



## National Unit Specification

### General information

**Unit title:** Mathematics for Science 1 (SCQF level 4)

**Unit code:** HP9V 44

**Superclass:** RB

**Publication date:** September 2017

**Source:** Scottish Qualifications Authority

**Version:** 2

### Unit purpose

The unit is intended for those learners who wish to gain the foundations of the Mathematics underpinning studies in all branches of Science. The unit develops basic skills in calculation, algebra, graph reading and drawing.

### Outcomes

On successful completion of the unit the learner will be able to:

- 1 Understand and perform basic calculations.
- 2 Perform algebraic operations.
- 3 Read and construct statistical graphs and calculate statistical measures.

### Credit points and level

1 National Unit credit at SCQF level 4 (6 SCQF credit points at SCQF level 4)

### Recommended entry to the unit

Entry to the course is at the discretion of the centre, although a background in Numeracy and Mathematics at SCQF level 3 would be advantageous.

## National Unit Specification: General information (cont)

**Unit title:** Mathematics for Science (SCQF level 4)

### Core Skills

Achievement of this unit gives automatic certification of the following Core Skills component:

Complete Core Skill                      *Numeracy* at SCQF level 4

Core Skill component                      *Critical Thinking* at SCQF level 4

### Context for delivery

The Assessment Support Pack (ASP) for this unit provides assessment and marking guidelines that exemplify the national standard for achievement. It is a valid, reliable and practicable assessment. Centres wishing to develop their own assessments should refer to the ASP to ensure a comparable standard. A list of existing ASPs is available to download from SQA's website (<http://www.sqa.org.uk/sqa/46233.2769.html>).

### 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.

Further advice can be found on our website [www.sqa.org.uk/assessmentarrangements](http://www.sqa.org.uk/assessmentarrangements).

## **National Unit Specification: Statement of standards**

**Unit title:** Mathematics for Science (SCQF level 4)

Acceptable performance in this unit will be the satisfactory achievement of the standards set out in this part of the unit specification. All sections of the statement of standards are mandatory and cannot be altered without reference to SQA.

### **Outcome 1**

Understand and perform basic calculations.

#### **Performance criteria**

- (a) Substitute values into single variable expressions and solve.
- (b) Round to a specified number of significant figures and decimal places.
- (c) Perform fraction arithmetic.
- (d) Calculate percentages and percentage change.
- (e) Compare fractions, percentages and decimals.
- (f) Calculate areas and volumes of basic shapes.
- (g) Perform calculations involving proportions and ratio.

### **Outcome 2**

Perform algebraic operations.

#### **Performance criteria**

- (a) Multiply out brackets with up to three terms.
- (b) Collect like terms and simplify.
- (c) Factorise with common factors.
- (d) Transpose linear equations.
- (e) Use Pythagoras' theorem.
- (f) Perform trigonometry in right angled triangles.

### **Outcome 3**

Read and construct statistical graphs and calculate statistical measures.

#### **Performance criteria**

- (a) Read and construct bar charts.
- (b) Read and construct pie charts.
- (c) Read and construct scatter graphs.
- (d) Construct single sided stem and leaf diagrams.
- (e) Determine the arithmetic mean, median, mode and range of ungrouped data.

## National Unit Specification: Statement of standards (cont)

**Unit title:** Mathematics for Science (SCQF level 4)

### Evidence requirements for this unit

Evidence is required to demonstrate that learners have achieved all outcomes and performance criteria.

Assessment may be carried out:

- ◆ Outcome by outcome
- ◆ Two or more outcomes together

Evidence should be produced under closed-book, supervised conditions.

Learners should not have information in advance about the content of the assessment.

Scientific calculators may be used, but computer algebra packages, graphical calculators or programmable calculators should not be used.

Sufficient working must be shown to demonstrate the method of solution.

Where reassessment is needed, an alternative instrument of assessment must be used.

Total assessment time should not exceed 2 hours.

### Outcome 1

Understand and perform basic calculations.

- ◆ Evaluate an expression involving brackets, addition or subtraction, and multiplication or division in combination.
- ◆ Round at least one number to a specified number of decimal places.
- ◆ Round at least one number to a specified number of significant places.
- ◆ Perform at least one operation add or subtract, one operation of multiply and one operation of divide using proper fractions with unequal denominators:
  - $\frac{a}{b} + \frac{c}{d}$  OR  $\frac{a}{b} - \frac{c}{d}$
  - $\frac{a}{b} \times \frac{c}{d}$
  - $\frac{a}{b} \div \frac{c}{d}$
- ◆ Calculate at least one percentage.
- ◆ Calculate at least one percentage change.
- ◆ Convert values in vulgar fraction and percentage form to decimal fraction and compare the magnitudes.
- ◆ Calculate one area and one volume, at least one of which should involve  $\pi$ :
  - Select area from rectangle, triangle or circle.
  - Select volume from cuboid or triangular prism.
- ◆ Perform one calculation involving the relationship between proportion and ratio.

