

## Higher National Unit Specification

### General information for centres

**Unit title:** Mathematics for Science 1

**Unit code:** DN8D 33

**Unit purpose:** This unit is designed to enable candidates to use and understand mathematical concepts and their application to science. Candidates should develop an appreciation of when and how to use the various mathematical methods. They will also apply their knowledge in the context of a scientific problem.

On completion of the unit the candidate will be able to:

1. Apply algebraic methods in problem solving.
2. Find a least squares line of best fit for given empirical data.
3. Use basic techniques of calculus with simple functions.

**Credit points and level:** 1 HN credit at SCQF level 6: (8 SCQF points at SCQF level 6\*)

*\*SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

**Recommended prior knowledge and skills:** Entry to this unit is at the discretion of the centre however, it is advisable that candidates have basic skills in mathematics. This may be evidenced by possession of Intermediate 2 Mathematics, Standard Grade at Credit Level or possession of appropriate National Certificate Modules such as Core Maths 4 or Algebra/Analysis 1.

**Core Skills:** There may be opportunities to gather evidence toward the core skills of Numeracy at Higher level in this unit, although there is no automatic certification of core skills or core skills components.

**Context for delivery:** This unit is included in a number of Group Awards for Science. If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the particular Group Award to which it contributes.

**Assessment:** Assessment of this unit lends itself to holistic assessment. Evidence for this Unit should be generated through assessment undertaken in closed book controlled conditions. Candidates will be assessed by means of an end of unit assessment of approximately 1.5 hours duration. If relevant, outcome two could be assessed separately by way of an integrated assessment with relevant units. In such cases then outcome two would not form part of the end of unit assessment and assessment for outcomes 1 and 3 could be approximately 1 hour

## Higher National Unit specification: statement of standards

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The sections of the Unit stating the Outcomes, Knowledge and/or skills, and Evidence requirements are mandatory. Please refer to *Evidence requirements for the Unit* after the Outcomes.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the knowledge and/or skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

### Outcome 1

Apply algebraic methods in problem solving

#### Knowledge and/or skills

- ◆ Numerical evaluation of expressions.
- ◆ Solutions of equations.
- ◆ Changing the subject of a formula.
- ◆ Solution of problems involving ratio and proportion.

### Outcome 2

Find a least squares line of best fit for given empirical data

#### Knowledge and/or skills

- ◆ Transformation of non-linear functions to linear form using logarithms.
- ◆ Calculation of least squares regression line.
- ◆ Use regression equation to obtain estimates.

### Outcome 3

Use basic techniques of calculus with simple functions

#### Knowledge and/or skills

- ◆ Use derivatives of simple functions.
- ◆ Use integrals of simple functions.

#### Evidence requirements for the unit

It is recommended that a holistic assessment at the end of the unit is given to the candidate. This should be assessed by a written/oral assessment of approximately 1.5 hours duration. This assessment should be carried out as a closed book exercise under controlled supervised conditions. A formula sheet will be given which would contain appropriate standard integrals, standard derivatives and regression formulae.

## **Higher National Unit specification: statement of standards (cont)**

### **Unit title:** Mathematics for Science 1

Evidence for the knowledge and/or skills for these outcomes will be provided on a sample basis and should include a representative range of questions to reflect the knowledge and/or skills items listed under the evidence requirements. The sampling is as follows:

- 2 out of 4 knowledge and skills for outcome 1,
- 2 out of 3 knowledge and skills for outcome 2
- 2 out of 2 knowledge and skills for outcome 3.

Each candidate will need evidence to show that they have achieved the threshold score set for this unit. An overall threshold of 60% is recommended, however candidates should be able to demonstrate understanding in each of the outcomes.

### **Assessment guidelines**

The use of a scientific calculator or appropriate computer software packages should be encouraged throughout this unit.

If relevant, outcome two could be assessed separately by way of an integrated assessment with relevant units where the candidate has the opportunity to generate appropriate experimental data which could then be analysed to provide the required evidence for achievement in outcome 2. In such cases then outcome two would not form part of the end of unit assessment and assessment for outcomes 1 and 3 would be approximately 1 hour.

## **Administrative Information**

<b>Unit code:</b>	DN8D 33
<b>Unit title:</b>	Mathematics for Science 1
<b>Superclass category:</b>	RB
<b>Date of publication:</b>	August 2005
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## Higher National Unit specification: support notes

### Unit title: Mathematics for Science 1

This part of the Unit specification is offered as guidance. The support notes 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

The aim of this unit is to enable HN science candidates to understand and apply a variety of mathematical methods that have application throughout science. Throughout this unit emphasis has been given to applying the techniques to a variety of contexts occurring in chemistry, biology, physics and environmental science.

