

# AQA Level 2 Certificate in Further Mathematics

## Specification

For exams June 2012 onwards  
For certification June 2012 onwards





# **Level 2**

## **Specification**

# **Level 2 Certificate in Further Mathematics 8360**

Our specification is published on our website ([www.aqa.org.uk](http://www.aqa.org.uk)). We will let centres know in writing about any changes to the specification. We will also publish changes on our website. The definitive version of our specification will always be the one on our website, this may differ from printed versions.

You can get further copies of this specification from:

AQA Logistics Centre (Manchester)

Unit 2

Wheel Forge Way

Ashburton Park

Trafford Park

Manchester

M17 1EH

Or, you can download a copy from our website ([www.aqa.org.uk](http://www.aqa.org.uk)).

Copyright © 2011 AQA and its licensors. All rights reserved.

AQA retains the copyright on all its publications, including the specifications. However, registered centres for AQA are permitted to copy material from this specification booklet for their own internal use.

The Assessment and Qualifications Alliance (AQA), is a company limited by guarantee registered in England and Wales (company number 3644723), and a registered charity 1073334.

Registered address:

AQA

Devas Street,

Manchester

M15 6EX

# Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
1a	Why choose AQA?	2
1b	Why choose the AQA Level 2 Certificate in Further Mathematics?	2
1c	How do I start using this specification?	3
1d	How can I find out more?	3
<b>2</b>	<b>Specification at a Glance</b>	<b>4</b>
	Summary of Assessment	4
<b>3</b>	<b>Subject Content</b>	<b>5</b>
3a	Introduction	5
3b	Subject Content	6
<b>4</b>	<b>Scheme of Assessment</b>	<b>11</b>
4a	Aims and learning outcomes	11
4b	Assessment Objectives (AOs)	11
4c	National Criteria	12
4d	Previous learning requirements	12
4e	Access to assessment: diversity and inclusion	12
<b>5</b>	<b>Administration</b>	<b>13</b>
5a	Availability of examination and certification	13
5b	Entries	13
5c	Private candidates	13
5d	Access arrangements, reasonable adjustments and special consideration	13
5e	Examination language	14
5f	Qualification title	14
5g	Awarding grades and reporting results	14
5h	Re-sits	14
	<b>Appendices</b>	<b>15</b>
A	Formulae sheet	15
B	Grade descriptions	16
C	Spiritual, moral, ethical, social, legislative, sustainable development, economic and cultural issues, and health and safety considerations	18

Vertical black lines indicate a significant change or addition to the previous version of this specification

# 1 Introduction

## 1a Why choose AQA?

We are the United Kingdom's favourite exam board and more students get their academic qualifications from us than from any other board. But why are we so popular?

**We understand the different requirements of each subject by working with teachers. Our qualifications:**

- help students achieve their full potential
- are relevant for today's challenges
- are manageable for schools and colleges
- are easy to understand by students of all levels of ability
- lead to accurate results, delivered on time
- are affordable and value for money

**We provide a wide range of support services for teachers, including:**

- access to subject departments
- training for teachers, including practical teaching strategies and approaches that work, presented by senior examiners

- individual support for Controlled Assessment
- 24-hour support through our website and online with **Ask AQA**
- past question papers and mark schemes
- a wide range of printed and electronic resources for teachers and students
- free online results analysis, with Enhanced Results Analysis.

We are an educational charity focused on the needs of the learner. All our income is spent on improving the quality of our specifications, examinations and support services. We don't aim to profit from education, we want you to.

If you are already a customer we thank you for your support. If you are thinking of joining us we look forward to welcoming you.

## 1b Why choose the AQA Level 2 Certificate in Further Mathematics?

This qualification fills the gap for high achieving students by assessing their higher order mathematical skills, particularly in algebraic reasoning, in greater depth without infringing upon AS Level mathematics, thus preparing them fully to maximise their potential in further studies at Level 3. It offers the opportunity for stretch and challenge that builds on the Key Stage 4 curriculum and is intended as an additional qualification to the GCSE Mathematics, rather than as a replacement. The content assumes prior knowledge of the Key Stage 4 Programme of Study and covers the areas of algebra and geometry, which are crucial to further study in the subject, in greater depth and breadth. This new qualification places an emphasis on higher order technical proficiency, rigorous argument and problem solving skills.

