



National Unit Specification

General information

Unit title: Computer Games: Mathematics (SCQF level 5)

Unit code: HY95 45

Superclass: RB

Publication date: May 2018

Source: Scottish Qualifications Authority

Version: 02

Unit purpose

The purpose of this unit is to allow learners to develop their knowledge and understanding of Mathematics with a view to supporting and underpinning their studies in the area of Computer Games at SCQF level 5.

The unit is designed to develop learners' skills in calculations, algebra and geometry and their applications in an appropriate computing context. The choice of programming language, or other appropriate game development platform, is optional.

This is a **non-specialist** unit intended for learners with some grounding in both Mathematics and a related Computing course. It is particularly suitable for learners who wish to progress to specialised courses in Computer Games in the future.

On completion of this unit, learners will be able to:

- ◆ Implement numerical functions in a suitable environment
- ◆ Use algebra to implement formulae in a suitable environment
- ◆ Use indices within calculations and implemented formulae
- ◆ Implement mathematics relating to position of objects on screen

Learners may progress to HY95 46 *Computer Games: Mathematics* (SCQF level 6).

National Unit Specification: General information (cont)

Unit title: Computer Games: Mathematics (SCQF level 5)

Outcomes

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

- 1 Implement numerical functions in a suitable environment
- 2 Use algebra to implement formulae in a suitable environment
- 3 Implement mathematics relating to position of objects on screen

Credit points and level

1 National Unit credit(s) at SCQF level 5: (6 SCQF credit points at SCQF level 5)

Recommended entry to the unit

No previous knowledge or experience is required. However, it would be beneficial if learners possessed *C747 74 Mathematics* (National 4).

Core Skills

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

Complete Core Skill	None
Core Skill component	Using Number at SCQF level 5

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

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.

National Unit Specification: Statement of standards

Unit title: Computer Games: Mathematics (SCQF level 5)

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 performance criteria 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

Implement numerical functions in a suitable environment.

Performance criteria

- (a) Implement whole numbers and integers
- (b) Implement numerical operators and operator priority
- (c) Use built-in numerical functions and library routines
- (d) Explain the structure of floating point numbers, using the terms mantissa and exponent
- (e) Implement floating point numbers (real numbers)

Outcome 2

Use algebra to implement formulae in a suitable environment.

Performance criteria

- (a) Implement formulae within a computer game or program
- (b) Change the subject of a formula to suit a given scenario or program
- (c) Describe the meaning of indices, powers of a number
- (d) Use indices/powers in relevant calculations within a programming context

Outcome 3

Implement mathematics relating to position of objects on screen.

Performance criteria

- (a) Explain how screen coordinates relate to screen position
- (b) Place objects in given positions on screen
- (c) Describe the scaling of objects
- (d) Scale objects on different screen sizes
- (e) Describe the meaning of 2D vectors and how they are added together
- (f) Implement 2D vectors within a computer game or program

National Unit Specification: Statement of standards (cont)

Unit title: Computer Games: Mathematics (SCQF level 5)

Evidence requirements for this unit

Learners will need to provide evidence to demonstrate the performance criteria across all outcomes. The evidence requirements for this unit will take two forms.

- 1 Knowledge evidence
- 2 Product evidence

The **knowledge evidence** will relate to all three outcomes. Knowledge evidence is required for all performance criteria except those explicitly relating to skills. However, sampling is permissible in certain circumstances (see below).

The **knowledge** evidence may be sampled when testing is used. When testing is used, it must be under supervised conditions and it must be controlled in terms of location and timing. Access to reference material is not permitted.

The **knowledge** evidence is required to demonstrate that the learner can:

- ◆ Use numerical operations, with an understanding of operator priority
- ◆ Use relevant examples to explain floating point notation, mantissa and exponent
- ◆ Change the subject of a formula
- ◆ Describe powers/indices
- ◆ Explain on-screen coordinates
- ◆ Describe the scaling of objects
- ◆ Describe 2D vectors and their addition

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.

The **product evidence** will relate to the computer game(s) created across all three outcomes. It will demonstrate that the learner has been able to contextualise the knowledge and implement it in the context of **at least one** computer game. This evidence may be produced over the life of the unit, under loosely controlled conditions (including access to reference materials). Authentication will be necessary (see below).

The **product** evidence is required to demonstrate that the learner can implement:

- ◆ Whole numbers, integers and real numbers
- ◆ Built-in functions
- ◆ Indices
- ◆ On-screen coordinates and the placing of objects
- ◆ Scaling of objects
- ◆ 2D vectors

The SCQF level (SCQF level 5) of this unit provides additional context on the nature of the required evidence and the associated standards. The SCQF level descriptors (<http://scqf.org.uk/wp-content/uploads/2014/03/SCQF-Level-Descriptors-WEB-Aug-2015.pdf>) should be used (explicitly or implicitly) when making judgements about the evidence.

National Unit Specification: Statement of standards (cont)

Unit title: Computer Games: Mathematics (SCQF level 5)

When evidence is produced in uncontrolled or loosely controlled conditions it must be authenticated. The *Guide to Assessment* provides further advice on methods of authentication (https://www.sqa.org.uk/files_ccc/Guide_To_Assessment.pdf).

The *Guidelines on Approaches to Assessment* (see the support notes section of this specification) provides specific examples of instruments of assessment.



National Unit Support Notes

Unit title: Computer Games: Mathematics (SCQF level 5)

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

Please note that the following guidance, relating to specific outcomes, does not seek to explain each performance criterion, which is left to the professionalism of the teacher. It seeks to clarify the statement of standards where it is potentially ambiguous. It also focuses on non-apparent teaching and learning issues that may be over-looked, or not emphasised, during unit delivery. As such, it is not representative of the relative importance of each outcome or performance criterion.

