



## Advanced Higher Mathematics

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## Draft National Course Specification

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Please refer to the note of changes at the end of this Course Specification for details of changes from previous version (where applicable).

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## Course outline

**Course title:** Advanced Higher Mathematics

**SCQF:** level 7 (32 SCQF credit points)

**Course code:** to be advised

### Mandatory Units

<b>Methods in Algebra and Calculus (Advanced Higher)</b>	<b>8 SCQF credit points</b>
<b>Applications of Algebra and Calculus (Advanced Higher)</b>	<b>8 SCQF credit points</b>
<b>Geometry and Systems of Equations (Advanced Higher)</b>	<b>8 SCQF credit points</b>

**Course assessment** **8 SCQF credit points**

This Course includes eight SCQF credit points to allow additional time for preparation for Course assessment. The Course assessment covers the added value of the Course. Further information on the Course assessment is provided in the Assessment section.

### Recommended entry

Entry to this Course is at the discretion of the centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by the following or equivalent qualifications and/or experience:

- ◆ Higher Mathematics Course

### Progression

This Course or its Units may provide progression to:

- ◆ other qualifications in Mathematics or related areas
- ◆ further study, employment and/or training

Further details are provided in the Rationale section.

### Equality and inclusion

This Course Specification has been designed to ensure that there are no unnecessary barriers to learning or assessment. The individual needs of learners should be taken into account when planning learning experiences, selecting assessment methods or considering alternative evidence. For further information, please refer to the *Course Support Notes* and the *Course Assessment Specification*.

## **Rationale**

All new and revised National Courses reflect Curriculum for Excellence values, purposes and principles. They offer flexibility, provide more time for learning, more focus on skills and applying learning, and scope for personalisation and choice.

In this Course, and its component Units, there will be an emphasis on skills development and the application of those skills. Assessment approaches will be proportionate, fit for purpose and will promote best practice, enabling learners to achieve the highest standards they can.

This Course provides learners with opportunities to continue to acquire and develop the attributes and capabilities of the four capacities, as well as skills for learning, skills for life and skills for work.

All Courses provide opportunities for learners to develop breadth, challenge and application, but the focus and balance of the assessment will be appropriate for the subject area.

## **Relationship between the Course and Curriculum for Excellence values, purposes and principles**

Mathematics is important in everyday life, allowing us to make sense of the world around us and to manage our lives. Using mathematics enables us to model real-life situations and to make connections and informed predictions. It equips us with the skills we need to interpret and analyse information, simplify and solve problems, assess risk and make informed decisions.

Because mathematics is rich and stimulating, it engages and fascinates learners of all ages, interests and abilities. Learning in mathematics develops logical reasoning, analysis, problem solving skills, creativity and the ability to think in abstract ways. It uses a universal language of numbers and symbols, which allows us to prove and communicate ideas in a concise, unambiguous and rigorous way.

Mathematics equips us with many of the skills required for life, learning and work. Understanding the part that mathematics plays in almost all aspects of life is crucial. This reinforces the need for mathematics to play an integral part in lifelong learning and be appreciated for the richness it brings.

This Course allows learners to acquire and develop the attributes and capabilities of the four capacities. For example, success in mathematical learning and activity leads to increased confidence as an individual, being able to think logically helps towards being a responsible citizen, and being able to understand, use and communicate mathematical ideas will assist in becoming an effective contributor.

## **Purpose and aims of the Course**

Mathematics helps us to make sense of the world around us. It is the study of relationships, patterns, proofs and the properties of numbers. Mathematics takes a reasoned approach to thinking and is characterised by order and the use of carefully designed terms and processes. Mathematics can be used to model real-

life situations and can equip us with the skills we need to interpret and analyse information, simplify and solve problems, assess risk, and make informed decisions. Mathematics at Advanced Higher provides the foundation for many developments in the sciences and in technology as well as having its own intrinsic value.

This Course is designed to enthuse, motivate, and challenge learners by enabling them to:

- ◆ select and apply complex mathematical techniques in a variety of mathematical situations, both practical and abstract
- ◆ extend and apply skills in problem solving and logical thinking
- ◆ extending skills in interpreting, analysing, communicating and managing information in mathematical form, while exploring more advanced techniques
- ◆ clarify their thinking through the process of rigorous proof

The Course develops and expands a range of mathematical skills. It allows the learner to develop further skills in calculus and algebra. Areas such as number theory (which helps keep the internet secure), complex numbers (the uses of which are ubiquitous, ranging from the solution of equations to the description of electronic circuits) and matrices (used in game theory and economics) are introduced. The learner's mathematical thinking will also benefit from examples of rigorous proof.

## **Information about typical learners who might do the Course**

This Course is suitable for learners who are secure in their attainment of the Higher Mathematics Course or an equivalent qualification.

Learners will develop skills in selecting and applying complex mathematical techniques in a variety of situations requiring knowledge of mathematics. These skills will enable progression to further learning and to employment. The abstract content of the Course will greatly benefit students who wish to pursue a career in pure mathematics and the more practical aspects of the Course will benefit those intending to study any of the many courses which utilise mathematics.

On successful completion of this Course, learners could progress to a course in higher education such as a degree or Higher National Diploma. These could be in mathematics or in a mathematics-related area. There are many careers where mathematical skills are important, and this level would be useful in areas of science, engineering and technology, through the use of mathematical modelling. There are applications in computer technology, encryption security, equipment design, and in the design and analysis of experiments and tests. There is use throughout the financial services sector, such as in economics, accountancy and actuarial work.

## **Course structure and conditions of award**

### **Course structure**

This Course will develop, deepen and extend the mathematical skills necessary at this level and beyond.

Learners will acquire and apply operational skills necessary for exploring more complex mathematical ideas. In addition, learners will develop mathematical reasoning skills and will gain experience in logical thinking and methods of proof.

