



National Unit Specification

General information

Unit title: Computer Games: Mathematics (SCQF level 6)

Unit code: HY95 46

Superclass: RB

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Unit purpose

The purpose of this unit is to allow learners to develop their knowledge and understanding of the use of Mathematics at SCQF level 6 with a view to supporting and underpinning their studies in the area of Computer Games. The unit is designed to develop learners' skills in a range of mathematical areas. It is primarily intended to demonstrate how mathematics can be applied in appropriate Computing contexts.

This is a **specialist** unit intended for learners with a grounding in both Mathematics and a related Computing course. It is particularly suitable for learners who wish to progress to higher level specialised courses in Computer Games. While not a prerequisite, knowledge of the material contained in the SCQF level 5 unit would be an advantage to learners.

The knowledge covered in this unit includes hexadecimal numbers, Boolean algebra, drawing parabolas and geometric shapes.

Learners may progress to relevant units, such as HR7R 47 *Mathematics for Interactive Computing: Essential Techniques* (SCQF level 7).

Outcomes

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

- 1 Implement complex numerical functions in a suitable environment
- 2 Implement sets of data in a suitable environment
- 3 Use Boolean algebra in a suitable environment
- 4 Use parabolas in a suitable environment
- 5 Implement a range of geometric shapes in a suitable environment

National Unit Specification: General information (cont)

Unit title: Computer Games: Mathematics (SCQF level 6)

Credit points and level

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

Recommended entry to the unit

No previous knowledge or experience is required. However, it would be beneficial if learners possessed HY95 45 *Computer Games: Mathematics* (SCQF level 5) or C847 75 *Mathematics* (National 5).

Core Skills

Opportunities to develop aspects of Core Skills are highlighted in the support notes for this unit specification.

There is no automatic certification of Core Skills or Core Skill components in this unit.

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 6)

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 complex numerical functions in a suitable environment.

Performance criteria

- (a) Explain the structure of binary and hexadecimal numbers
- (b) Convert between decimal, binary and hexadecimal numbers
- (c) Use hexadecimal numbers within a computer game
- (d) Use standard mathematical library functions

Outcome 2

Implement sets of data in a suitable environment.

Performance criteria

- (a) Describe set operations: union, intersection and difference
- (b) Implement sets as data structures
- (c) Implement set operations: union, intersection and difference

Outcome 3

Use Boolean algebra in a suitable environment.

Performance criteria

- (a) Explain the Boolean operations AND, OR, NOT and XOR
- (b) Describe logical inputs and outputs in a truth table
- (c) Explain Boolean identities
- (d) Apply Boolean algebra within a computer game

Outcome 4

Use parabolas in a suitable environment.

Performance criteria

- (a) Describe parabolic functions
- (b) Implement parabolas in a simple computer game

National Unit Specification: Statement of standards (cont)

Unit title: Computer Games: Mathematics (SCQF level 6)

Outcome 5

Implement a range of 2D geometric shapes in a suitable environment.

Performance criteria

- (a) Explain Cartesian and polar co-ordinate systems
- (b) Implement 2D geometrical points and shapes, including line and rectangle
- (c) Explain acute, obtuse, right-angle and reflex angles in a suitable environment
- (d) Implement circles/arcs, including radius, diameter and circumference
- (e) Implement polygons in a suitable environment

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 of the 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:

- ◆ Understand and translate between decimal, binary and hexadecimal numbers
- ◆ Describe sets of data and the operations union, intersection and difference
- ◆ Explain Boolean operations AND, OR, NOT and XOR
- ◆ Use truth tables
- ◆ Use and describe parabolic functions
- ◆ Explain Cartesian and polar co-ordinates
- ◆ Explain acute, right-angle, obtuse and reflex angles

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) produced across all the 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).

National Unit Specification: Statement of standards (cont)

Unit title: Computer Games: Mathematics (SCQF level 6)

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

- ◆ Hexadecimal numbers
- ◆ Sets as data structures
- ◆ Union, intersection, and difference of two data structures
- ◆ Boolean operations AND, OR, NOT
- ◆ Simple parabolas
- ◆ Cartesian and polar co-ordinates
- ◆ Drawing shapes on screen (line, rectangle, circle, arc, polygon)

The SCQF level (SCQF level 6) 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.

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 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

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 complex numerical functions in a suitable environment.

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

- ◆ Explain the structure of binary and hexadecimal numbers
- ◆ Be able to convert between decimal, binary and hexadecimal numbers
- ◆ Use hexadecimal numbers within a computer game
- ◆ Use mathematical library functions (eg, for square root and trigonometry)

Outcome 2: Implement sets of data in a suitable environment.

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

- ◆ Implement sets as data structures
- ◆ Describe and implement set operations: union, intersection and difference

Outcome 3: Use Boolean algebra in a suitable environment.

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

- ◆ Explain and implement the Boolean operations AND, OR, NOT and XOR
- ◆ Describe logical inputs and outputs in a truth table
- ◆ Explain Boolean identities

National Unit Support Notes (cont)

Unit title: Computer Games: Mathematics (SCQF level 6)

Outcome 4: Use parabolas in a suitable environment.

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

- ◆ Describe the mathematics of parabolas
- ◆ Implement parabolas in a simple computer game

Outcome 5: Implement a range of 2D geometric shapes in a suitable environment.

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

- ◆ Explain Cartesian and polar co-ordinate systems
- ◆ Use 2D geometrical points and shapes, including line and rectangle
- ◆ Use angles (eg, acute, obtuse, right-angle and reflex)
- ◆ Use circles/arcs, including radius, diameter and circumference
- ◆ Use polygons

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, across the outcomes, is:

Outcome 1: 5 hours
Outcome 2: 10 hours
Outcome 3: 5 hours
Outcome 4: 10 hours
Outcome 5: 10 hours

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.

National Unit Support Notes (cont)

Unit title: Computer Games: Mathematics (SCQF level 6)

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.

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 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.

National Unit Support Notes (cont)

Unit title: Computer Games: Mathematics (SCQF level 6)

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.

History of changes to unit

Version	Description of change	Date

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General information for learners

Unit title: Computer Games: Mathematics (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.

The unit looks at the most common mathematics topics that are used in computer games. It looks at:

- ◆ Translating between decimal, binary and hexadecimal numbers
- ◆ Describing sets of data and the operations union, intersection and difference
- ◆ Boolean operations AND, OR, NOT and XOR
- ◆ Truth tables
- ◆ Using parabolic functions to draw trajectories of projectiles
- ◆ Using Cartesian and polar co-ordinates
- ◆ Drawing shapes on screen (line, rectangle, circle, arc, polygon)

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 game(s) to demonstrate your new skills.

When you pass this unit, you could apply what you know in a National Progression Award for Computer Games Development at SCQF level 6 or try some of the maths units in the GM09 15 HNC Computer Games Development (SCQF level 7).