

## National Unit Specification: general information

**UNIT** Problem Solving in Mathematics (Access 1)

**CODE** DM57 07

### SUMMARY

This unit is designed principally for candidates to develop a basic understanding of the mathematical methods to solve problems in a supported learning environment. It provides the candidate with the opportunity to:

- become familiar with the appropriate terminology of the different mathematical methods to solve problems
- apply the different mathematical methods to problems based on familiar situations.

### OUTCOME

Solve a given mathematical problem for an everyday situation.

### RECOMMENDED ENTRY

Entry to this unit is at the discretion of the centre and as this is an introductory unit, no prior knowledge or experience is required.

### CREDIT VALUE

1 credit at Access 1 (6 SCQF credit points at SCQF level 1\*)

*\*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.*

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### Administrative Information

**Superclass:** HD

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## **National Unit Specification: statement of standards**

### **UNIT**      Problem Solving in Mathematics (Access 1)

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 the Scottish Qualifications Authority.

#### **OUTCOME**

Solve a given mathematical problem for an everyday situation.

#### **Performance Criteria**

- a) Choose the correct method from a choice of two methods to solve a given mathematical problem.
- b) Use the correct method to solve the problem effectively.

#### **EVIDENCE REQUIREMENTS FOR THIS UNIT**

Written and/or oral and/or performance evidence to show that the candidate can:

on one occasion, select an appropriate method from a choice of 2 in order to solve a problem.

on one occasion, successfully use a chosen method to solve the problem.

## National Unit Specification: support notes

### UNIT      Problem Solving in Mathematics (Access 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**

This unit will help candidates to begin to understand the terminology, skills, and methods used for problem solving at a very basic level. The emphasis of the unit is on the methods and the development of the understanding of their use in solving problems.

This unit has been written so that it may be taught as a freestanding Access 1 Independent Unit. However, the unit may be integrated with other Access 1 level units as the unit may be used in the context of any of these or indeed in relation to any other area that is relevant to the candidate, eg football.

A candidate who successfully completes this unit may progress to one or more of the Access 1 Mathematics units:

*DM58 07 Recognising Number*

*DM59 07 Using Mathematics to Handle Information*

*DM53 07 Investigating Measurement*

*DM54 07 Investigating Length in Familiar Situations*

*DM55 07 Investigating Weight in Familiar Situations*

*DM56 07 Investigating Volume in Familiar Situations*

*D9EV 07 Recognising Time*

*D9ET 07 Handling Money*

or to the Derived Access 1 Units:

*D3K0 07 Using Mathematics in Everyday situations 1 – Time*

*D3K1 07 Using Mathematics in Everyday situations 1 – Money*

*D3K2 07 Using Mathematics in Everyday situations 1 – Measure*

For further information on progression please see Appendix 1.

## National Unit Specification: support notes (cont)

### UNIT          Problem Solving in Mathematics (Access 1)

Centres may choose the context in which the unit may be taught depending on the programme of learning being undertaken by the candidates.

Appendix 2 is an outline of the three methods that could be chosen to provide enough breadth to the course.

#### **GUIDANCE ON LEARNING AND TEACHING APPROACHES FOR THIS UNIT**

Candidates should have the opportunity to work individually, in pairs or in a small group.

There are two separate areas of problem solving in Maths. These are the skills of problem solving and the mathematical methods to solve problems.

The skills of problem solving are:

- Critical thinking
- Planning
- Organising
- Reviewing
- Evaluating
- Reporting

These skills are not explicitly covered in this unit, but are necessary in order for the candidate to solve the problems, and to implement the chosen methods. At present these skills are covered in the PSE programmes for Access 1, without being outlined in a specific unit, eg in the Access 1 Derived units for Making Local Journeys — Planning Local Journeys (Access 1) the candidate has to plan two local journeys, while in the Making local Journeys — Reviewing (Access 1), the candidate has to review his/her progress and identify further development needs.