It also gives an introduction to calculus and matrices and develops further skills in trigonometry, functions and graphs.

The AQA Level 2 Certificate in Further Mathematics is an **untiered Level 2 linear qualification** for learners who

- either already have, or are expected to achieve, grades A and A\* in GCSE mathematics
- are likely to progress to A-Level study in mathematics and possibly further mathematics.

## 1c How do I start using this specification?

- You need to register at **[www.aqa.org.uk/askaqa.php](http://www.aqa.org.uk/askaqa.php)** to ensure that you receive regular updates and have access to the various resources available.

Once you have decided to enter candidates you need to tell us so we can make sure that you get all the material you need for the examinations. This is very important where examination material is sent to you before the final entry deadline. You can let us know by filling in the appropriate 'Intention to Enter' and 'Estimated Entry' forms.

- If your centre is registered on e-AQA you will receive an email prompting you to submit entry information on-line.

- If you are not e-AQA registered we will send copies to your exams officer. Both forms can be downloaded from our website (**<http://web.aqa.org.uk/exams-office/entries.php>**).

If your centre has not used AQA for any examinations in the past, please contact our centre approval team at **[centreapproval@aqa.org.uk](mailto:centreapproval@aqa.org.uk)**

## 1d How can I find out more?

**You can choose to find out more about this specification or the services that AQA offer in a number of ways.**

### Ask AQA

You have 24-hour access to useful information and answers to the most commonly asked questions at **[www.aqa.org.uk/askaqa](http://www.aqa.org.uk/askaqa)**

If the answer to your question is not available, you can submit a query through **Ask AQA** for our team. We will respond within 2 working days.

### Speak to your subject team

You can talk directly to the Mathematics subject team about this specification either by e-mailing **[maths@aqa.org.uk](mailto:maths@aqa.org.uk)** or by calling 0161 957 3852.

### Teacher Support Meetings

Details of the full range of our Teacher Support meetings are available on our website at **[www.aqa.org.uk/support/teachers.php](http://www.aqa.org.uk/support/teachers.php)**

There is also a link to our fast and convenient online booking system for our Teacher Support meetings at **<https://coursesandevents.aqa.org.uk>**

### Latest information online

You can find out more including the latest news, how to register for support and downloadable resources on our website at **[www.aqa.org.uk](http://www.aqa.org.uk)**



## 2 Specification at a Glance

### AQA Level 2 Certificate in Further Mathematics

The Scheme of Assessment is linear with two question papers to be taken in the same examination series as detailed below.

#### Paper 1

##### Written paper (Non-calculator)

40% of the AQA Level 2 Certificate in Further Mathematics assessment

1 hour 30 mins – 70 marks

**PLUS**

#### Paper 2

##### Written paper (Calculator)

60% of the AQA Level 2 Certificate in Further Mathematics assessment

2 hours – 105 marks

### Summary of Assessment

A question paper/answer booklet is provided for each paper.  
All questions are compulsory.

The detailed content for the specification is provided in Section 3.  
All content can be assessed on either paper.

Each paper addresses both Assessment Objectives. Details of the Assessment Objectives can be found in Section 4 of this specification.

## 3 Subject Content

### 3a Introduction

**This qualification is designed to be taught:**

- either in parallel with GCSE Mathematics
- after GCSE Mathematics
- or instead of GCSE Mathematics if the assumed knowledge areas of this specification have been covered (possibly in Key Stage 3).

The qualification is designed to be assessed as a full Level 2 mathematics qualification in its own right and is therefore not dependent on GCSE mathematics.

Therefore there are no prior learning requirements but there is the expectation that candidates have some assumed knowledge.

The specification content is set out in six distinct topic areas although questions will be asked that range across these topics.

