Qualification Accredited

OCR
Oxford Cambridge and RSA

LEVEL 3 CERTIFICATE

Specification

FREE STANDING MATHEMATICS QUALIFICATION: ADDITIONAL MATHEMATICS

6993

For first assessment in 2019

Registered office:
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

Contents

1 Why choose OCR Level 3 FSMQ: Additional Maths?

1a. Why choose an OCR qualification?

1

Choose OCR and you have got the reassurance that you're working with one of the UK's leading exam boards. All our qualifications are developed in consultation with teachers, employers and Higher Education institutions to provide learners with a qualification that is 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. Centres can choose from our extensive range of 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 learners to achieve more.

We have created teacher-friendly specifications that are designed to be straightforward and accessible so that you can tailor the delivery of the course to suit your learners' needs. We want learners to become confident in discussing ideas and engaged in their own learning.

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:

- access to Subject Advisors to support you through the lifetime of the specification
- CPD/Training for teachers to introduce the qualification and prepare you for first teaching
- Active Results – our free results analysis service to help you review the performance of individual learners or whole schools.

All qualifications offered by OCR are accredited or regulated by Ofqual, the Regulator for qualifications offered in England. The accreditation number for OCR's Level 3 FSMQ: Additional Maths is QN:100/2548/0.

1b. Why choose OCR Level 3 FSMQ: Additional Maths?

OCR's FSMQ: Additional Maths targets learners who will take GCSE (9–1) Higher tier Mathematics. Many learners will go on to study AS and A Level Mathematics and, for these learners, this qualification provides an introduction to the subject at that level, with the possibility of subsequent, accelerated progress into AS and A Level Further Mathematics.

There are others who will not continue with mathematics beyond Year 11. For these learners this qualification provides a worthwhile and enriching course in its own right.

This qualification provides a broad, coherent and satisfying course of study. It encourages learners to develop more confidence in, and a positive attitude towards, mathematics following on from GCSE (9–1) Mathematics qualifications. It consolidates and develops GCSE level mathematical skill and encourages learners 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, those learners who go on to study other subjects which make use of mathematics or those learners progressing to vocational qualifications or directly into employment.

This qualification is part of a wide range of OCR Mathematics qualifications which allows progression from Entry Level Certificate, through GCSE (9–1), to Core Maths, AS and A Level.

Aims and learning outcomes

OCR's FSMQ: Additional Maths will encourage 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
- develop confidence in using mathematical techniques in a variety of ways.

1

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

The key features of OCR's Level 3 FSMQ: Additional Maths for you and your learners are that:

- it is designed for learners who are likely to be high achieving at GCSE (9–1)
- it will allow learners to experience the directions in which the subject is developed post-GCSE (9–1)
- it provides an excellent preparation for AS and A level study
- it provides an enriching and challenging course of mathematical study for those following a non-mathematical A level course without having to follow a full AS course
- it will provide a springboard for future progress and achievement in a variety of subjects and in future employment
- it attracts up to 10 UCAS points in the new tariff
- it is a simple assessment model, which consists of one two-hour examination, with no non-examination assessment
- it is easily co-taught with OCR's GCSE (9–1) Mathematics qualifications.

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.

Teacher-centred

OCR will target support and resources to develop fluency, reasoning and problem solving skills.

OCR's assessment will be solid and dependable, recognising positive achievement in candidate learning and ability.

Dependable

OCR's high-quality assessment is 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.

There is an emphasis on learning and understanding mathematical concepts underpinned by a sound, reliable and valid assessment.

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**

If you are not yet an approved centre and would like to become one go to: **www.ocr.org.uk**

Want to find out more?

Get in touch with one of OCR's Subject Advisors:

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

Customer Contact Centre: 01223 553998

Visit our Online Support Centre at **support.ocr.org.uk**

2 The specification overview

2a. OCR's Level 3 FSMQ: Additional Maths (6993)

Learners take the mandatory Paper 1 to be awarded the OCR Level 3 FSMQ: Additional Maths

Content Overview	Assessment Overview	
The single paper will assess content, detailed in section 2c, covering: • Algebra • Enumeration • Coordinate Geometry • Pythagoras and Trigonometry • Calculus • Numerical Methods • Exponentials and Logarithms	Paper 1 (01)* 100 marks 2 hours Written paper Calculators permitted	**100%** of total FSMQ

*Indicates inclusion of synoptic assessment.

2b. Content of Level 3 FSMQ: Additional Maths (6993)

This FSMQ builds on the skills, knowledge and understanding acquired during the GCSE (9–1) course. It consists of four main 'pure' mathematics topics, each of which contains an 'applied' dimension, and two numerical topics, all underpinned by an Algebra section.