The methods used for solving problems are:

- Acting it out/concrete manipulation
- Drawing/using a picture/diagram/map or making/using a model
- Looking for a pattern
- Making a conjecture and testing it
- Guessing, checking and improving
- Organising lists/tables
- Working backwards
- Reasoning logically
- Trying simpler case
- Finding all answers

The above methods are the focus of the unit and give an indication of the range in the complexity of the methods, although the list above is neither in order of difficulty nor exhaustive. The teacher/lecturer will be able to select the most appropriate methods for their candidates. The exact phrasing and language used to identify the methods is not universal, and teachers/lecturers should use what is appropriate for their candidates. The first three methods given in the list are possibly the most straightforward for candidates to undertake.

## **National Unit Specification: support notes (cont)**

### **UNIT      Problem Solving in Mathematics (Access 1)**

The content of the problem solving tasks should be very familiar to the candidate and should facilitate the learning of the specific chosen methods. This is particularly important when the candidate is being assessed, as the content and context of the problem should not be a barrier to the candidate achieving the unit. A wide range of contexts should be used when working on a particular method.

Different tools such as an Interactive Smart Board, or video/audio equipment may be used to facilitate the learning. A wide range of computer software could also be used, eg programmes such as Boardmaker, or Bulletpoint.

There will possibly be some overlap between the methods used. However, candidates should be made aware of the differences between each method in a problem solving task. Candidates may be made aware that a problem may be solved using more than one method. However, while undertaking the task the candidate should know the method to be implemented and the method to be applied to solve the problem.

This unit involves candidates in practical experiential tasks and it is essential that teachers/lecturers keep log books in a suitable form, to record proceedings and collect evidence. The log book could include video/photographic records, computer files, and written/audio recordings. (See Appendix 3 Sample Log for a teacher/lecturer and Appendix 4 for a completed log). These logs could also be used to record evidence for the assessment.

#### **GUIDANCE ON APPROACHES TO ASSESSMENT FOR THIS UNIT**

Teachers/lecturers should provide adequate opportunities for formative assessment to take place, prior to the candidates undertaking the required unit assessment, which is recorded for assessment purposes. Teachers/lecturers may give the candidate advice and support during formative assessment in order to prepare them for the formal unit assessment.

Teachers/lecturers can use various means of recoding evidence for the assessment, for example observational checklists, written/audio recordings, video/photographic evidence or oral responses recorded by a responsible adult

#### **Where to find information about Problem Solving**

In schools there may already be materials which could be adapted to meet the needs of the candidates which would allow them to get credit for their learning. Some sample problems are included in Appendix 5, but these will need to be adapted by teachers/lecturers for their own programmes of learning.

## **National Unit Specification: support notes (cont)**

### **UNIT**      Problem Solving in Mathematics (Access 1)

Records of all assessment instruments used and evidence produced by each candidate should be retained for moderation purposes. As candidate evidence may be generated by written and/or oral and/or performance evidence for this unit, records should be kept of candidate performance. These could be in the form of checklists completed by a responsible person observing the performance or recording the answers to questions, or they may also be in the form of video or audio recordings of candidate performance. All checklists must be signed and dated by the teacher/lecturer who assesses the evidence and authenticates the record as an accurate record of the work of the named candidate.

#### **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 document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* (SQA, 2004).

Curriculum Descriptors (not certificated)	<p>Curriculum Descriptors provide a framework for describing the learning process for candidates for whom an Access 1 unit is not appropriate. They use performance criteria from Access 1 units as <i>Learning Targets</i>. Progress within the Curriculum Descriptor framework may be recorded by means of Progress File or by a centre's own systems for recording achievement. Curriculum Descriptors belong to Learning and Teaching Scotland and are not certificated by SQA.</p> <p>Some candidates may progress from Curriculum Descriptors to free-standing Access 1 units.</p>
Independent Access 1 units	<p>Independent Access 1 units are designed principally for candidates who are developing basic skills in a supported learning environment. Candidates are not required to have completed any other units prior to undertaking these units. Independent Access 1 units are not derived from the outcomes of Access 2 units. They may provide progression from Curriculum Descriptors for some candidates or be delivered within an integrated programme comprising a mixture of units and Curriculum Descriptors according to the needs of the candidate. On completion of an independent Access 1 unit, candidates may progress to other independent units at Access 1, such as:</p> <p>D9ER 07    Sampling Work: An Introduction  D9EV 07    Recognising Time  D9EW 07    Basic Communication in a Familiar Setting  D9EX 07    Using Basic Computer Skills  D9EY 07    Personal Profiling: An Introduction  D9F0 07    Working with Others on a Group Activity</p> <p>Alternatively, progression may be to Access 1 units which are derived from Access 2 outcomes or to Access 2 units.</p>
Access 1 units derived from Access 2 outcomes	<p>These Access 1 units are based on outcomes of Access 2 units. This allows candidates to build up to an Access 2 unit in a step by step approach as they achieve the appropriate component outcomes. Access 1 units derived from Access 2 outcomes may be a starting point for some candidates or may provide progression from the above independent Access 1 units.</p>
Access 2 units	<p>Access 2 units enable progression from Access 1 units although for some candidates, they may be a starting point. Candidates who have achieved an Access 2 unit may progress to other Access 2 units or to Access 3 units. They may also progress laterally to a Scottish Group Award at Access 2 (single, double or triple) or to the more vocational Skillstart Group Award at Access 2.</p>