- Number
- Algebra
- Co-ordinate Geometry (2 dimensions only)
- Calculus
- Matrix Transformations
- Geometry

Within each topic area, the prescribed content is given in the left hand column. The right hand column summarises the assumed knowledge, where relevant, for the topic and then provides guidance notes and examples to clarify the scope of the prescribed content. This content section should be read in conjunction with the accompanying specimen papers for the specification.



## 3b Subject content

Ref	Content	Notes
<b>1</b>	<b>Number</b>	
1.1		Knowledge and use of numbers and the number system including fractions, decimals, percentages, ratio, proportion and order of operations are expected
1.2	Manipulation of surds, including rationalising the denominator	<p>The use of surds in exact calculations</p> <p>Write <math>\sqrt{200} - \sqrt{72} + 3\sqrt{162}</math> in the form <math>a\sqrt{2}</math></p> <p>Rationalise and simplify <math>\frac{3\sqrt{2} + 4}{5\sqrt{2} - 7}</math></p> <p>Write the expression <math>\frac{3\sqrt{3} + 7}{3\sqrt{3} - 5}</math> in the form <math>a + b\sqrt{3}</math>, where <math>a</math> and <math>b</math> are integers</p>
<b>2</b>	<b>Algebra</b>	
2.1	The basic processes of algebra	Knowledge and use of basic skills in manipulative algebra including use of the associative, commutative and distributive laws, are expected
2.2	Definition of a function	Notation $f(x)$ will be used, eg $f(x) = x^2 - 9$
2.3	Domain and range of a function	Domain may be expressed as, for example, $x > 2$ , or 'for all $x$ , except $x = 0$ ' and range may be expressed as $f(x) > -1$
2.4	Expanding brackets and collecting like terms	<p>Simplify <math>(y^2 - 2y + 3)(2y - 1) - 2(y^3 - 3y^2 + 4y - 2)</math></p> <p>Expand and simplify <math>(x + 2)^3</math></p>
2.5	Factorising	<p>Factorise fully <math>(2x + 3)^2 - (2x - 5)^2</math></p> <p>Factorise <math>15x^2 - 34xy - 16y^2</math></p> <p>Factorise <math>x^4 - 25x^2</math></p>
2.6	Manipulation of rational expressions: Use of $+$ $-$ $\times$ $\div$ for algebraic fractions with denominators being numeric, linear or quadratic	<p>Simplify <math>\frac{x^2 + 3x - 10}{x^2 - 9} \div \frac{x + 5}{x^2 + 3x}</math></p> <p>Simplify <math>\frac{x^3 + 2x^2 + x}{x^2 + x}</math></p> <p>Simplify <math>\frac{5x^2 - 14x - 3}{4x^2 - 25} \div \frac{x - 3}{4x^2 + 10x}</math></p>
2.7	Use and manipulation of formulae and expressions	Rearrange $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ to make $v$ the subject
2.8	Use of the factor theorem for integer values of the variable, including cubics	<p>Factorise <math>x^3 - 2x^2 - 5x + 6</math></p> <p>Show that <math>x - 1</math> is a factor of <math>x^3 - 3x^2 - 4x + 6</math></p> <p>Solve <math>x^3 + x^2 - 10x + 8 = 0</math></p>
2.9	Completing the square	<p>Work out the values of <math>a</math>, <math>b</math> and <math>c</math> such that <math>2x^2 + 6x + 7 \equiv a(x + b)^2 + c</math></p>