This unit could be integrated with other units such e.g. physics in differentiation of kinematics equations or IT in the analysis data. This unit is likely to be included near the beginning of the course in order to provide the candidate with the relevant mathematical skills required in other units.

**Outcome 1** revises basic mathematical skills and is included to provide a base knowledge that may be lacking and extends these skills to include the laws of logarithms and exponentials. Candidates should be able to evaluate expressions involving scientific notation, and be able to manipulate equations and formulae involving indices, exponentials and logarithms.

**Outcome 2** considers regression analysis of bivariate data using the least squares regression line. The formulae should be used when calculating the regression coefficients manually to encourage understanding however, as many science projects are written up on computer so, where computers are available, the data can be input into a spreadsheet and appropriate statistical functions used.

**Outcome 3** introduces the basic concepts of calculus. Differentiation and integration of simple functions such as polynomials,  $e^{ax+b}$  and  $\ln(ax + b)$  should be considered in terms of their application in various scientific contexts.

### Guidance on the delivery and assessment of this unit

This unit forms part of the mandatory section in the group award, HNC Applied Sciences. This unit is likely to be delivered at towards the start of the Group Award. This should allow the candidates to make use of their mathematical skills in other subject areas. This Unit should be delivered in such a way that enables the candidates to appreciate its relevance to the branch of science concerned.

It is recommended that this unit is assessed by means of an end of unit assessment. However, assessment of outcome 2 can be done separately with an assessment for outcomes 1 and 3 combined.

Assessment will be closed book and under controlled conditions. Any relevant formula will be given with each assessment, which will be in the form of a formulae sheet. Candidates must achieve all of the minimum evidence specified for each outcome in order to pass the unit.

The use of a scientific calculator or appropriate computer software packages should be encouraged throughout this unit.

## **Higher National Unit specification: support notes (cont)**

**Unit title:** Mathematics for Science 1

### **Open learning**

If this unit is delivered by open or distance learning methods, additional planning resources may be required for candidate support, assessment and quality assurance.

A combination of new and traditional authentication tools may have to be devised for assessment and reassessment purposes.

For further information and advice, please see *Assessment and Quality Assurance for Open and Distance Learning* (SQA, February 2001 – publication code A1030).

### **Candidates with additional support needs**

This Unit specification is intended to ensure that there are no artificial barriers to learning or assessment. The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments or considering alternative Outcomes for Units. For information on these, please refer to the SQA document *Guidance Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs*, which is available on the SQA website [www.sqa.org.uk](http://www.sqa.org.uk).

## Higher National Unit specification: support notes (cont)

### General information for candidates

#### Unit title: Mathematics for Science 1

This is a 1 credit HN unit at SCQF level 6. This unit consists of three outcomes and is assessed by means of a holistic assessment under closed-book conditions

This unit is designed to provide the basic mathematical skills required when studying HN Science. Prior to commencement of this unit it is recommended that you will have a background in basic mathematics as well as have good numerical skills.

**Outcome 1** revises basic mathematical skills. Solution of equations, scientific notation and transposition and evaluation of formulae revised. These skills are then extended to consider the laws of logarithms and exponentials. All of these skills are relevant in various scientific contexts and it is likely that you will make use of the skills learned in other subject areas.

**Outcome 2** introduces the concept of regression analysis for bivariate data. In many controlled scientific experiments, sets of data are generated as a direct result of experimentation. You will learn how to model data that exhibits a linear relationship using the method of least squares, and then using the laws of logarithms from the previous outcome you will then extend this knowledge to modelling data that does not necessarily exhibit a linear relationship.

**Outcome 3** introduces the basic concepts of calculus. In science it is often important to be able to predict rates of reaction or rates of displacement over time. Differentiation is a mathematical technique that allows scientists to calculate and manipulate rates of change. Integration is the reverse process of differentiation whereby, if the rate of change of a quantity is known then a mathematical expression can often be derived to show how the quantity changes with time.

The end of unit assessment will be undertaken in closed book and under controlled conditions. You will need to demonstrate an understanding of each mathematical concept outlined above and an ability to apply these skills in relevant scientific contexts. The assessment will be of approximately 1.5 hours duration and a formulae sheet will be supplied to provide any relevant formulae that you require in the assessment.