## **Planned outline for 3 Methods (based on a 40 hour unit)**

## **Appendix 2**

For each type of method (11 hours each)

Mixed choice and practice assessment (9 hours)

### **Choice of methods:**

Acting it out/concrete manipulation

Drawing/using a picture/diagram/map or making/using a model

Looking for a pattern

**Aims:** To provide the candidate with the opportunity to:

- become familiar with the appropriate terminology of the different mathematical methods to solve problems
- apply the different mathematical methods to problems based on familiar situations
- build their confidence in tackling problems.

**Objectives:** The candidate will be able to:

- choose the correct method to solve a given mathematical problem from a choice of two methods
- use the correct method to solve the problem effectively.

### **For each method:**

- Introduction of language/terminology alongside the teacher modelling the method
- Very simple problems working in whole class/groups, with a high level of teacher support
- Slightly harder problems in a variety of group settings, with less teacher support
- Simple problems with little teacher support
- Harder problems with little teacher support
- Mixed problems with no teacher support
- Games/puzzles interspersed at the different stages of difficulty
- At all times candidates should be encouraged to use the correct language, and to identify what they are doing. All the problems within each method should match the method.

### **For mixed choice and practice:**

- Simple problems with teacher support to remind candidates of previously learned methods. Special attention should be given to language and to talking about the differences between the problems. No choice is being made by the candidates at this stage.
- Simple mixed problems which involves some teacher support in making the choice, but does not involve teacher support in the application. Please note that the choice is from 2 given methods
- Simple mixed problems which involve no support from teacher in either the choice of method or in application. Please note that the choice is from two given methods.
- Harder mixed problems with no teacher support in either choice or application
- Practice assessment type problems with feedback.
- Assessment.

### Possible Assessments for Plan

Please note that although there are 5 possible assessments outlined here, only one task would have to be undertaken for the formal assessment. These are only suggestions.

**Assessment 1)** Simple timetable problem.

Train 1 leaves at 1:00 p.m.

Train 2 leaves at 2:00 p.m.

Train 3 leaves at 3:00 p.m.

What time will train 4 leave? Response through the usual means of communication.

Possible Method choices.

Look for a pattern. ✓

Act it out.

**Assessment 2)** Complete the pattern

No materials given for this, just the illustration, and pencil, or computer illustrations and possible images to drag and drop. Response can be given through normal means of communication.



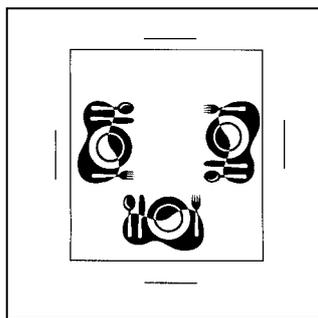
What will come next?

Possible Method choices.

Look for a pattern

Act it out

**Assessment 3)** Setting the table.



Possible method choices.

Photograph of place setting for 4 people with a space for the 4<sup>th</sup>. No plates etc. the candidate has to draw, mark in or if on the computer, drag in the correct images.

What will go in the space?

Response through the usual means of communication.

Look for a pattern. ✓

Act it out.