Ref	Content	Notes
2.10	Sketching of functions Sketch graphs of linear and quadratic functions	<p>Graphs could be linear, quadratic or restricted to no more than 3 domains</p> <p>eg <math>y = x^2 - 5x + 6</math></p> <p>Label clearly any points of the intersection with the axes</p> <p>eg A function <math>f(x)</math> is defined as</p> $f(x) = \begin{cases} x^2 & 0 \leq x < 1 \\ 1 & 1 \leq x < 2 \\ 3 - x & 2 \leq x < 3 \end{cases}$ <p>Draw the graph of <math>f(x)</math> on the grid below for values of <math>x</math> from 0 to 3</p>
2.11	Solution of linear and quadratic equations	<p>Solutions of quadratics to include solution by factorisation, by graph, by completing the square or by formula</p> <p>Problems will be set in a variety of contexts, which result in the solution of linear or quadratic equations</p>
2.12	Algebraic and graphical solution of simultaneous equations in two unknowns where the equations could both be linear or one linear and one second order	<p>Solve <math>4x - 3y = 0</math> and <math>6x + 15y = 13</math></p> <p>Solve <math>y = x + 2</math> and <math>y^2 = 4x + 5</math></p> <p>Solve <math>y = x^2</math> and <math>y - 5x = 6</math></p>
2.13	Solution of linear and quadratic inequalities	<p>Solve <math>5(x - 7) &gt; 2(x + 1)</math></p> <p>Solve <math>x^2 &lt; 9</math></p> <p>Solve <math>2x^2 + 5x \leq 3</math></p>
2.14	Index laws, including fractional and negative indices	<p>Express as a single power of <math>x</math> <math>\sqrt{x^{\frac{1}{2}}} \times x^{\frac{7}{2}}</math></p> <p>Express as a single power of <math>x</math> <math>\sqrt{\frac{x^{\frac{3}{2}} \times x^{\frac{7}{2}}}{x^2}}</math></p> <p>Solve <math>x^{-\frac{1}{2}} = 3</math></p>
2.15	Algebraic proof	Prove $(n + 5)^2 - (n + 3)^2$ is divisible by 4 for any integer value of $n$
<b>Sequences</b>		
2.16	$n$ th terms of linear and quadratic sequences Limiting value of a sequence as $n \rightarrow \infty$	<p>Write down the 10th term of the sequence</p> $\frac{2n}{n + 4}$ <p>Write down the limiting value of <math>\frac{2n}{n + 4}</math> as <math>n \rightarrow \infty</math></p>

Ref	Content	Notes
<b>3 Co-ordinate Geometry (2 dimensions only)</b>		
<b>The straight line</b>		
3.1	Know and use the definition of a gradient	
3.2	Know the relationship between the gradients of parallel and perpendicular lines	Show that $A(0, 2)$ , $B(4, 6)$ and $C(10, 0)$ form a right angled triangle
3.3	Use Pythagoras' theorem to calculate the distance between two points	
3.4	Use ratio to find the coordinates of a point on a line given the coordinates of two other points.	Including midpoint
3.5	The equation of a straight line in the forms $y = mx + c$ and $y - y_1 = m(x - x_1)$	Including interpretation of the gradient and $y$ -intercept from the equation
3.6	Draw a straight line from given information	
<b>The co-ordinate geometry of circles</b>		
3.7	Understand that the equation of a circle, centre $(0, 0)$ , radius $r$ is $x^2 + y^2 = r^2$	Including writing down the equation of a circle given centre $(0, 0)$ and radius  The application of circle geometry facts where appropriate: eg the angle in a semi-circle is $90^\circ$ , the perpendicular from the centre to a chord bisects the chord, the angle between tangent and radius is $90^\circ$
3.8	Understand that $(x - a)^2 + (y - b)^2 = r^2$ is the equation of a circle with centre $(a, b)$ and radius $r$	Including writing down the equation of any circle given centre and radius
<b>4 Calculus</b>		
<b>Differentiation</b>		
4.1	Know that the gradient function $\frac{dy}{dx}$ gives the gradient of the curve and measures the rate of change of $y$ with respect to $x$	
4.2	Know that the gradient of a function is the gradient of the tangent at that point	
4.3	Differentiation of $kx^n$ where $n$ is a positive integer or 0, and the sum of such functions	Including expressions which need to be simplified first Given $y = (3x + 2)(x - 3)$ work out $\frac{dy}{dx}$
4.4	The equation of a tangent and normal at any point on a curve	
4.5	Use of differentiation to find stationary points on a curve: maxima, minima and points of inflection	Understand the terms 'increasing function' and 'decreasing function' and applying them to determine the nature of stationary points
4.6	Sketch a curve with known stationary points	