The content is arranged by topic area statements that each have a unique reference code. The content is separated into 7 sections, however, links should be made across sections and centres are free to teach the content in the order most appropriate to their learners' needs.

Exemplification of the content statements provides further detail of the requirements of this specification. All exemplars contained in the specification under the heading 'e.g.' are for illustration only and do not constitute an exhaustive list. The heading 'i.e.' is used to denote a complete list. For the avoidance of doubt an italic statement in square brackets indicates content which will not be tested.

The expectation is that some assessment items will require learners to use two or more content statements without further guidance. Learners are expected to have explored the connections between different areas of the specification.

Learners are expected to be able to use their knowledge to reason mathematically and solve problems both within mathematics and in context. Content that is covered by any statement may be required in reasoning or problem-solving tasks even if that is not explicitly stated in the statement.

Use of calculators

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

It is expected that calculators available in the assessment will include an iterative function, such as an ANS key.

Allowable calculators can be used for any function they can perform.

When using calculators, candidates should bear in mind the following.

1. Candidates are advised to write down explicitly any expressions, including integrals, that they use the calculator to evaluate.

2. Candidates are advised to write down the values of any parameters and variables that they input into the calculator. Candidates are not expected to write down data transferred from question paper to calculator.

3. Correct mathematical notation (rather than 'calculator notation') should be used. Incorrect notation may result in loss of marks.

2

Formulae
Learners will be given formulae in each assessment on page 2 of the integrated answer booklet. See Section 5d for a list of these formulae.

The meanings of some instructions and words used in this specification

Exact
An exact answer is one where numbers are not given in rounded form. The answer will often contain an irrational number such as $\sqrt{3}$ or π and these numbers should be given in that form when an exact answer is required.
The use of the word 'exact' also tells learners that rigorous (exact) working is expected in the answer to the question.
e.g. Find the exact solution of $3x = 2$.
The correct answer is $x = \frac{2}{3}$ or $x = 0.\dot{6}$, not $x = 0.67$ or similar.

Show that
Learners are given a result and have to show that it is true. Because they are given the result, the explanation has to be sufficiently detailed to cover every step of their working.
e.g. Show that the curve $y = 2x^2 - 12x + 13$ has a stationary point $(3,-5)$. In this case, candidates would be expected to show that there was a turning point at $x = 3$, by calculus or completing the square, and that when $x = 3$ then $y = -5$. A sketch of the curve would not be sufficient.

Determine
This command word indicates that justification should be given for any results found, including working where appropriate.

Give, State, Write down
These command words indicate that neither working nor justification is required.

In this question you must show detailed reasoning
When a question includes this instruction, learners must give a solution which leads to a conclusion showing a detailed and complete analytical method. Their solution should contain sufficient detail to allow the line of their argument to be followed. This is not a restriction on a learner's use of a calculator when tackling the question, e.g. for checking an answer or evaluating a function at a given point, but it is a restriction on what will be accepted as evidence of a complete method.

In these examples variations in the structure of the solutions are possible (for example using a different base for the logarithms in example 1), and different intermediate steps may be given.

Example 1:

Use logarithms to solve the equation $3^{2x+1} = 4^{100}$, giving your answer correct to 3 significant figures.
The answer is $x = 62.6$, but the learner *must* include the steps $\log 3^{2x+1} = \log 4^{100}$, $(2x+1)\log 3 = \log 4^{100}$ and an intermediate evaluation step, e.g. $2x + 1 = 126.18...$. Using the solve function on a calculator to skip one of these steps would not result in a complete analytical method.

Example 2:

Evaluate $\int_0^1 x^3 + 4x^2 - 1\,dx$.

The answer is $\frac{7}{12}$, but the learner *must* include at least $\left[\frac{1}{4}x^4 + \frac{4}{3}x^3 - x\right]_0^1$ and the substitution $\frac{1}{4} + \frac{4}{3} - 1$.

Just writing down the answer using the definite integral function on a calculator would therefore not be awarded full marks.

Hence
When a question uses the word 'hence', it is an indication that the next step should be based on what has gone before. The intention is that learners should start from the indicated statement.
e.g. Show that $(x-1)$ is a factor of $2x^3 - x^2 - 7x + 6$.
Hence solve the equation $2x^3 - x^2 - 7x + 6 = 0$.

You may use the result
When this phrase is used it indicates a given result that learners would not normally be expected to know but which may be useful in answering the question.
The phrase should be taken as permissive. Use of the given result is not required.

