



Higher National Unit specification

General information for centres

Unit title: Mathematics for Construction

Unit code: DW4F 33

Unit purpose: The Unit is designed to enable candidates to know, understand and apply algebraic techniques to manipulate expressions and solve equations commonly found in construction. It provides candidates with an opportunity to develop the knowledge and skills to carry out operations using algebra, trigonometry and circular measure formula. The Unit also enables the candidate the opportunity to develop the skills necessary to analyse numerical data using simple statistical techniques.

On completion of the Unit the candidate should be able to:

- 1 Manipulate mathematical expressions and solve equations.
- 2 Use trigonometry and circular measure formulae to solve commonly encountered problems in the construction industry.
- 3 Create and interpret graphs and charts from raw data, and use statistical methods to investigate variation of data.

Credit points and level: 1 HN credit at SCQF level 6: (8 SCQF credit 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: It would be beneficial if candidates had skills in mathematics as evidenced by possession of an appropriate National Certificate Unit, SCE Standard Grade Mathematics 1/2, Intermediate 2 Maths (including Unit 3) A/ B or an equivalent level of experience.

Core Skills: There are opportunities to develop the Core Skills of Numeracy, IT and Problem Solving in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: 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 Group Award to which it contributes.

Assessment: It is possible to assess candidates either on an Outcome-by-Outcome basis or by a single holistic assessment combining all three Outcomes. The assessment papers could be composed of an appropriate balance of short answer, restricted response and structured questions. Assessment should be carried out under supervised controlled conditions.

General information for centres (cont)

A single holistic assessment for all Outcomes should not exceed two hours.

Candidates should be allowed to use a scientific (non programmable) calculator as and when required however computer software should normally not be used.

An exemplar instrument of assessment and marking guidelines have been produced to provide examples of the type of evidence required to demonstrate achievement of the aims of this Unit and to indicate the national standard of achievement at SCQF level 6.

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.

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

Manipulate mathematical expressions and solve problems

Knowledge and/or Skills

- ◆ Numerical expressions including scientific/engineering notation
- ◆ Manipulate Algebraic expressions including Indices and logarithmic functions
- ◆ Transposition of formulae
- ◆ Solve Equations

Evidence Requirements

In any assessment of this Outcome **all** Knowledge and/or Skills items should be included. Candidates must provide a satisfactory response to all items.

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ apply algebraic techniques to manipulate expressions and solve equations commonly found in the construction industry
- ◆ include indices and/or logarithms in at least two knowledge and/or skills items

Evidence for the Knowledge and/or Skills in this Outcome might be provided by an assessment taken at a single event lasting 60 minutes and carried out under supervised controlled conditions. Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Assessment Guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome can be combined with Outcomes 2 and 3 to form a single assessment paper, details of which are given under Outcome 3.

Higher National Unit specification: statement of standards (cont)

Unit title: Mathematics for Construction

Outcome 2

Use Trigonometry and circular measure formulae to solve commonly encountered problems in the construction industry

Knowledge and/or Skills

- ◆ Trigonometry in a right angled triangle
- ◆ Trigonometry in a non right angled triangle
- ◆ Trigonometry of three dimensional shapes
- ◆ Circle problems

Evidence Requirements

In any assessment of this Outcome **all** Knowledge and/or Skills items should be included. Candidates must provide a satisfactory response to all items.

Candidates will need to provide evidence of Knowledge and/or Skills by showing they can:

- ◆ solve common building and surveying problems in two and three dimensions using trigonometry
- ◆ determine the area of a sector, or segment of a circle and the arc length in context

Evidence for the Knowledge and/or Skills in this Outcome might be provided by an assessment taken at a single event lasting 60 minutes and carried out under supervised controlled conditions. Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Assessment Guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome can be combined with Outcomes 1 and 3 to form a single assessment paper, details of which are given under Outcome 3.

Outcome 3

Create and interpret graphs and charts from raw data, and use statistical methods to investigate variation of numerical data

Knowledge and/or Skills

- ◆ Statistical charts
- ◆ Measures of centre
- ◆ Measures of spread
- ◆ Correlation coefficient and line of regression

Higher National Unit specification: statement of standards (cont)

Unit title: Mathematics for Construction

Evidence Requirements

In any assessment of this Outcome **all** Knowledge and/or Skills items should be included. Candidates must provide a satisfactory response to all items.

Candidates will need to provide evidence of Knowledge and/or Skills by showing they can:

- ◆ form raw data into a frequency distribution and construct appropriate statistical chart
- ◆ determine the Mean and Median, Standard Deviation and Interquartile range of small sets of data and grouped frequencies
- ◆ calculate correlation coefficient and equation of line of regression

Evidence for the Knowledge and/or Skills in this Outcome might be provided by an taken at a single assessment event lasting 60 minutes and carried out under supervised controlled conditions.

Assessment should be conducted under closed-book conditions and as such candidates should not be allowed to bring textbooks, handouts or notes to the assessment.

Assessment Guidelines

Questions used to elicit candidate evidence may take the form of an appropriate balance of short answer, restricted response and structured questions.

The assessment of this Outcome can be combined with Outcomes 1 and 2 to form a single assessment paper, details of which are given under Outcome 3.