Ref	Content	Notes
<b>5 Matrix Transformations</b>		
		All calculations will be restricted to $2 \times 2$ or $2 \times 1$ matrices
5.1	Multiplication of matrices	Multiplying a $2 \times 2$ matrix by a $2 \times 2$ matrix or by a $2 \times 1$ matrix Multiplication by a scalar
5.2	The identity matrix, <b>I</b>	$2 \times 2$ only
5.3	Transformations of the unit square in the $x - y$ plane	Representation by a $2 \times 2$ matrix Transformations restricted to rotations of $90^\circ$ , $180^\circ$ or $270^\circ$ about the origin, reflections in a line through the origin (ie $x = 0$ , $y = 0$ , $y = x$ , $y = -x$ ) and enlargements centred on the origin
5.4	Combination of transformations	Using matrix multiplications Use of <b>i</b> and <b>j</b> notation is not required
<b>6 Geometry</b>		
6.1		Knowledge of perimeter and area of rectangles, triangles and circles, including area of a triangle $= \frac{1}{2} ab \sin C$ and volume of solids is expected Knowledge of angle properties of parallel and intersecting lines, triangles, all special types of quadrilaterals and polygons Understand and use circle theorems: Angle at the centre is twice the angle at the circumference; angles in the same segment are equal; opposite angles in cyclic quadrilateral add up to $180^\circ$ ; alternate segment theorem; the theorems listed in the notes of section 3.7
<b>Geometric proof</b>		
6.2	Understand and construct geometrical proofs using formal arguments	The use of theorems listed in the notes of 3.7 and 6.1
<b>Trigonometry in triangles</b>		
6.3	Sine and cosine rules in scalene triangles	Knowledge and use of trigonometry to solve right angled triangles is expected
<b>Pythagoras' theorem</b>		
6.4	Use of Pythagoras' theorem in 2D and 3D	Recognise Pythagorean triples; 3, 4, 5; 5, 12, 13; 8, 15, 17; 7, 24, 25 and simple multiples of these
6.5	Be able to apply trigonometry and Pythagoras' theorem to 2 and 3 dimensional problems	Including the angle between a line and a plane and the angle between two planes

Ref	Content	Notes
<b>Ratios of angles and their graphs</b>		
6.6	Sketch and use graphs of $y = \sin x$ , $y = \cos x$ and $y = \tan x$ for $0^\circ \leq x \leq 360^\circ$	
6.7	Be able to use the definitions $\sin \theta$ , $\cos \theta$ and $\tan \theta$ for any positive angle up to $360^\circ$ (measured in degrees only)	Angles measured anticlockwise will be taken as positive
6.8	Knowledge and use of $30^\circ$ , $60^\circ$ , $90^\circ$ triangles and $45^\circ$ , $45^\circ$ , $90^\circ$ triangles	The use of the ratios $1:\sqrt{3}:2$ and $1:1:\sqrt{2}$
6.9	Use of $\tan \theta = \frac{\sin \theta}{\cos \theta}$ and $\sin^2 \theta + \cos^2 \theta = 1$	Including expressions to be simplified, proofs of identities and equations solved
6.10	Solution of simple trigonometric equations in given intervals	Equations will be restricted to single angles: $\sin x = 0.5$ ; $\sqrt{2} \sin x = \cos x$ for $0^\circ \leq x \leq 360^\circ$ ; $\sin^2 x = \frac{1}{4}$ for $0^\circ \leq x \leq 360^\circ$

## 4 Scheme of Assessment

### 4a Aims and learning outcomes

Courses based on this specification should encourage learners to be inspired and challenged by following a rigorous and satisfying course of study which emphasises the power of mathematics. Learners should be encouraged to reason logically and recognise incorrect reasoning, and to appreciate the power of generalisation and mathematical proof.

They should be encouraged to see algebra as a natural tool for communicating mathematically and for solving a range of problems. They should begin to appreciate how situations can be represented by mathematical models and to consider the assumptions made and limitations of mathematical models. They should see mathematics as a coherent subject and understand how different areas of the subject link together. They should be encouraged to appreciate the elegance and beauty of mathematics for its own sake as well as beginning to realise its fundamental importance in understanding and shaping our world.

