SQA Advanced Unit specification

General information for centres

Unit title: Mathematics for the Built Environment (SCQF level 6)

Unit code: HR4V 46

Superclass:	RB
Publication date:	August 2017
Source:	Scottish Qualifications Authority
Version:	01

Unit purpose

The Unit is designed to enable candidates to understand and apply algebraic techniques to manipulate expressions and solve equations commonly found in construction. The Unit provides candidates with an opportunity to develop the knowledge and skills to carry out operations using algebra, trigonometry, circular measure formulae, central tendency, spread, and determining areas using approximation methods.

Outcomes

On successful completion of the Unit the learner will 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 Use statistical methods to investigate variation of data and use numerical methods to calculate areas under a graph.

Credit points and level

1 SQA Credit at SCQF level 6: (8 SCQF credit points at SCQF level 6)

Recommended entry to the Unit

It would be beneficial if learners had skills in mathematics as evidenced by possession of an appropriate National Certificate Unit, Standard Grade Mathematics 1/2, Intermediate 2 Maths (including Unit 3) A/B, National 5 A/B, or an equivalent level of experience.

Core Skills

Achievement of this Unit gives automatic certification of the following:

Complete Core Skill(s)   None

Core Skill component(s)   Using Number at SCQF level 6

There are also opportunities to develop aspects of Core Skills which are highlighted in the Support Notes for this Unit specification.

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.

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**.

SQA Advanced Unit specification: Statement of standards

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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.

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. Learners 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

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 involving arc lengths and sector/segment areas

Outcome 3

Use statistical methods to investigate variation of data and use numerical methods to calculate areas under a graph.

Knowledge and/or Skills

♦ Measure of central tendency: Mean, Median from a (grouped) frequency table
♦ Measure of spread: Standard deviation from a (grouped) frequency table
♦ Correlation and regression: Line of best fit using least squares
♦ Determination of Areas by use of approximation methods: Simpson's Rule and Trapezoidal Rule.

SQA Advanced Unit Specification

Evidence Requirements for this Unit

Learners will need to provide evidence to demonstrate ALL Knowledge and/or Skills across all Outcomes by showing that they can:

♦ Apply algebraic techniques to manipulate expressions and solve equations commonly found in the construction industry.
♦ Solve problems involving indices and logarithms.
♦ 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.
♦ Determine the mean, median and standard deviation values from data presented in a grouped frequency table.
♦ Calculate correlation coefficient and equation of line of regression and use this to predict results. Built in calculator functionality may be used, if available.
♦ Calculate approximate areas and volumes using Simpson's Rule or Trapezoidal Rule.

Evidence should be produced under closed-book, supervised conditions in response to an appropriate set of questions. And as such learners should not be allowed to bring textbooks, hard and/or soft handouts or notes to the assessment. Learners should be allowed to use the standard functions available on most scientific calculators to calculate mean, standard deviation, correlation coefficients and an equation of line of regression.

Assessment may be carried out:

♦ Outcome by Outcome
♦ Two or more Outcomes together
♦ All Outcomes together — holistic assessment of the Unit

The total time allowed for the assessment(s) should not exceed two hours.

Learners should be given access to calculators. Sufficient working must be shown to demonstrate the method of solution.

Where re-assessment is needed, a different set of questions must be used on each assessment occasion.

Under no circumstances should the learners be notified of the assessment questions prior to the assessment.

SQA Advanced Unit Support Notes

Unit title: Mathematics for the Built Environment (SCQF level 6)

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

Outcome 1

Manipulate mathematical expressions and solve equations (10 hours)

Factors; removal of brackets; linear, simultaneous and quadratic equations; indices and logarithmic functions; scientific/engineering notation.
Equations: $A = P (1 + r/100)^t$, $ax^2 + bx + c = 0$
Indices: Positive, negative, and fractional

Outcome 2

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

Outcome 3

Use statistical methods to investigate variation of data and use numerical methods to calculate areas under a graph (15 hours)

Measure of central tendency: Mean, Median from a (grouped) frequency table
Measure of spread: Standard deviation from a (grouped) frequency table
Correlation and regression: Correlation coefficient, line of best fit equation
Determination of Areas and Volumes: Simpson's Rule and Trapezoidal Rule.

Mathematics for the Built Environment has been incorporated within the first year of the SQA Advanced Diplomas in Architectural Technology, Building Surveying, Construction Management, Quantity Surveying and Facilities Management. 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.

Guidance on approaches to delivery of this Unit

As the Unit provides core mathematical principles, which underpin many of the studies done in the SQA Advanced Diplomas, 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 learners sufficient time to practise 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.

Guidance on approaches to assessment of this Unit

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

Centres are reminded that prior verification of centre-devised assessments would help to ensure that the national standard is being met. Where learners experience a range of assessment methods, this helps them to develop different skills that should be transferable to work or further and higher education.

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

Learners 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.
♦ Solve problems involving indices and logarithms.
♦ 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.
♦ Determine the mean, median and standard deviation values from data presented in a grouped frequency table.
♦ Calculate correlation coefficient and equation of line of regression and use this to predict results. Built in calculator functionality may be used, if available.
♦ Calculate approximate areas and volumes using Simpson's Rule or Trapezoidal Rule.

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

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

In the assessment of this Unit all Outcomes can be combined to form a single assessment paper.

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**.

Opportunities for developing Core and other essential skills

Achievement of this Unit gives automatic certification of *Using Number* at SCQF level 6

This Unit has the Using Number component of Numeracy embedded in it. This means that when candidates achieve the Unit, their Core Skills profile will also be updated to show they have achieved Using Number at SCQF level 6

History of changes to Unit

Version	Description of change	Date

General information for learners

Unit title: Mathematics for the Built Environment (SCQF level 6)

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.

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 SQA Advanced Certificate/Diploma Built Environment 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, statistical analysis and approximations for area.

Outcome 1 — you will be introduced to applying algebraic techniques to manipulate expressions and solve equations commonly found in the built environment.

Outcome 2 — you will study ways in which trigonometry and circular measure formulae can be used to solve commonly found problems in the built environment.

Outcome 3 — you will be using techniques learnt from statistical analysis and approximate areas to solve problems found in construction.

The precise form of assessment will depend on the centre where you are taking the Unit. Achievement of this Unit gives automatic certification of *Using Number* at SCQF level 6.