Mathematics (National 5)

Draft Course and Unit Support Notes

For general advice and guidance on the Course.

This edition: January 2012, draft version 1.0

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Contents

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the Mathematics (National 5) Course. They are intended for teachers and lecturers who are delivering the Course and its Units. They should be read in conjunction with the *Course Specification*, the *Course Assessment Specification* and the Unit Specifications for the Units in the Course.

General guidance on the Course

Aims

Mathematics is important in everyday life, allowing us to make sense of the world around us and to manage our lives.

Using mathematics enables us to model real-life situations and make connections and informed predictions. It equips us with the skills we need to interpret and analyse information, simplify and solve problems, assess risk and make informed decisions.

The Course aims to:

- motivate and challenge learners by enabling them to select and apply mathematical techniques in a variety of mathematical and real-life situations
- develop confidence in the subject and a positive attitude towards further study in mathematics
- develop skills in manipulation of abstract terms in order to solve problems and to generalise
- allow learners to interpret, communicate and manage information in mathematical form, skills which are vital to scientific and technological research and development
- develop the learner's skills in using mathematical language and to explore mathematical ideas
- develop skills relevant to learning, life and work in an engaging and enjoyable way

Progression into this Course

Entry to this Course is at the discretion of the Centre. However, learners would normally be expected to have attained the skills and knowledge required by one or more of the following or by equivalent qualifications and/or experience:

- Mathematics (National 4) Course
- Lifeskills Mathematics (National 4) Course with significant bridging of skills, knowledge and understanding in the areas of expressions, formulae and relationships
- Lifeskills Mathematics (National 5) Course with some bridging of skills, knowledge and understanding in the areas of expressions, formulae and relationships

In terms of prior learning and experience, the Mathematics principles and practices experiences and outcomes at Fourth level may also provide an appropriate basis for entry to this Course.

It should be noted that, although these experiences and outcomes provide a general background which is relevant to this Course, there is no direct match between the experiences and outcomes and the requirements of this Course.

Centres wishing to establish the suitability of learners without prior qualifications and/or experiences and outcomes may benefit from carrying out a review of prior

life and work experiences. This approach may be particularly suitable for adult returners to education.

Experiences and outcomes
New National Courses have been designed to draw on and build on the curriculum experiences and outcomes as appropriate. Qualifications developed for the senior phase of secondary education are benchmarked against SCQF levels. SCQF level 4 and the curriculum level 4 are broadly equivalent in terms of level of demand although qualifications at SCQF level 4 will be more specific to allow for more specialist study of subjects.

Learners who have completed Curriculum for Excellence experiences and outcomes will find these an appropriate basis for doing the Course.

Skills, knowledge and understanding covered in the Course

This section provides further advice and guidance about skills, knowledge and understanding that could be included in the Course.

Note: teachers and lecturers should refer to the *Course Assessment Specification* for mandatory information about the skills, knowledge and understanding to be covered in this Course.

Throughout this Course there are opportunities to build on the Fourth level Numeracy experiences and outcomes.

The following table provides further advice and guidance about skills, knowledge and understanding within the Course.

The first column gives links to the skills contained within the Units.

The second column is the mandatory skills, knowledge and understanding given in the *Course Assessment Specification*. This includes a description of the Unit standard and the added value for Course assessment. In the list below, skills which confirm that learners can meet the minimum competence of the Assessment Standards for the Units are indicated by a round bullet point. Those skills marked by an arrow bullet point are beyond minimum competence for the Units but are part of the added value for the Course assessment.

The third column gives suggested learning and teaching contexts to exemplify possible approaches to learning and teaching. These provide examples of where the different skills could be used in individual activities or pieces of work.

Mathematics (National 5) Expressions and Formulae (EF)		
Standard	**Description of Unit Standard and Added Value**	**Learning and Teaching Contexts**
Numerical Skills (N) ***The learner will be able to use these numerical skills and apply them in context***		
1.1 Working with surds	• Simplification ➢ Rationalising denominators	Explore the properties of square roots. Exact values are an important method of communication in maths science and technology.
1.2 Simplifying expressions using the laws of indices	• Multiplication and division using positive and negative indices including fractions • Calculations using scientific notation ➢ Simplification of nested indices	Introduce notation and why it is written that way eg ms^{-1} Emphasise the relationship between fractional indices and surds. Use examples of scientific notation within science and technology.
1.3 Rounding to a given number of significant figures		Consider effects of rounding and using rounding appropriately. Investigate contexts for different levels of accuracy and precision. Link to Outcome 3 (Calculations of lengths, areas and volumes). Consider the effect of rounding an angle after calculating it using trigonometry. There is a precision limitation if it is rounded to the nearest degree especially as distance increases. Use examples from science, technology and finance.