It is anticipated that learners will plan and implement one or more computer games to demonstrate the range of outcomes and performance criteria. Assessors should ensure that each performance criterion is explicitly demonstrated in the planning and/or implementations.

Outcome 1: Implement numerical functions in a suitable environment.

Learners should, within their game(s) or planning:

- ◆ use integers and real numbers (float)
- ◆ explain the meanings of mantissa and exponent, with relevant examples of floating point numbers
- ◆ use arithmetical operations (+ - / *), demonstrating understanding of priority (BIDMAS)
- ◆ use at least two built-in functions — rounding, square root, integer/truncate, etc

Outcome 2: Use algebra to implement formulae in a suitable environment.

Learners should, within their game(s) or planning:

- ◆ manipulate and change the subject of formulae
- ◆ implement formulae
- ◆ describe powers and indices of numbers
- ◆ use the power operator (^ in some languages) and/or relevant functions

Outcome 3: Implement mathematics relating to position of objects on screen.

Learners should, within their game(s) or planning:

- ◆ explain the use of screen coordinates
- ◆ place objects on screen at specified points
- ◆ describe and implement the scaling of objects
- ◆ describe the meaning of 2D vectors and how they are added together
- ◆ implement 2D vectors within a computer game or program

National Unit Support Notes (cont)

Unit title: Computer Games: Mathematics (SCQF level 5)

Guidance on approaches to delivery of this unit

A variety of different types of information sources should be used in the preparation for and completion of this unit. There are many suitable websites, both related to general mathematics and more specific articles related to Maths in Computer Games, such as Gamasutra or NRICH:

- ◆ https://www.gamasutra.com/view/feature/131605/mathematics_in_videogames.php
- ◆ <https://nrich.maths.org/1374>

A suggested distribution of time for research and planning, across the outcomes, is:

Outcome 1: 10 hours

Outcome 2: 10 hours

Outcome 3: 20 hours

The allocation of time spent on the implementation and testing of one or more computer games demonstrating the range of performance criteria is, by the very nature of the task(s), flexible.

Summative assessment may be carried out at any time. However, when testing is used (see evidence requirements) it is recommended that this is carried out towards the end of the unit (but with sufficient time for remediation and re-assessment). When continuous assessment is used (such as the use of a web log), this could commence early in the life of the unit and be carried out throughout the life of the unit.

There are opportunities to carry out formative assessment at various stages in the unit. For example, formative assessment could be carried out on the completion of each outcome to ensure that learners have grasped the knowledge contained within it. This would provide assessors with an opportunity to diagnose misconceptions, and intervene to remedy them before progressing to the next outcome.

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.

A portfolio approach to assessment should be taken. The portfolio may be paper or electronic (digital). The portfolio should be constructed over the period of the unit, with learners contributing material to the portfolio on an on-going basis. The contents of the portfolio should be clearly labelled and related to specific evidence requirements. The inclusion of specific items in the portfolio should be negotiated between learner and assessor, with only the 'best' example of work stored.

National Unit Support Notes (cont)

Unit title: Computer Games: Mathematics (SCQF level 5)

A more contemporary approach to assessment would involve the use of a web log (blog) to record learning (and the associated activities) throughout the life of the unit. The blog would provide knowledge evidence (in the descriptions and explanations) and product evidence. The blog should be assessed using defined criteria to permit a correct judgement about the quality of the evidence. In this scenario, every performance criterion must be evidenced; sampling would not be appropriate.

Formative assessment could be used to assess learners' knowledge at various stages throughout the life of the unit. An ideal time to gauge their knowledge would be at the end of each outcome. This assessment could be delivered through an item bank of selected response questions, providing diagnostic feedback to learners.

If a blog is used for summative assessment, it would also facilitate formative assessment since learning (including misconceptions) would be apparent from the blog, and intervention could take place to correct misunderstandings on an on-going basis.

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

This unit will provide opportunities for learners to develop Core Skills in Digital Literacy due to the variety of software that they may use. Opportunities are also provided for learners to develop skills in planning, design, testing and evaluation.

Broader skills development in the areas of enterprise, employability, sustainable development and citizenship may also be included depending on the task/scenario selected.

This Unit has the Using Number component of Numeracy embedded in it. This means that when learners achieve the Unit, their Core Skills profile will also be updated to show they have achieved Using Number at SCQF level 5.

History of changes to unit

Version	Description of change	Date
02	Core Skills Component Using Number at SCQF level 5 embedded.	31/05/18

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General information for learners

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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 looks at some of the main concepts of mathematics used in computer games. It looks at:

- ◆ different types of numbers (whole and decimal, positive and negative, powers of numbers)
- ◆ how the computer does arithmetic calculations
- ◆ how equations are used in games and how to switch them around
- ◆ how you work out where things go on screen and the maths of moving them around

You will have to show that you understand the various concepts of maths involved. This can be through reports, planning, or even in a short test. Most of the assessment will be based on you planning and creating one or more computer games to demonstrate your new skills.

When you pass this unit, you could try the SCQF level 6 *Computer Games: Mathematics* unit next, or apply what you know in a National Progression Award in Computer Games Development at SCQF level 5 or 6.

This Unit has the using Number component of Numeracy embedded in it. This means that when you achieve the Unit, your Core Skills profile will also be updated to show you have achieved Using Number at SCQF level 5.