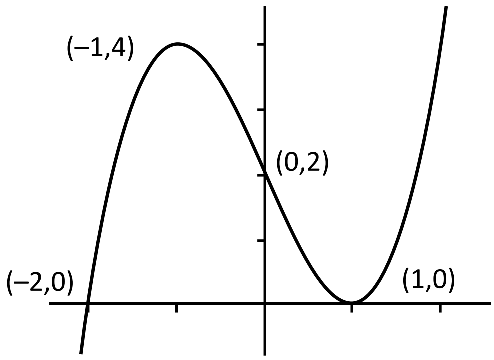
Plot
Learners should mark points accurately on the graph in their integrated answer booklet. They will either have been given the points or have had to calculate them. They may also need to join them with a curve or a straight line, or draw a line of best fit through them.
e.g. Plot this additional point on the scatter diagram.

Sketch
Learners should draw a diagram, not necessarily to scale, showing the main features of a curve. These are likely to include at least some of the following:

- turning points
- asymptotes
- intersection with the *y*-axis
- intersection with the *x*-axis
- behaviour for large *x* (+ or –).

Any other important features should also be shown.

e.g. Sketch the curve with equation $y = x^3 - 3x + 2$.



Draw
Learners should draw to an accuracy appropriate to the problem. They are being asked to make a sensible judgement about this.
e.g. Draw a line of best fit to estimate the gradient.

Other command words
Other command words, for example ‘explain’ or ‘calculate’, will have their ordinary English meaning.

2

2c. Content of FSMQ: Additional Maths (01)

Content	Learners should be able to	Notes
Algebra (AL)		
Algebraic Manipulation	AL1 Know and use algebraic vocabulary and notation.	i.e. constant, coefficient, expression, equation, identity, index, variable, unknown, f(x) .
	AL2 Simplify expressions involving algebraic fractions and square roots.	e.g. Simplify $\frac{2}{x-1} - \frac{1}{x+1}$. e.g. Simplify $\sqrt{125}$, $\sqrt{12} + \sqrt{27}$, $\frac{1}{2+\sqrt{3}}$.
	AL3 Perform operations with polynomials, including addition, subtraction, multiplication and division.	e.g. $\frac{x^3 - 3x^2 - x - 3}{x-1}$.
	AL4 Find linear factors of a polynomial.	Includes the use of the factor theorem.
	AL5 Complete the square of a quadratic polynomial.	$ax^2 + bx + c \equiv a(x+p)^2 + q$
Applications of equations	AL6 Set up and solve problems leading to linear, quadratic and cubic equations in one unknown, and to simultaneous equations in two unknowns.	Problems could be set in mathematical or non-mathematical contexts.
Inequalities	AL7 Manipulate inequalities.	e.g. $24x + 28y \leqslant 400$
	AL8 Set up and solve linear and quadratic inequalities algebraically and graphically.	e.g. solve $-3 < 2x - 1 < 5$
	AL9 Illustrate linear inequalities in two variables.	i.e. the use of appropriate shading.
Recurrence relationships	AL10 Understand and use notation of recurrence relationships to describe and determine sequences.	e.g. $x_{n+1} = x_n + a$ e.g. $x_{n+1} = ax_n$ e.g. $x_{n+2} = x_n + x_{n+1}$
	AL11 Use recurrence relationships in modelling.	e.g. modelling compound interest.

Content	Learners should be able to	Notes
Enumeration (EN)		
Binomial expansion	EN1 Understand and be able to apply the binomial expansion of $(a+b)^n$ where n is a positive integer.	e.g. Expand $(2+3x)^5$ in ascending powers of x .
Representation	EN2 Construct and use tree diagrams, two way tables, Venn Diagrams or the binomial distribution to enumerate outcomes.	
Product Rule	EN3 Use the product rule for counting numbers of outcomes of combined events.	e.g. Number of outcomes rolling n dice is 6^n e.g. Number of arrangements of n distinct objects is $n!$.
Permutations	EN4 Enumerate the number of ways of obtaining an ordered linear subset (permutation) of r elements from a set of n distinct objects.	e.g. How many ways of awarding two prizes in a group of ten people. Includes the use of the notation ${}_n\mathrm{P}_r$ (${}^n\mathrm{P}_r$).
Combinations	EN5 Enumerate an unordered subset (combination) of r elements from a set of n distinct objects.	e.g. How many ways are there of choosing two people out of a group of ten to sit on a committee? Includes the use of the notation ${}_n\mathrm{C}_r$ (${}^n\mathrm{C}_r$).
Applications	EN6 Solve problems about outcomes, including problems in the context of probability.	e.g. Find the probability of obtaining at least two sixes when five dice are rolled.