Courses based on this specification must enable candidates to:

- develop knowledge, skills and understanding of higher order mathematical methods and concepts.
- acquire and use problem solving strategies including the use of algebra as a tool for solving problems
- select, apply and link mathematical techniques and methods to solve challenging and non-routine problems
- reason mathematically, make deductions and inferences and draw conclusions
- interpret and communicate mathematical information in a variety of forms appropriate to the information and context including rigorous use of algebraic argument and formal proof.

### 4b Assessment Objectives (AOs)

The examination papers will assess the following assessment objectives in the context of the content and skills set out in Section 3 (Subject Content).

**AO1:** Recall and use their knowledge of the prescribed content.

**AO2:** Apply mathematical reasoning, skills and knowledge to solve mathematical problems including rigorous justification and formal proof.

### Weighting of Assessment Objectives

The table below shows the approximate weighting of each of the Assessment Objectives in the question papers

Assessment Objectives	Paper weightings (%)		Overall weighting of AOs (%)
	Paper 1	Paper 2	
AO1	22–26	33–39	55–65
AO2	14–18	21–27	35–45
Overall weighting of papers (%)	40	60	

## 4c National Criteria

**This specification is in line with the following.**

■ The Code of Practice

■ The Arrangements for the Statutory Regulation of External Qualifications in England Wales and Northern Ireland: Common Criteria

## 4d Previous learning requirements

There are no prior learning requirements for this specification. However, students preparing for this specification may be studying, or have studied, a course leading to the Higher tier of GCSE Mathematics.

Requirements set for entry to a course based on this specification are at your centre's discretion.

## 4e Access to assessment: diversity and inclusion

Specifications at Level 2 often need to access a wide range of competences. This is because they are general qualifications designed to prepare candidates for a wide range of occupations and further study.

The criteria on which this specification has been based were reviewed to see whether any of the skills or knowledge needed by candidates, whatever their ethnic background, religion, sex, age, disability or sexuality. If there were difficulties, the situation was reviewed again to make sure that such tests of specific competences were only included if they were important to the subject.

The findings were discussed with groups who represented the interests of a diverse range of candidates.

Arrangements are made for candidates with special needs to help them access the assessments as long as the competences being tested are not changed. Because of this, most candidates will be able to access any part of the assessment. More details are given in Section 5d.



## 5 Administration

### 5a Availability of examination and certification

This specification is designed to be taken over a one- or two-year course of study with all assessment at the end of the course.

From June 2013 assessment will only be available once a year in June. Examinations and certification for this specification will be available in June 2013 and every June thereafter throughout the life of the specification.

### 5b Entries

Please check the current version of **Entry Procedures and Codes** for up-to-date entry procedures. You should use the following entry code for both examination and for certification.

**8360**

A single entry is all that is needed for both examination papers and certification.

An A\* with Distinction grade will be represented by A<sup>+</sup>.

### 5c Private candidates

This specification is available to private candidates. Private candidates should write to us for a copy of **Supplementary Guidance for Private Candidates** (for specifications without controlled assessment).

### 5d Access arrangements, reasonable adjustments and special consideration

We have taken note of the equality and discrimination legislation and the interests of minority groups in developing and administering this specification.

We follow guidelines in the Joint Council for Qualifications (JCQ) document: *Access Arrangements, Reasonable Adjustments and Special Consideration: General and Vocational Qualifications*. This is published on the JCQ website **www.jcq.org.uk** or you can follow the link from our website **www.aqa.org.uk**

#### Access arrangements

We can arrange for candidates with special needs to access assessment. These arrangements must be made **before** the examination. For example, we can produce a Braille paper for a candidate with sight problems.

#### Reasonable adjustments

An access arrangement which meets the needs of a particular disabled candidate would be a reasonable adjustment for that candidate. For example a Braille paper would be a reasonable adjustment for a Braille reader but not for a candidate who did not read Braille. The Equality Act requires us to make reasonable adjustments to remove or lessen any disadvantage affecting a disabled candidate.