## National Unit Specification: Statement of standards (cont)

**Unit title:** Mathematics for Science (SCQF level 4)

### Outcome 2

Perform algebraic operations.

- ◆ Expansion of brackets and collection of terms:
  - Multiply out one expression of the form  $a(b+c+d)$ .
  - One question of the form  $a(b+c)+d+e$  with collection of terms.
  - Note that  $a, b, c, d$  can be positive or negative.
- ◆ Factorisation:
  - Factorise a symbol out of an expression of the form  $ax+bxy$ .
  - Factorise a number out of an expression of the form  $ax+ay$
- ◆ Transposing an equation of the form  $ax+b=c$  to  $x$ .
- ◆ Pythagoras' Theorem:
  - Calculate the length of one of the two shorter sides in a right angled triangle using Pythagoras' theorem.
  - Calculate the length of a hypotenuse in a right angled triangle using Pythagoras' theorem.
- ◆ Trigonometry of right angle triangles:
  - Perform two calculations solving trigonometric problems in a right angled triangle (Different trigonometric functions should be used in the two problems.):
    - one problem should find a side
    - one problem should find an angle

### Outcome 3

Read and construct statistical graphs and calculate statistical measures.

- ◆ Read and construct charts:
  - Read or construct three charts (read one and construct two, or read two and construct one):
    - one bar chart (with at least five columns)
    - one pie chart (with at least three sectors)
    - one scatter graph (with at least five points), showing or drawing an estimated line of best fit)
  - Construct single sided, ordered, stem and leaf diagram:
    - the data set should include at least 15 values with at least four elements on the stem
- ◆ Calculate arithmetic mean, median, range and mode of a set of ungrouped data.



## National Unit Support Notes

**Unit title:** Mathematics for Science (SCQF level 4)

Unit support notes are offered as guidance and are not mandatory.

While the exact time allocated to this unit is at the discretion of the centre, the notional design length is 40 hours.

### Guidance on the content and context for this unit

This unit is part of the National Certificate Group Awards in Applied Science, but can also be a free-standing unit. This unit aims to build on and extend the learner's mathematical knowledge and skills.

It is envisaged that the content of this unit is delivered in scientific contexts appropriate to the learner, whether as a unit of the group award or as a free-standing unit.

Applying the mathematical skills of the unit in meaningful scientific scenarios will enable the learner to appreciate that those skills are essential tools for scientific analysis.

Consideration of this list of topics alongside the assessment support pack for this unit will provide clear indication of the standard expected.

#### Outcome 1

Understand and perform basic calculations.

- ◆ Explore the rules of arithmetic precedence (BODMAS), and substitute values into expressions involving brackets, addition or subtraction, and multiplication or division in combination.
- ◆ Round numbers to a specified number of decimal places.
- ◆ Round numbers to a specified number of significant places.
- ◆ It would be useful to cover the concepts of estimation and order of magnitude if time allows. This will introduce the students to checking whether their answers are realistic or not, and introduce some concepts useful for Scientific Notation.
- ◆ Perform algebraic simplifications involving algebraic fractions:
  - $\frac{a}{b} + \frac{c}{d}$
  - $\frac{a}{b} - \frac{c}{d}$
  - $\frac{a}{b} \times \frac{c}{d}$
  - $\frac{a}{b} \div \frac{c}{d}$

## National Unit Support Notes (cont)

**Unit title:** Mathematics for Science (SCQF level 4)

- ◆ Calculate percentages and percentage differences.
- ◆ Convert values between vulgar fraction, decimal fraction and percentage form.
- ◆ Calculate volumes and areas using basic formulae.
- ◆ Perform calculations involving the relationship between proportion and ratio (eg a mixture of chemical a and chemical b are in a ratio of 4:7 respectively, chemical a constitutes  $\frac{4}{11}$  of the mixture, and chemical b constitutes  $\frac{7}{11}$  of the mixture).

### Outcome 2

Perform algebraic operations.