Content	Learners should be able to		Notes
Coordinate Geometry (two dimensions only) (CG)			
The straight line	CG1	Calculate the distance between two points.	e.g. $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$.
	CG2	Find the mid-point of a line segment.	e.g. $\left(\frac{x_1 + x_2}{2}, \frac{y_1 + y_2}{2}\right)$.
The coordinate geometry of circles	CG3	Know and use the equation of a circle $(x-a)^2 + (y-b)^2 = r^2$, where (a,b) is the centre and r is the radius of the circle.	e.g. A(1, 1) and B(5, 7) are the ends of a diameter of the circle. Show that the equation of the circle is $(x-3)^2 + (y-4)^2 = 13$.
Graphs	CG4	Sketch and plot linear, polynomial, trigonometric and exponential functions.	
	CG5	Know, understand and use gradient, intercept, tangent and normal in problems involving points that can be defined by equations and inequalities.	
Applications in linear programming	CG6	Express real situations in terms of linear inequalities.	
	CG7	Use graphs of linear inequalities to solve 2-dimensional maximisation and minimisation problems.	e.g. Given $4x + 7y < 56$, $6x + 3y < 54$, $x > 0$, $y > 0$ find the maximum value of $x + y$.
	CG8	Know the definition of objective function and be able to find it in 2-dimensional cases.	

Content	Learners should be able to		Notes
Pythagoras' Theorem and Trigonometry (PT)			
Ratios of any angles	PT1	Use the definitions of $\sin\theta$, $\cos\theta$ and $\tan\theta$ for any angle and their graphs.	Measured in degrees only.
	PT2	Know the sine and cosine rules and be able to apply them, including the ambiguous case for sine.	e.g. In a triangle ABC, AB = 10 m, AC = 8 m and angle B = 40°. Find the two possible values of angle C.
Trigonometric identities	PT3	Know and use the identity $\tan\theta \equiv \frac{\sin\theta}{\cos\theta}$.	
	PT4	Know and use the identity $\sin^2\theta + \cos^2\theta \equiv 1$.	
Trigonometric equations	PT5	Solve simple trigonometric equations in given intervals.	e.g. Solve $\tan 2x = 0.5$ for $0° \leqslant x \leqslant 360°$.
Applications in modelling	PT6	Apply Pythagoras' Theorem and trigonometry to 2- and 3-dimensional problems.	e.g. Find the angle of greatest slope.

Content	Learners should be able to	Notes
Calculus (CA)		
Differentiation	CA1 Differentiate kx^n where n is a positive integer or 0, and the sum of such functions.	i.e. use of notation $\frac{dy}{dx}$, $f'(x)$, $\dot{x}$.
	CA2 Know that the gradient function gives the gradient of the curve and measures the rate of change of y with x .	
	CA3 Know that the gradient of the function is the gradient of the tangent at that point.	
	CA4 Find the equation of a tangent and normal at any point on a curve.	e.g. Find the equations of normal to the curve $y = x^3 - 2x + 3$ at the point (1, 2).
	CA5 Use differentiation to find stationary points on a curve.	
	CA6 Determine the nature of a stationary point.	
	CA7 Sketch a curve with known stationary points.	
Integration	CA8 Integrate kx^n where n is a positive integer or 0, and the sum of such functions.	$\int y \, dx$
	CA9 Be aware that integration is the reverse of differentiation.	e.g. be able to find the equation of a curve, given its gradient function and one point.
	CA10 Know what is meant by an indefinite and a definite integral.	Understand the constant of integration.
	CA11 Evaluate definite integrals.	$\int_a^b y \, dx$
	CA12 Find the area between a curve, two ordinates and the x-axis.	
	CA13 Find the area between two curves.	$\int_a^b f(x)\, dx - \int_a^b g(x)\, dx$
Application to kinematics	CA14 Use differentiation and integration with respect to time to solve simple problems involving variable acceleration.	
	CA15 Recognise the special case where the use of constant acceleration formulae is appropriate.	

Content	Learners should be able to	Notes
Numerical Methods (NM)		
Solving equations	NM1 Solve equations approximately by considering the change of sign. NM2 Use a simple iterative method to solve equations approximately. NM3 Recognise when these numerical methods may fail.	
Gradients of tangents	NM4 Use a chord to estimate gradient of a tangent to a curve at a point. NM5 Recognise how to improve an estimate for the gradient of a curve at a point.	
Area under a curve	NM6 Use rectangular strips to estimate the area between a curve and the x-axis. NM7 Use trapezium rule to estimate the area between a curve and the x-axis. NM8 Recognise whether an estimate would be an over or under estimate, and understand how to calculate an improved estimate.	Formula will be provided.
Applications of Numerical methods	NM9 Apply numerical methods in context where appropriate.	e.g. determine the velocity from displacement-time curve.

