



Advanced Higher Mathematics — draft Course rationale and summary



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The Optima Building, 58 Robertson Street, Glasgow G2 8DQ
Lowden, 24 Wester Shawfair, Dalkeith, Midlothian EH22 1FD

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Course rationale

Background

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. The in-depth study of mathematical concepts allows the learner to appreciate how mathematics can help to describe our world. 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 communicate ideas in a concise, unambiguous and rigorous way. For example, such skills are vital in areas of scientific and technological research.

Mathematics equips us with many of the skills required for learning, life 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. The mathematics studied in the Advanced Higher Course has aided the design and invention of many products that we take for granted today, from car engines to smart phones.

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 problem solving and logic skills
- ◆ extending skills in interpreting, analysing, communicating and managing information in mathematical form, while exploring more advanced techniques

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 (which enable us to perform calculations to aid our understanding of the physics of the universe) and matrices (used in game theory and economics) are introduced. The learner will also benefit from examples of rigorous proof. 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.

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 mathematical situations. These skills will enable progression to further learning and to employment.

On successful completion of this Course, learners could progress to:

- ◆ degrees in Mathematics and related disciplines
- ◆ a range of mathematics-related Higher National Diplomas (HNDs)
- ◆ careers in mathematics and in roles where mathematical skills are important

Mathematics has applications in many other subject areas, and skills developed in this Course support progression in other curriculum areas.

Course summary

Course title: Advanced Higher Mathematics

SCQF level 7 (32 SCQF credit points)

Course outline

Mandatory Units

The Course comprises the following mandatory Units:

Mathematics: Calculus, Expressions and Equations (Advanced Higher)	8 SCQF credit points
Mathematics: Techniques and Representations (Advanced Higher)	8 SCQF credit points
Mathematics: Equations and Proofs (Advanced Higher)	8 SCQF credit points

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.

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 mathematical ideas through symbolic representation and diagrams. In addition, learners will develop mathematical reasoning skills and will gain experience in making informed decisions.

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.

Mathematics: Calculus, Expressions and Equations (Advanced Higher)

This Unit involves developing algebraic techniques along with skills in differentiation and integration. The differentiation skills are then applied to curve sketching. Gaussian elimination is used to solve systems of equations.

Mathematics: Techniques and Representations (Advanced Higher)

This Unit uses algebra and calculus and applies them to implicit and parametric differentiation and to differential equations. Complex numbers are introduced. Skills in handling sequences and series, and in methods of proof in the context of number theory, are developed.

Mathematics: Equations and Proofs (Advanced Higher)

This Unit covers vectors, which builds on the work done at Higher. Matrices are introduced. Series and sequences work includes Maclaurin's expansion and iteration. Calculus skills are developed by working with differential equations. Logical thinking using induction and number theory is also developed.

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.

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.

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

Course assessment

Courses from National 4 to Advanced Higher include assessment of [added value](#)¹. 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:

- ◆ 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](#)² requiring demonstration of the breadth of knowledge, skills and understanding acquired from across the Units and how they can be applied in unfamiliar contexts and/or integrated ways.

¹ Definitions can be found here: www.sqa.org.uk/sqa/45528.html

² See link above for definitions.