

# Draft National Unit Specification



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**Unit title:** Mathematical Techniques for Mechanics (Advanced Higher)

**SCQF:** level 7 (8 SCQF credit points)

**Unit code:** to be advised

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## Unit outline

This Unit covers development of advanced skills in algebra and calculus relevant to the study of problems in mechanics. Learners are introduced to the modelling of practical problems using first order differential equations including those with separable variables and those with integrating factor. The expansion of expressions is developed and partial fractions introduced. Learners' skills in calculus are widened to include parametric and implicit differentiation as well as integration using substitution, using partial fractions and by parts.

Learners who complete this Unit will be able to:

- 1 Use mathematical operational skills linked to mechanics

This Unit is a mandatory Unit of the Advanced Higher Applied Mathematics (Mechanics) Course and is also available as a free-standing Unit. The Unit Specification should be read in conjunction with the *Unit Support Notes*, which provide advice and guidance on delivery, assessment approaches and development of skills for learning, skills for life and skills for work. Exemplification of the standards in this Unit is given in the *National Assessment Resource*.

The *Course Assessment Specification* for the Advanced Higher Applied Mathematics (Mechanics) Course gives further mandatory information on Course coverage for learners taking this Unit as part of the Advanced Higher Applied Mathematics (Mechanics) Course.

## Recommended entry

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

- ◆ Higher Mathematics Course or relevant component Units

## Equality and inclusion

This Unit 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 *Unit Support Notes*.

# Standards

## Outcomes and assessment standards

### Outcome 1

The learner will:

#### 1 Use mathematical operational skills linked to mechanics by:

- 1.1 Applying algebraic skills to expansion of expressions and to partial fractions
- 1.2 Applying calculus skills to differentiation of functions
- 1.3 Applying calculus skills to multi-stage integration
- 1.4 Applying calculus skills to differential equations

### Evidence Requirements for the Unit

Assessors should use their professional judgement, subject knowledge and experience, and understanding of their learners, to determine the most appropriate ways to generate evidence and the conditions and contexts in which they are used. They should ensure there is sufficient evidence of competence in algebraic and calculus skills from the Outcomes and Assessment Standards to allow a judgement to be made that the learner has achieved the Unit.

Assessors should use their professional judgement when giving learners credit for an appropriate degree of accuracy. This may mean giving credit for incomplete solutions or numerically incorrect solutions which show correct methodology, therefore demonstrating required knowledge and understanding of algebraic and calculus processes involved.

A calculator or equivalent technologies may be used.

For this Unit, learners will be required to produce evidence as follows.

For Outcome 1, learners will be required to provide evidence for each Assessment Standard by drawing on the following:

#### Algebraic Skills (1.1)

- ◆ Expand an expression of the form  $(x + y)^n$
- ◆ Express a proper rational function as a sum of partial fractions where the denominator is a quadratic.

#### Calculus Skills (1.2)

- ◆ Differentiate a product.
- ◆ Differentiate a quotient.
- ◆ Find the first derivative of a function defined parametrically.

#### Calculus Skills (1.3)

- ◆ Integrate using a substitution when the substitution is given.
- ◆ Integrate a proper rational function where the denominator is a factorised quadratic.

#### Calculus Skills (1.4)

- ◆ Find a general solution of a first order differential equation (variables separable type).
- ◆ Solve a simple first order linear differential equation using an integrating factor.

Exemplification of assessment is provided in the *National Assessment Resource*. Advice and guidance on possible approaches to assessment is provided in the *Unit Support Notes*.

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

It is expected that learners will develop broad, generic skills through this Unit. The skills that learners will be expected to improve on and develop through the Unit 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 Unit 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 is given in SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work*. The level of these skills should be at the same SCQF level as the Unit and be consistent with the SCQF level descriptor. Further information on building in skills for learning, skills for life and skills for work is given in the *Unit Support Notes*.

## Administrative information



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

**Superclass:** to be advised

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### History of changes

Version	Description of change	Authorised by	Date

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