Content	Learners should be able to	Notes
Exponentials and logarithms (EL)		
Properties of the exponential function	EL1 Know and use the function ka^x and its graph, where a is positive.	
Properties of the logarithmic function	EL2 Know and use the definition of $\log_a x$ as the inverse of a^x . EL3 Understand and use the laws of logarithms.	i.e. • $\log x + \log y = \log(xy)$ • $\log x - \log y = \log\left(\frac{x}{y}\right)$ • $\log x^n = n\log x$.
Reduction to linear form	EL4 Convert equations of the form $y = ka^x$ and $y = kx^n$ to a linear form using logarithms. EL5 Estimate values of k and a or k and n from graphs.	
Equations involving exponentials	EL6 Solve equations of the form $a^x = b$ for $a > 0$. EL7 Use exponentials and logarithms in problems involving exponential growth and decay.	

2d. Prior knowledge, learning and progression

Although there are no prior qualifications required in order for learners to enter for the Level 3 FSMQ: Additional Maths, learners are expected to have a thorough knowledge of the content of the Higher tier of GCSE (9–1) Mathematics.

The Level 3 FSMQ: Additional Maths provides the foundations on which a large number of learners continue the subject beyond GCSE (9–1) level. It supports their mathematical needs across a broad range of other subjects at Level 3 and provides a basis for subsequent quantitative work in a very wide range of higher education courses and in employment. It also supports the study of AS and A Level Mathematics, and Further Mathematics.

The Level 3 FSMQ: Additional Maths prepares learners for further study and employment in a wide range of disciplines involving the use of mathematics, including STEM disciplines.

Some learners may choose to follow this qualification in order to broaden their curriculum and to consolidate their interest and understanding of mathematics. A learner who has taken this qualification is, by design, well prepared to continue mathematics at AS and A Level.

There are a number of Mathematics specifications at OCR. Find out more at **www.ocr.org.uk**

3 Assessment of Level 3 FSMQ: Additional Maths (6993)

3a. Forms of assessment

OCR's Level 3 FSMQ: Additional Maths consists of one component that is externally assessed.

The examination consists of one two-hour paper, which assesses all of the Assessment Objectives. The total number of marks available in the examination paper is 100. Learners answer all the questions. The assessment has a gradient of difficulty and consists of a mix of short and long answer questions.

In each question, learners are expected to support their answers with appropriate working.

Learners are permitted to use a scientific or graphical calculator in this examination. Calculators are subject to the rules in the document: *Instructions for conducting examinations* published annually by JCQ (**www.jcq.org.uk**).

The assessment will contain some synoptic assessment, some extended response questions and at least one unstructured problem solving question. A formulae sheet will be included at the beginning of the examination paper.

3

3b. Assessment Objectives (AO)

There are three Assessment Objectives in OCR's Level 3 FSMQ: Additional Maths. These are detailed in the table below.

	Assessment Objective
AO1	**Use and apply standard techniques** Learners should be able to: • select and correctly carry out routine procedures • use mathematical language and notation correctly.
AO2	**Reason, interpret and communicate mathematically** Learners should be able to: • construct rigorous mathematical arguments • make deductions and inferences • explain their reasoning.
AO3	**Solve problems within mathematics and in other contexts** Learners should be able to: • translate problems into mathematical processes, including modelling • interpret solutions to problems in their original context • evaluate the accuracy and limitations of solutions, including the outcome(s) of models.

3c. Teaching time

Guided Learning Hours

The FSMQ: Additional Maths is allocated 30 Guided Learning Hours (GLH) in total. Guided learning indicates the approximate allocation of teaching time. However, this is only a guide. Centres with particularly able candidates could deliver this course considerably faster.

Total Qualification Time

Total Qualification Time (TQT) is the total amount of time, in hours, expected to be spent by a learner to achieve a qualification. It includes both guided learning hours, listed above, and hours spent in preparation, study and assessment. The Total Qualification Time for the FSMQ: Additional Maths is 60 hours.

