: • perform procedures accurately • interpret and communicate complex information accurately • make deductions and inferences and draw conclusions • construct substantial chains of reasoning, including convincing arguments and formal proofs • generate efficient strategies to solve complex mathematical and non-mathematical problems by translating them into a series of mathematical processes • make and use connections, which may not be immediately obvious, between different parts of mathematics • interpret results in the context of the given problem • critically evaluate methods, arguments, results and the assumptions made
Grade 5	To achieve grade 5, candidates will be able to: • perform routine single- and multi-step procedures effectively by recalling, applying and interpreting notation, terminology, facts, definitions and formulae • interpret and communicate information effectively • make deductions, inferences and draw conclusions • construct chains of reasoning, including arguments • generate strategies to solve mathematical and non-mathematical problems by translating them into mathematical processes, realising connections between different parts of mathematics • interpret results in the context of the given problem • evaluate methods and results
Grade 2	To achieve grade 2, candidates will be able to: • recall and use notation, terminology, facts and definitions; perform routine procedures, including some multi-step procedures • interpret and communicate basic information; make deductions and use reasoning to obtain results • solve problems by translating simple mathematical and non-mathematical problems into mathematical processes • provide basic evaluation of methods or results • interpret results in the context of the given problem

5b. Overlap with other qualifications

There is a small degree of overlap between the content of this specification and those for GCSE Statistics and Free Standing Mathematics Qualifications.

5c. Avoidance of bias

The GCSE (9–1) qualification and subject criteria have been reviewed in order to identify any feature which could disadvantage learners who share a protected Characteristic as defined by the Equality Act 2010. All reasonable steps have been taken to minimise any such disadvantage.

Summary of Updates

Date	Version	Section	Title of section	Change
April 2018	1.1	4d	Results and certificates	Amend to certification titling

Your checklist

Our aim is to provide you with all the information and support you need to deliver our specifications.

- [ ] Bookmark ocr.org.uk/gcsemaths for all the latest resources, information and news on GCSE (9-1) maths
- [ ] Be among the first to hear about support materials and resources as they become available – register for Mathematics updates at ocr.org.uk/updates
- [ ] Find out about our professional development at cpdhub.ocr.org.uk
- [ ] View our range of skills guides for use across subjects and qualifications at ocr.org.uk/skillsguides
- [ ] Discover our new online past paper service at ocr.org.uk/exambuilder
- [ ] Learn more about Active Results at ocr.org.uk/activeresults
- [ ] Join our Mathematics social network community for teachers at social.ocr.org.uk

Download high-quality, exciting and innovative GCSE (9-1) maths resources from ocr.org.uk/gcsemaths

Free resources and support for our GCSE (9-1) Mathematics qualification, developed through collaboration between our Maths Subject Advisors, teachers and other subject experts, are available from our website. You can also contact our Maths Subject Advisors for specialist advice, guidance and support, giving you individual service and assistance whenever you need it.

Contact the team at:
01223 553998
maths@ocr.org.uk
@OCR_maths

To stay up to date with all the relevant news about our qualifications, register for email updates at **ocr.org.uk/updates**

Mathematics community

The social network is a free platform where teachers can engage with each other – and with us – to find and offer guidance, discover and share ideas, best practice and a range of Maths support materials.
To sign up, go to **social.ocr.org.uk**

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