The Advanced Higher Mathematics Course has three Units, totalling 24 SCQF credit points, with an additional eight SCQF credit points to allow the use of an extended range of learning and teaching approaches, consolidation of learning, integration, and preparation for external assessment.

Units are statements of standards for assessment and not programmes of learning and teaching. They can be delivered in a number of ways.

#### **Methods in Algebra and Calculus (Advanced Higher)**

The general aim of the Unit is to develop knowledge and skills in algebra and calculus. The Outcomes cover partial fractions and complex numbers, standard procedures for both differential calculus and integral calculus, as well as methods for solving both first-order and second-order differential equations. The importance of logical thinking and proof is emphasised throughout.

#### **Applications of Algebra and Calculus (Advanced Higher)**

The general aim of the Unit is to develop knowledge and skills that involve algebraic applications and applications of calculus. The Outcomes cover the binomial theorem, aspects of sequences and series, including summations, properties of functions and rates of change. Proof by induction is introduced.

#### **Geometry and Systems of Equations (Advanced Higher)**

The general aim of the Unit is to develop knowledge and skills that involve geometry, number and algebra and to examine the close relationship between them. The Outcomes cover solving systems of equations using a variety of methods, matrices, vectors and the geometry of complex numbers. Further methods of proof and logical thinking are examined and encouraged.

### **Conditions of award**

To gain the award of the Course, the learner must pass all of the Units as well as the Course assessment. The required Units are shown in the Course outline section. Course assessment will provide the basis for grading attainment in the Course award.

## Skills, knowledge and understanding

Further information on the assessment of skills, knowledge and understanding for the Course is given in the *Course Assessment Specification*. A broad overview of the mandatory subject skills, knowledge and understanding that will be assessed in the Course is given in this section.

This includes:

- ◆ the ability to use mathematical reasoning skills to think logically, provide justification and solve problems
- ◆ knowledge and understanding of a range of complex concepts
- ◆ the ability to select and apply complex operational skills
- ◆ the ability to use reasoning skills to interpret information and to use complex mathematical models
- ◆ the ability to effectively communicate solutions in a variety of contexts
- ◆ the ability to explain and justify concepts through the idea of rigorous proof
- ◆ the ability to think creatively

Skills, knowledge and understanding to be included in the Course will be appropriate to the SCQF level of the Course. The SCQF level descriptors give further information on characteristics and expected performance at each SCQF level ([www.sqa.org.uk/scqf](http://www.sqa.org.uk/scqf)).

## Assessment

Information about assessment for the Course is included in the *Course Assessment Specification*, which provides full details including advice on how a learner's overall attainment for the Course will be determined.

### Unit assessment

All Units are internally assessed against the requirements shown in the *Unit Specification*.

They can be assessed on a Unit-by-Unit basis or by combined assessment.

They will be assessed on a pass/fail basis within centres. SQA will provide rigorous external quality assurance, including external verification, to ensure assessment judgments are consistent and meet national standards.

The assessment of the Units in this Course will be as follows.

#### Methods in Algebra and Calculus (Advanced Higher)

Learners who complete the Unit will be able to:

- ◆ use mathematical operational and reasoning skills relevant to methods in algebra and calculus

#### Applications of Algebra and Calculus (Advanced Higher)

Learners who complete the Unit will be able to:

- ◆ use mathematical operational and reasoning skills relevant to applications of algebra and calculus

#### Geometry and Systems of Equations (Advanced Higher)

Learners who complete the Unit will be able to:

- ◆ use mathematical operational and reasoning skills relevant to geometry and systems of equations

Exemplification of possible approaches to assessment for these Units is provided in the *National Assessment Resource*.

### Course assessment

Courses from National 4 to Advanced Higher include assessment of [added value](#)<sup>1</sup>. At National 5, Higher and Advanced Higher, the added value will be assessed in the Course assessment. The added value for the Course must address the key purposes and aims of the Course, as defined in the Course rationale. It will do this by addressing one or more of breadth, challenge and application.

In the Advanced Higher Mathematics Course, added value will focus on:

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<sup>1</sup> Definitions can be found here: [www.sqa.org.uk/sqa/45528.html](http://www.sqa.org.uk/sqa/45528.html)

- ◆ breadth
- ◆ challenge
- ◆ application

Learners will draw on, extend and apply the skills they have learned during the Course. This will be assessed within a [question paper](#)<sup>2</sup>, requiring demonstration of the knowledge, skills and understanding acquired from across the Units and how they can be applied in unfamiliar contexts and/or integrated ways.

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<sup>2</sup> Definitions can be found here: [www.sqa.org.uk/sqa/45528.html](http://www.sqa.org.uk/sqa/45528.html)

## Development of skills for learning, skills for life and skills for work

It is expected that learners will develop broad, generic skills through this Course. The skills that learners will be expected to improve on and develop through the Course are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and drawn from the main skills areas listed below. These must be built into the Course where there are appropriate opportunities.

### **2 Numeracy**

- 2.1 Number processes
- 2.2 Money, time and measurement
- 2.3 Information handling

### **5 Thinking skills**

- 5.3 Applying
- 5.4 Analysing and evaluating

Amplification of these skills is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work*. The level of these skills will be appropriate to the level of the Course. Further information on building in skills for learning, skills for life and skills for work for the Course is given in the *Course Support Notes*.

## Administrative information

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**Published:** May 2012 (draft version 1.0)

**Superclass:** to be advised

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## History of changes to National Course Specification

Course details	Version	Description of change	Authorised by	Date

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Note: You are advised to check SQA's website ([www.sqa.org.uk](http://www.sqa.org.uk)) to ensure you are using the most up-to-date version of the Course Specification.