	Total Qualification Time (%)
Guided learning	30 hours (50%)
Independent learning	30 hours (50%)

AO weightings in FSMQ: Additional Maths

The relationship between the assessment objectives and the components is shown in the following table:

Component	% of overall FSMQ: Additional Maths (6993)		
	AO1	AO2	AO3
Paper 1	54–58	20–24	20–24

3d. Qualification availability outside of England

This qualification is available in England. For Wales and Northern Ireland please check the Qualifications in Wales Portal (QIW) or the Northern Ireland Department of Education Performance Measures / Northern Ireland Entitlement Framework Qualifications Accreditation Number (NIEFQAN) list to see current availability.

3e. Language

This qualification is available in English only. All assessment materials are available in English only and all candidate work must be in English.

3f. Assessment availability

There will be one examination series available each year in May/June to **all** learners.

The examined component must be taken at the end of the course.

This specification will be certificated from the June 2019 examination series onwards.

3g. Retaking the qualification

Learners can retake the qualification as many times as they wish.

3h. Assessment of extended response

The assessment materials for this qualification provide learners with the opportunity to demonstrate their ability to construct and develop a sustained and coherent line of reasoning, and any marks for extended responses are integrated into the marking criteria.

3i. Synoptic assessment

Mathematics is, by nature, a synoptic subject. The assessment in this specification allows learners to demonstrate the understanding they have acquired from the course as a whole and their ability to integrate and apply that understanding. This level of understanding is needed for successful use of the knowledge and skills from this course in future life, work and study.

The Level 3 FSMQ: Additional Maths allows learners to revisit earlier learning taught at Higher tier GCSE (9–1) in a more challenging context.

In the examination paper, learners will be required to integrate and apply their understanding in order to address problems which require both breadth and depth of understanding in order to reach a satisfactory solution.

Learners will be expected to reflect on and interpret solutions, drawing on their understanding of different aspects of the course.

3j. Calculating qualification results

A learner's overall qualification grade for the Level 3 FSMQ: Additional Maths will be calculated from the component taken.

This mark will then be compared to the qualification level grade boundaries 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. 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.

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

All learners taking Level 3 FSMQ: Additional Maths must be entered for 6993.

Entry code	Title	Component code	Component title	Assessment type
6993	Additional Maths	01	Paper 1	External Assessment

4b. Special consideration

Special consideration is a post-assessment adjustment to marks or grades to reflect temporary injury, illness or any 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* (**www.jcq.org.uk**).

Collecting evidence of student performance to ensure resilience in the qualifications system

Regulators have published guidance on collecting evidence of student performance as part of long-term contingency arrangements to improve the resilience of the qualifications system. You should review and consider this guidance when delivering this qualification to students at your centre.

For more detailed information on collecting evidence of student performance please visit our website at: **https://www.ocr.org.uk/administration/general-qualifications/assessment/**

4c. External assessment arrangements

Regulations governing examination arrangements are contained in the JCQ *Instructions for conducting examinations* (**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/students/private-candidates**

4d. Results and certificates

Grade scale

Level 3 FSMQ: Additional Maths is graded on the scale: A, B, C, D, E, where A is the highest. Learners who fail to reach the minimum standard for E will be Unclassified (U).

Only subjects in which grades A to E 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 total weighted mark for the qualification (equal to the raw mark for the component).

The following supporting information will be available:

- weighted mark grade boundaries for the qualification.

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 3 Free Standing Mathematics Qualification: Additional Maths'.

4e. Post-results services

A number of post-results services are available:

- **Review of results** – In the event of dissatisfaction with a learner's result centres may request a review of marking.
- **Missing and incomplete results** – This service should be used if an individual subject result for a learner is missing, or if 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 non-exam assessment work 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 the JCQ publication *Suspected Malpractice in Examinations and Assessments: Policies and Procedures* (**www.jcq.org.uk**).

5 Appendices

5a. Overlap with other qualifications

The full GCSE (9–1) Mathematics subject criteria defined by DfE is assumed knowledge for this qualification. The content of this course introduces aspects of the AS and A Level mathematics subject criteria of DfE.

Consequently, a student who has taken this qualification is, by design, well-prepared to continue to mathematics at AS and A Level. There are also aspects of optional content from AS Level Further Mathematics.

5b. Accessibility

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 Adjustment* (**www.jcq.org.uk**).

The Level 3 FSMQ: Additional Maths has 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.

