**Advanced Higher Unit Specification**

**✕SQA**

# Mathematics of Mechanics: Mathematical Techniques for Mechanics (Advanced Higher) Unit

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

**Unit code:** H7VL 77

## 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 differential equations including those with separable variables and those with integrating factors. Partial fractions are 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 and reasoning skills linked to mechanics.

This Unit is a mandatory Unit of the Advanced Higher Mathematics of 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 *Unit Assessment Support*.

The *Course Assessment Specification* for the Advanced Higher Mathematics of Mechanics Course gives further mandatory information on Course coverage for learners taking this Unit as part of the Advanced Higher Mathematics of 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 and reasoning skills linked to mechanics by:**

1.1    Applying algebraic skills to partial fractions
1.2    Applying calculus skills through techniques of differentiation
1.3    Applying calculus skills through techniques of integration
1.4    Applying calculus skills to solving 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)
♦   Expressing rational functions as a sum of partial fractions (denominator of degree at most 3 and easily factorised)

Calculus Skills (1.2)
♦   Differentiating exponential and logarithmic functions
♦   Differentiating functions using the chain rule
♦   Differentiating functions given in the form of a product and/or in the form of a quotient
♦   Finding the derivative of functions defined implicitly
♦   Finding the derivatives of a function defined parametrically

Calculus Skills (1.3)
♦   Integrating expressions using standard results
♦   Integrating using a substitution when the substitution is given
♦   Integrating by parts
♦   Applying integration to a range of physical situations

Calculus Skills (1.4)

♦ Finding a general solution of a first order differential equation with variables separable
♦ Solving a simple first order linear differential equations using an integrating factor
♦ Solving second order homogeneous equations

Candidates who achieve the Units: Methods in Algebra and Calculus, and Applications of Algebra and Calculus from the Advanced Higher Mathematics Course can use these as evidence for achieving this Unit.

Exemplification of assessment is provided in *Unit Assessment Support*. 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

**Published:**      April 2015 (version 2.0)

**Superclass:**    RB

## History of changes to National Unit Specification

| Version | Description of change | Authorised by | Date |
|---------|----------------------|---------------|------|
| 2.0 | Unit title amended to include 'Mathematics of Mechanics:' prefix.<br><br>Outcome 1 amended to include reasoning.<br><br>Assessment Standards 1.1 and 1.2 amended.<br><br>Evidence Requirements relating to sub-skills updated; statement inserted about evidence from Advanced Higher Mathematics Units being suitable to demonstrate achievement in this Unit. | Qualifications Development Manager | April 2015 |
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