**Advanced Higher
Unit Specification**

✕SQA

Mathematics of Mechanics: Linear and Parabolic Motion (Advanced Higher) Unit

SCQF: level 7 (8 SCQF credit points)

Unit code: H7VM 77

Unit outline

The general aim of the Unit is to develop advanced knowledge and skills in algebra and calculus to be applied to the mechanics of linear and parabolic motion. Learners will interpret the effects of forces on a body and will use mathematical models in problems involving motion in a straight line under the influence of either constant force or variable force where acceleration is dependent on time. A vector approach is encouraged in the study of the relative motion of bodies, the effects of winds and currents, collision courses and closest approach. The motion of projectiles in a vertical plane is explored. Newton's Laws of Motion are used to develop an understanding of equilibrium, friction and resulting motion, with particular emphasis on Newton's Second Law to consider one-dimensional motion on horizontal and inclined planes.

Learners who complete this Unit will be able to:

1   Use mathematical operational and reasoning skills linked to linear and parabolic motion.

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 linear and parabolic motion by:

1.1 Applying skills to motion in a straight line
1.2 Applying skills to vectors associated with motion
1.3 Applying skills to projectiles moving in a vertical plane
1.4 Applying skills to forces associated with dynamics and equilibrium

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 mathematical 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 the mathematical 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:

Skills appropriate to application (1.1)
♦ Working with time-dependent graphs
♦ Working with rates of change with respect to time in one dimension
♦ Using equations of motion in one dimension under constant acceleration

Skills appropriate to application (1.2)
♦ Using vectors to define displacement, velocity and acceleration
♦ Finding resultant velocity, relative velocity or relative acceleration of one body with respect to another
♦ Applying understanding of relative motion

Skills appropriate to application (1.3)
♦ Establishing the conditions of motion in horizontal and vertical directions involved in parabolic motion
♦ Using the equations of motion in parabolic flight

Skills appropriate to application (1.4)
♦ Using Newton's first and third laws of motion to understand equilibrium
♦ Understanding the concept of static friction, dynamic friction and limiting friction
♦ Using Newton's second law of motion

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

Version	Description of change	Authorised by	Date
2.0	Unit title amended to include 'Mathematics of Mechanics:' prefix. Evidence Requirements relating to sub-skills updated.	Qualifications Development Manager	April 2015

This specification may be reproduced in whole or in part for educational purposes provided that no profit is derived from reproduction and that, if it is reproduced in part, the source is acknowledged. Additional copies of this Unit can be downloaded from SQA's website at **www.sqa.org.uk**.

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

© Scottish Qualifications Authority 2015