5c. Mathematical notation

1	Miscellaneous Symbols	
1.1	$=$	is equal to
1.2	$\neq$	is not equal to
1.3	$\equiv$	is identical to or is congruent to
1.4	$\approx$	is approximately equal to
1.5	∞	infinity
1.6	$\propto$	is proportional to
1.7	$\therefore$	therefore
1.8	$\because$	because
1.9	$<$	is less than
1.10	$\leqslant$	is less than or equal to, is not greater than
1.11	$>$	is greater than
1.12	$\geqslant$	is greater than or equal to, is not less than
2	**Operations**	
2.1	$a + b$	a plus b
2.2	$a - b$	a minus b
2.3	$a \times b$, ab, $a.b$	a multiplied by b
2.4	$a \div b$, $\frac{a}{b}$	a divided by b
2.5	$\sqrt{a}$	the (non-negative) square root of a
2.6	$n!$	n factorial: $n! = n \times (n-1) \times \ldots \times 2 \times 1$, for positive integers n; 0!=1
2.7	${}^{n}\mathrm{P}_{r}$, ${}_{n}\mathrm{P}_{r}$	$\frac{n!}{(n-r)!}$
2.8	$\binom{n}{r}$, ${}^{n}\mathrm{C}_{r}$, ${}_{n}\mathrm{C}_{r}$	the binomial coefficient $\frac{n!}{r!(n-r)!}$ for non-negative integers n, r, and $r \leqslant n$

5

3	**Functions**	
3.1	Δx	an increment of x
3.2	$\frac{\mathrm{d}y}{\mathrm{d}x}$	the derivative of y with respect to x
3.3	$\frac{\mathrm{d}^2y}{\mathrm{d}x^2}$	the *second* derivative of y with respect to x
3.4	$\dot{x}$	the first derivative of x with respect to t
3.5	$\ddot{x}$	the second derivative of x with respect to t
3.6	$\int y \, \mathrm{d}x$	the indefinite integral of y with respect to x
3.7	$\int_a^b y \, \mathrm{d}x$	the definite integral of y with respect to x between the limits $x = a$ and $x = b$
4	**Exponential and Logarithmic Functions**	
4.1	$\log_a x$	logarithm to the base a of x
5	**Trigonometric Functions**	
5.1	sin, cos, tan	the trigonometric functions
5.2	$\sin^{-1}$, $\cos^{-1}$, $\tan^{-1}$ arcsin, arccos, arctan	the inverse trigonometric functions
5.3	°	degrees
6	**Probability and Statistics**	
6.1	A, B, C, etc.	events
6.2	$\mathrm{P}(A)$	probability of the event A
6.3	A'	complement of the event A
6.4	X, Y, R, etc.	random variables
6.5	x, y, r, etc.	values of the random variables X, Y, R, etc.
6.6	$p(x)$, $\mathrm{P}(X = x)$	probability function of the discrete random variable X
6.7	$\sim$	has the distribution
6.8	$\mathrm{B}(n, p)$	binomial distribution with parameters n and p, where n is the number of trials and p is the probability of success in a trial
6.9	q	$q = 1 - p$ for binomial distribution

7	**Mechanics**	
7.1	kg	kilograms
7.2	m	metres
7.3	km	kilometres
7.4	m/s, m s^{-1}	metres per second (velocity)
7.5	m/s^2, m s^{-2}	metres per second per second (acceleration)
7.6	t	time
7.7	s	displacement
7.8	u	initial velocity
7.9	v	velocity or final velocity
7.10	a	acceleration

5d. Mathematical formulae and identities

Learners must be able to use the following formulae and identities for FSMQ: Additional Maths without these formulae and identities being provided, either in these forms or in equivalent forms. These formulae and identities may only be provided where they are the starting point for a proof or as a result to be proved.

Quadratic Equations

$ax^2 + bx + c = 0$ has roots $x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Laws of Indices

$a^x a^y \equiv a^{x+y}$

$a^x \div a^y \equiv a^{x-y}$

$(a^x)^y \equiv a^{xy}$

Laws of Logarithms

$x = a^n \Leftrightarrow n = \log_a x$ for $a > 0$ and $x > 0$

$\log_a x + \log_a y \equiv \log_a (xy)$

$\log_a x - \log_a y \equiv \log_a \left(\dfrac{x}{y}\right)$

$k \log_a x \equiv \log_a (x^k)$

Trigonometry

In the triangle ABC

Sine rule: $\dfrac{a}{\sin A} = \dfrac{b}{\sin B} = \dfrac{c}{\sin C}$

Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$

Area $= \dfrac{1}{2} ab \sin C$

$\tan\theta \equiv \dfrac{\sin\theta}{\cos\theta}$

$\sin^2\theta + \cos^2\theta \equiv 1$

Mensuration

Circumference and Area of circle, radius r and diameter d:

$C = 2\pi r = \pi d \qquad A = \pi r^2$

Pythagoras' Theorem: In any right-angled triangle where a, b and c are the lengths of the sides and c is the hypotenuse:

$c^2 = a^2 + b^2$

Area of a trapezium $= \frac{1}{2}(a+b)h$, where a and b are the lengths of the parallel sides and h is their perpendicular separation.