#### Special consideration

We can give special consideration to candidates who have had a temporary illness, injury or serious problem such as death of a relative, at the time of the examination. We can only do this **after** the examination.

The Examinations Officer at the centre should apply online for access arrangements and special consideration by following the eAQA link from our website **www.aqa.org.uk**

---

## 5e Examination language

We only provide papers for this specification in English.

---

## 5f Qualification title

**The qualification based on this specification is:**

- AQA Level 2 Certificate in Further Mathematics

---

## 5g Awarding grades and reporting results

The AQA Level 2 Certificate in Further Mathematics qualification will be graded on a five-grade scale: A\* with Distinction (A<sup>+</sup>), A\*, A, B and C. Candidates who fail to reach the minimum standard for the grade C will be recorded as 'U' (unclassified) and will not receive a qualification certificate.

We will publish the minimum raw mark for each grade, for each paper and for the overall qualification, when we issue candidates' results. We will report a candidate's results to your centre in terms of overall grade and marks for each paper. A candidate's grade is determined solely by their overall mark. There is no requirement to achieve the grade boundary in each paper in order to achieve a particular grade overall. Hence, a strong performance in one paper can compensate for a weaker performance in the other.

---

## 5h Re-sits

This is a traditional linear specification and, as such, results for individual examination papers cannot be carried forward or re-used.

Candidates can re-sit the qualification as many times as they wish.

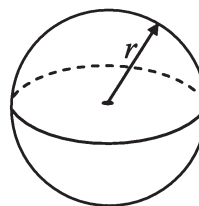
Candidates' grades are based on the work they submit for assessment.

# Appendices

## A Formulae Sheet

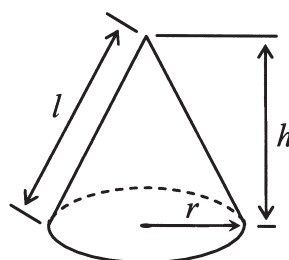
**Volume of sphere**  $= \frac{4}{3} \pi r^3$

**Surface area of sphere**  $= 4\pi r^2$



**Volume of cone**  $= \frac{1}{3} \pi r^2 h$

**Curved surface area of cone**  $= \pi r l$



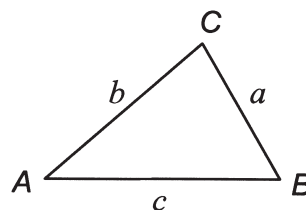
**In any triangle ABC**

**Area of triangle**  $= \frac{1}{2} ab \sin C$

**Sine rule**  $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

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

$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$



### The Quadratic Equation

The solutions of  $ax^2 + bx + c = 0$ , where  $a \neq 0$ , are given by  $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

### Trigonometric Identities

$\tan \theta \equiv \frac{\sin \theta}{\cos \theta}$        $\sin^2 \theta + \cos^2 \theta \equiv 1$

## B Grade descriptions

Grade descriptions are provided to give a general indication of the standards of achievement likely to have been shown by candidates who were awarded particular grades. The descriptions should be considered in relation to the content outlined in the specification – they are not designed to define that

content. The grade awarded will depend on how well the candidate has met the assessment objectives (see Section 4). If a candidate has performed less well in some areas this may be balanced by better performance in others.