Administrative Information

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Version	Description of change	Date
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Higher National Unit specification: support notes

Unit title: Mathematics for Construction

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

This Unit has been written in order to allow candidates to develop knowledge, understanding and skills in the following areas:

1 The application of algebraic techniques to manipulate expressions and solve equations commonly found in construction (10 hours)

Factors, removal of brackets. Linear, Simultaneous, Quadratic equations. Indices and logarithmic functions. Scientific / engineering notation.

Equations: $A = P(1 + r/100)^t$, $ax^2 + bx + c = 0$

Indices: Positive, Negative, Fractional

2 The use of trigonometry and circular measure formula to solve commonly found problems in construction (15 hours)

Trigonometry: Pythagoras, Sine ratio, Cosine ratio, Tangent ratio, Sine rule, Cosine rule.

Circular measure: Arc length, Sector area, Segmental area.

Angular measure: Degrees, minutes, and seconds

3 The drawing of graphs from experimental results and the application of statistics to analyse data (15 hours)

Graphs: Histogram, Ogive, Box plot.

Measure of centre: Mean, Median

Measure of spread: Inter-Quartile range, Standard deviation

Correlation and regression: Line of best fit using least squares

Mathematics for Construction has been incorporated within the first year of the HNDs in Architectural Technology, Building Surveying, Construction Management, Quantity Surveying and Facilities Management and Civil Engineering awards as a mandatory Unit. It is considered that a Unit in Mathematics is essential to support other areas of work in the awards, notably the surveying and structural principles areas.

In designing this Unit the Unit writers have identified the range of subjects they would expect to be covered by lecturers. The writers have also given recommendations as to how much time should be spent on each Outcome. This has been done to help lecturers decide the depth of treatment that should be given to the list of topics attached to each Outcome. Although it is not mandatory for centres to use this list of topics it is strongly recommended that they do so to ensure continuity of teaching and learning across the Mathematics Units and because the exemplar pack for this Unit is based on the knowledge and/or skills and list of topics in each of the Outcomes.

Higher National Unit specification: support notes (cont)

Unit title: Mathematics for Construction

Guidance on the delivery and assessment of this Unit

As the Unit provides core mathematical principles, which underpin many of the studies done in the HND awards, it is recommended that the Unit be delivered towards the start of these awards.

The Unit has been designed to incorporate sufficient time to allow lecturers to teach the core Mathematics contained within the Unit. The Unit has also been written to allow candidates sufficient time to practice what they have learnt through appropriate formative assessments and exercises.

Delivery of the Unit should focus on, and be within the context of commonly encountered problems in the construction industry.

Details on approaches to assessment are given under Evidence Requirements and assessment guidelines under each Outcome in the Unit specification: statement of standards section. It is recommended that these sections be read carefully before proceeding with assessment of candidates.

The content of this Unit is such that it is recommended that if the Unit is assessed by one holistic assessment instrument then assessment takes place at the end of the Unit delivery time.

Opportunities for developing Core Skills

The following grid provides a general guide to opportunities for the development of Core Skills in this Unit. Opportunities for the development of Core Skills at the output level are more fully identified in the Core Skills Signposting Guide.

Core Skill	Outcome 1	Outcome 2	Outcome 3	Outcome 4	Outcome 5
1 Communication					
Reading					
Writing					
Oral					
2 Numeracy					
Using Number	✓	✓	✓		
Using Graphical Information			✓		
3 IT					
Using Information Technology					
4 Problem Solving					
Critical Thinking	✓	✓	✓		
Planning and Organising			✓		
Reviewing and Evaluating	✓	✓	✓		
5 Working with Others					

Higher National Unit specification: support notes (cont)

Unit title: Mathematics for Construction

Open learning

This Unit could be delivered by distance learning, which may incorporate some degree of on-line support. However, with regard to assessment, planning would be required by the centre concerned to ensure the standard and authenticity of candidate evidence. Arrangements would have to be put in place to ensure that assessment whether done at a single or at multiple events was conducted under controlled, supervised conditions.

To keep administrative arrangements to a minimum, it is recommended that a single assessment paper (taken by candidates at a single assessment event) be used for distance learning candidates.

For information on normal open learning arrangements, please refer to the SQA guide *Assessment and Quality of Open and Distance Learning* (SQA 2001).

Candidates with disabilities and/or additional support needs

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. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (www.sqa.org.uk).

General information for candidates

Unit title: Mathematics for Construction

This Unit has been designed to allow you to develop your knowledge, understanding and skills in mathematics that underpin many of the subjects studied in the HND Built Environment and Civil Engineering awards. If you have studied some of these topics before, the early part of the Unit will provide you with an opportunity to revise the techniques you have learned on other courses.

By the end of the Unit you will be expected to apply algebraic techniques to manipulate and solve equations commonly found in construction. You will also be expected to carry out operations using trigonometry and finally you will be expected to analyse graphs of experimental data and use statistical data as an evaluation tool.

Outcome 1 you will be introduced to applying algebraic techniques to manipulate expressions and solve equations commonly found in construction that underpin your later studies

Outcome 2 you will study ways in which trigonometry applied to triangles can be used to solve various problems within the construction industry

Outcome 3 you will learn how to draw and interpret graphs of experimental data and carry out basic statistical calculations.

The precise form of assessment will depend on the centre where you are taking the Unit.