Volume of a prism = area of cross section × length

Calculus

<u>Differentiation</u>

Function	Derivative
x^n	nx^{n-1}
$\mathrm{f}(x) + \mathrm{g}(x)$	$\mathrm{f}'(x) + \mathrm{g}'(x)$

<u>Integration</u>

Function	Integral
x^n	$\frac{1}{n+1}x^{n+1} + c, n \neq -1$
$\mathrm{f}'(x) + \mathrm{g}'(x)$	$\mathrm{f}(x) + \mathrm{g}(x) + c$

Area under a curve $= \int_a^b y \, \mathrm{d}x \ (y \geqslant 0)$

5

Learners will be given the following formulae sheet in each question paper.

Formulae
FSMQ: Additional Maths (6993)

Binomial series

$(a+b)^n = a^n + {}^nC_1\, a^{n-1}b + {}^nC_2\, a^{n-2}b^2 + \ldots + {}^nC_r\, a^{n-r}b^r + \ldots + b^n$, for positive integers, n,

where ${}^nC_r = {}_nC_r = \binom{n}{r} = \dfrac{n!}{r!(n-r)!}$, $r \le n$

The binomial distribution

If $X \sim B(n, p)$ then $P(X = x) = \binom{n}{x} p^x (1-p)^{n-x}$

Numerical methods

Trapezium rule: $\int_a^b y\,dx \approx \frac{1}{2}h\{(y_0 + y_n) + 2(y_1 + y_2 + \ldots + y_{n-1})\}$, where $h = \dfrac{b-a}{n}$

5

Kinematics

Variable acceleration formulae

$v = \dfrac{ds}{dt}$

$a = \dfrac{dv}{dt} = \dfrac{d^2s}{dt^2}$

$s = \int v\,dt$ and $v = \int a\,dt$

Constant acceleration formulae

$v = u + at$

$s = ut + \frac{1}{2}at^2$

$s = \frac{1}{2}(u + v)t$

$v^2 = u^2 + 2as$

$s = vt - \frac{1}{2}at^2$

Summary of updates

Date	Section	Summary of updates
January 2018	Throughout specification	The qualification has been formatted and updated to reflect the changes in both the GCSE (9–1) and A/AS Level Mathematics qualifications, as well as bringing the Assessment Objectives in line with those at AS Level. The specification has new mathematical content (AL4, AL10, AL11, EN2–EN5, NM1–NM9, EL1–EL7) and amended mathematical content (PT2, PT6). A TQT value has been added.
February 2019	5d.	Correction of minor typographical errors.
June 2019	2b. and 5c.	Correction of minor typographical errors.
January 2020	i) 1d. ii) 4e.	i) Insertion of Online Support Centre link ii) Enquiry about results changed to Review of results
August 2020	5d	Kinematics non-constant acceleration formulae removed from list that candidates must know, and added to formulae sheet instead.
February 2021		Update to specification covers to meet digital accessibility standards.
January 2024	3d, 3e 4a Checklist	Inclusion of disclaimer regarding language and availability Update to include resilience guidance Inclusion of Teach Cambridge

YOUR CHECKLIST

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

- ☐ Bookmark the OCR website for all the latest information and news on Free Standing Mathematics Qualification: Additional Mathematics
- ☐ Sign up for Teach Cambridge: our personalised and secure website that provides teachers with access to all planning, teaching and assessment support materials
- ☐ Be among the first to hear about support materials and resources as they become available – register for Free Standing Mathematics Qualification: Additional Mathematics updates
- ☐ Find out about our professional development
- ☐ View our range of skills guides for use across subjects and qualifications
- ☐ Discover our new online past paper service
- ☐ Learn more about Active Results
- ☐ Visit our Online Support Centre

Download high-quality, exciting and innovative Free Standing Mathematics Qualification: Additional Mathematics resources from ocr.org.uk/fsmq

Resources and support for our Free Standing Mathematics Qualification: Additional Mathematics, 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 who can give you specialist advice, guidance and support.

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**

Visit our Online Support Centre at **support.ocr.org.uk**

follow us on

facebook.com/ocrexams

linkedin.com/company/ocr

@OCRexams

youtube.com/ocrexams

CAMBRIDGE
UNIVERSITY PRESS & ASSESSMENT