Grade	Description
<b>A* with Distinction</b>	<p>Candidates use a wide range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately. Candidates are able to use different representations effectively and they recognise equivalent representations: for example, numerical, graphical and algebraic representations. Candidates use complex graphs, sketches and diagrams, all with accuracy and skill.</p> <p>Candidates manipulate complex algebraic expressions concisely, and use algebra to solve problems, with fluency and accuracy. They use trigonometry and geometrical properties to solve complex problems showing a high level of spatial awareness. Candidates demonstrate a comprehensive understanding of function notation, matrix transformations and differentiation through calculus. They evaluate the appropriateness, effectiveness and efficiency of different approaches to problem solving through their knowledge and understanding of mathematical inter-connectedness.</p> <p>Candidates tackle problems that bring together different aspects of mathematics that involve multiple variables, often in non-standard situations. They can identify variables and investigate them systematically; the outcomes of which are used in solving the problem.</p> <p>Candidates communicate their chosen strategy concisely. They can construct a rigorous argument, and engage in multi-step reasoning, making inferences and drawing conclusions. They use mathematical language correctly, proceed logically through extended arguments or proofs and can identify errors in reasoning.</p>
<b>A</b>	<p>Candidates use a wide range of mathematical techniques, terminology, diagrams and symbols consistently, appropriately and accurately. Candidates are able to use different representations effectively and they recognise equivalent representations: for example, numerical, graphical and algebraic representations. Their numerical skills are sound, they use a calculator effectively</p> <p>Candidates demonstrate algebraic fluency. They have a mastery of trigonometry and geometrical properties to solve problems. Candidates also demonstrate familiarity and proficiency in function notation, matrix transformations and in differentiation through calculus.</p> <p>Candidates tackle problems that bring together different aspects of mathematics and may involve multiple variables. They can identify some variables and investigate them systematically; the outcomes of which are used in solving the problem.</p> <p>Candidates communicate their chosen strategy. They can construct a rigorous argument, making inferences and drawing conclusions. They are proficient in problem solving. They produce simple proofs and can identify errors in reasoning.</p>

**C**

Candidates use a range of mathematical techniques, terminology, diagrams and symbols consistently and appropriately. Candidates are able to use different representations effectively and they recognise some equivalent representations: for example, numerical, graphical and algebraic. Their numerical skills are sound, they use a calculator accurately.

Candidates apply ideas of proportionality to numerical problems and use geometric properties of angles, lines and shapes. They understand simple function and sequence notation and can manipulate and simplify straightforward algebraic expressions.

Candidates identify relevant information, select appropriate representations and apply appropriate methods and knowledge. They are able to move from one representation to another, in order to make sense of a situation. Candidates tackle problems that bring aspects of mathematics together and use some algebraic and geometrical properties to understand problems and begin to seek solutions. They identify strategies to solve problems involving a limited number of variables. Candidates communicate their chosen strategy. They can construct a mathematical argument, although there may be gaps in their reasoning.

## C Spiritual, moral, ethical, social, legislative, sustainable development, economic and cultural issues, and health and safety considerations

We have taken great care to make sure that any wider issues (for example, spiritual, moral, ethical, social, legal, sustainable development, economic and cultural issues), including those relevant to the education of students at Key Stage 4, have been taken into account when preparing this specification. They will only form part of the assessment requirements where they are relevant to the specific content of the specification and have been identified in Section 3: Content.

### European Dimension

We have taken the 1988 Resolution of the Council of the European Community into account when preparing this specification and associated specimen units.

### Environmental Education

We have taken the 1988 Resolution of the Council of the European Community and the Report 'Environmental Responsibility: An Agenda for Further and Higher Education' 1993 into account when preparing this specification and associated specimen units.

### Avoiding bias

We have taken great care to avoid bias of any kind when preparing this specification and specimen units.



## AQA Level 2 Certificate in Further Mathematics from 2011 onwards

---

**Qualification Accreditation Number: 600/2123/8**

---

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

Centres should be aware that candidates who enter for more than one GCSE qualification with the same classification code will have only one grade counted for the purpose of the School and College Performance Tables. In the case of a candidate taking two qualifications with the same classification code that are of the same size and level, eg two full course GCSEs, the higher grade will count.

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

For updates and further information on any of our specifications, to find answers or ask us a question, register with Ask AQA at:

**[aqa.org.uk/askaqa](http://aqa.org.uk/askaqa)**

Download a copy of this specification from our website at:

**[aqa.org.uk/igcsemaths](http://aqa.org.uk/igcsemaths)**

Free launch meetings are available in 2011 followed by further support meetings through the life of the specification.

Further information is available at:

**<http://events.aqa.org.uk/ebooking>**