- ◆ Expand brackets and collect of terms in algebraic expressions of the form:
  - Factorise symbols and numbers out of expressions.
- ◆ Transposing the subject of linear equations.
- ◆ Calculate missing side lengths using Pythagoras' theorem.
- ◆ Calculate missing side length and angles in right angle triangles using basic trigonometric rules:
  - use SOH CAH TOA

### Outcome 3

Read and construct statistical graphs and calculate statistical measures.

- ◆ Read and construct bar charts, pie charts, and scatter graphs.
- ◆ Construct and read single sided, ordered, stem and leaf diagrams.
- ◆ Calculate arithmetic mean, median, range and mode using ungrouped data.

## Guidance on approaches to delivery of this unit

This unit provides skills, techniques and processes underpinning studies undertaken in Science, and as such, opportunities should be taken to contextualise delivery where possible.

Centres may deliver the outcomes in any order they wish.

All teaching input should be supplemented by formative assessment in which learners are provided with opportunities to develop their knowledge, understanding and skills.

Computer software, computer algebra, and graphical calculators may be used to support learning (eg to confirm the solutions of mathematical problems).

## National Unit Support Notes (cont)

**Unit title:** Mathematics for Science (SCQF level 4)

### Guidance on approaches to assessment of this unit

Evidence may be generated using different types of assessment. The following are suggestions only, and there may be other methods that would be more suitable to learners.

It is possible to assess learners either on an outcome by outcome basis or by combining some or all outcomes into one assessment event. Centres may assess the outcomes in any order they wish.

The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Most parts of this unit lend themselves to assessment using straightforward scientific contexts, and questions should be contextualised where appropriate. Some parts of the unit, however, such as those dealing with basic algebraic skills might be better assessed without context.

Care should be taken to avoid excessively elaborate contexts or language.

### Opportunities for e-assessment

E-assessment may be appropriate for some assessments in this unit. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or social software. Centres which wish to use e-assessment must ensure that the national standard is applied to all learner evidence and that conditions of assessment as specified in the evidence requirements are met, regardless of the mode of gathering evidence. The most up-to-date guidance on the use of e-assessment to support SQA's qualifications is available at [www.sqa.org.uk/e-assessment](http://www.sqa.org.uk/e-assessment).

### Opportunities for developing Core and other essential skills

This unit has the Core Skill of *Numeracy* embedded in it, so when learners achieve this unit their Core Skills profile will be updated to show that they have achieved *Numeracy* at SCQF Level 4

This unit has the *Critical Thinking* component of *Problem Solving* embedded in it. This means that when learners achieve the unit, their Core Skills profile will also be updated to show they have achieved *Critical Thinking* at SCQF level 4.



## History of changes to unit

Version	Description of change	Date
2	Core Skill Numeracy at SCQF level 4 embedded. Core Skill Component Critical Thinking at SCQF level 4 embedded.	12/09/2017

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## General information for learners

### Unit title: Mathematics for Science (SCQF level 4)

This section will help you decide whether this is the unit for you by explaining what the unit is about, what you should know or be able to do before you start, what you will need to do during the unit and opportunities for further learning and employment.

The unit is intended to help you consolidate and develop your knowledge of the mathematics underpinning studies in science, and is designed to lead on to the other Mathematics units in the NQ Framework for Applied Science and related disciplines. The unit develops basic skills in calculation, algebra, graphs and statistics.

The unit covers the following topics:

- ◆ Understand and perform basic calculations:
  - In this section you will learn some basic methods of calculation. You will look at substitution, rounding, fractions, percentages, proportion, ratio, and areas and volumes.
  
- ◆ Perform algebraic operations:
  - Algebra is the basic language of scientific analysis. In this section you will learn some algebraic methods including handling brackets, factorisation, transposition, use of Pythagoras' theorem and trigonometry.
  -
  
- ◆ Read and construct statistical graphs and calculate statistical measures:
  - In this section, you will learn how to construct various charts used in science, as well as looking at basic charts for sorting and comparing data. You will also look at basic statistical measures used commonly in science.

### Assessment

The assessments for this unit may be distributed throughout the course, or at the end of the unit, and will be closed book (that is, you cannot take notes into the assessment). You will be allowed to use a scientific calculator, but not an advanced programmable or graphing calculator. Total assessment time is a maximum of 2 hours.

### Core Skills

This unit has the Core Skill of *Numeracy* embedded in it, so when you achieve this unit your Core Skills profile will be updated to show that you have achieved *Numeracy* at SCQF level 4.

This unit also has the *Critical Thinking* component of *Problem Solving* embedded in it. This means that when you achieve the unit, your Core Skills profile will also be updated to show you have achieved *Critical Thinking* at SCQF level 4.