**Assessment 4)** Plan/map of the school (class).

Plan/map of the class or school. Pictures could be used to identify locations, eg picture of the door of the Maths room.

How do you get from the door of the classroom to your desk?

Or

Can you mark the route, making sure you can collect your pencil and folder on the way?

Or

Can you get to your desk without passing the computer?

Response through the usual means of communication.

Possible method choices.

Look for a pattern

Draw/Use a picture/map/diagram ✓

Date: \_\_\_\_\_

Candidate: \_\_\_\_\_

**Problem**

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**Materials needed:**

**Choice of problem solving method (if appropriate)**

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**What should the candidate consider for this method?**

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**How did the candidate solve the problem using this method?**

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**Additional comments:**

Teacher/Lecturer: \_\_\_\_\_

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

Date: 2/10/05

Candidate: P.Gloss

**Problem:**

Make a pair of earrings to match this necklace, using these beads.

**Materials needed**

Selection of beads, not only those used to make the necklace.  
Necklace already made using beads constructed in a simple pattern of 1 blue, 1 white, 1 pink (repeating).

**Choice of Problem solving method (if appropriate)**

P. Gloss is not ready yet to make choices about the type of method to use. P. Gloss was given the method of “look for a pattern”.

**What should the candidate consider for this method?**

Candidates should consider the colours, type of bead used in the necklace and should try to match the pattern. Only the colours used in the necklace should be used by the candidate.

**How did the candidate solve the problem using this method?**

P. Gloss picked up the necklace and examined it. P. Gloss sorted out pink, white and blue beads and proceeded to make two earrings, the first using one blue and one white bead, the other one pink and one white bead. When I clarified they had to match exactly, P.Gloss, made the necessary changes to meet the criterion.

**Additional comments:**

P. Gloss solved the problem, but not in the way I expected, in the first attempt. P.Gloss identified the colours being used, and did a variation of the pattern on the necklace by separating out the pattern. In this case, the problem could have been more explicit, in saying the pattern had to be the same or match exactly, or if a bracelet was to be made instead of earrings.

Teacher/Lecturer: \_\_\_\_\_

Signed: \_\_\_\_\_

Date: \_\_\_\_\_

These problems may need to be adapted to suit the needs of individual candidates. Many of these problems may already be used in centres. This list is to provide possible scenarios for problem solving. These are general problems which have not been sorted into method type.

- Comparisons/contrasts: tallest/shortest, heaviest/lightest, dark/light, up/down, sweet/sour
- Arrange 4 people (2 boys, 2 girls) so that (a) the girls are not next to each other; (b) the boys are not next to each other or (c) Show the other ways that you can arrange the people?
- Make a life size model out of the given materials. The model should be able to stand by itself. (sugar paper, tape and scissors)
- Wrap this present or choose the most suitable wrapping for this present
- Make up a game using playing cards
- Pack a case for going away for a few days, away for a week
- Make a bed
- Sort out the cutlery drawer
- Sort the clothes into piles for washing/put them into the machine
- Cards and envelopes all mixed up. Pair each card with an envelope that fits
- Lay out the clothes in the order you have to put them on
- Make a shopping list using pictures/drawings/symbols for (a) your favourite things; (b) making breakfast, or (c) going on holiday
- Make a sign to tell someone else to do something in maths. You cannot use words
- These are the bed covers and pillow cases you have. What combinations can you have?
- Within the class context, find as many ways as you can to get from your desk to the door
- Share out this chocolate with a friend so that you both get the same amount. (1 by 2 bar, or more complex with 2 by 2 or 2 by 4 bars). Same problem but with individual sweets not a bar
- Design as many flags (t-shirts) as you can using 2 (or 3) colours. (Use different flag designs as a template, broken into more than 2 pieces, e.g. 4 long strips, diagonal cross shape)
- Make a necklace/bracelet using these beads, to match this pair of earrings (or the other way around). Or keep the pattern going on this necklace to finish it
- Follow the instructions on the card to make a milk shake
- Make a maze in the classroom, blindfold a friend and lead him/her through the maze, by guiding him/her or by using only instructions
- Put this shoe stand together by using the pictures
- Make instructions for someone else to follow to make your favourite sandwich.