Algebraic Skills (A) ***The learner will be able to use these algebraic skills and apply them in context***		
2.1 Working with algebraic expressions involving brackets	• a(bx+c) +d(ex +f) • (ax+b)(cx+d) • ax(bx+c) ➢ $(ax+b)(cx^2+dx+e)$ where a,b,c,d,e,f are integers	Make connection with geometrical representations. Emphasise systematic approach to expansion of brackets.
2.2 Factorising an algebraic expression	• Common factor • Difference of squares x^2-a^2 ➢ px^2-q^2 ➢ Common factor with difference of squares • Trinomials with unitary x^2 coefficient ➢ Trinomials with non-unitary x^2 coefficient	Explore algebraic and numerical uses of difference of squares. Use practical examples including calculation of areas. Emphasise that this is the inverse process to expanding brackets.
2.3 Completing the square in a quadratic expression with unitary x^2 coefficient		Connect features of graphs to equations of quadratic functions.
2.4 Reducing an algebraic fraction to its simplest form	• a/b where a,b are of the form $(x+p)^n$ or (x+p)(x+q)	Link to factorisation.

2.5 Applying the four operations to algebraic fractions	• a/b *c/d where a,b,c,d can be simple constants or variables. *can be add, subtract, multiply or divide	Net resistance from two resistors in parallel: convert $1/R = 1/R_1 + 1/R_2$ to $R = (R_1 + R_2) / (R_1R_2)$
Geometric Skills (G) ***The learner will be able to use these geometric skills and apply them in context***		
3.1 Determining the gradient of a straight line, given two points	• $m=\frac{y_2-y_1}{x_2-x_1}$	Deduce the formula from coordinate diagram. Link to equation of a straight line and line of best fit. Use context such as rates of change, steepness of slope. Discuss zero gradients and undefined gradients.
3.2 Working with the length of arc or the area of a sector of a circle		Deduce formulae from practical approach emphasising fractions. Opportunities to use examples from designing, manufacturing and decorating.
3.3 Working with the volume of a standard solid	• sphere, cone, pyramid	Use practical and investigative approaches to confirm formulae. Use combinations of solids including prisms. Opportunities to use examples from designing, manufacturing and packaging.
Reasoning Skills ***The learner will be able to use mathematical reasoning skills (these Assessment Standards can be used in combination or separately)***		
4.1 Interpreting a situation where mathematics can be used and identifying a strategy	Can be attached to any Assessment Standard in the other outcomes to require analysis of a situation	This should be a mathematical or real life context problem in which some analysis is required. The learner should be required to choose an appropriate strategy and employ mathematics to the situation. Examples of context: home economics, health and wellbeing, finance (inflation and interest rates), science (energy consumption in the home or car), technology (manufacturing), modern studies (population, statistics)

4.2 Explaining a solution and relating it to context	Can be attached to any other Assessment Standard to require explanation of the solution given	The learner should be required to give meaning to the determined solution in everyday language.

Mathematics (National 5) Relationships (Rel)		
Standard	**Description of Unit Standard and Added Value**	**Learning and Teaching Contexts**
Algebraic (Linear) Skills(A) ***The learner will be able to use the algebraic skills relating to linear relationships and apply them in context***		
1.1 Determining the equation of a straight line	• Use the formula $y - b = m(x - a)$ or equivalent to find the equation of a straight line, given two points or one point and the gradient of the line. • Identify gradient and y-intercept values from various forms of the equation of a straight line. • Use functional notation.	Use of graphing packages to investigate the equation of a straight line including parallel lines and lines with zero and undefined gradients is encouraged. Use a variety of contexts such as science, finance, commerce, experimental data, population statistics, life expectancy. Discuss importance of functional notation as an alternative mathematical language to Leibnitz notation.
1.2 Working with linear equations and inequations	• Coefficients are a member of Z • Solutions are a member of Q	Real life limitations should be considered for inequations, eg max safe load for a concrete beam of given cross section area
1.3 Working with simultaneous equations	• Construct from text • Graphical solution • Algebraic solution	Investigate real life situations such as hiring a car, mobile phone charges, health and fitness. Intersection of paths of moving objects described by equations. Use of graphing packages is encouraged to enable more complex realistic contexts to be investigated.

1.4 Changing the subject of a formula	• Linear equation ➢ Equation involving a simple square or square root	Contexts using formulae from science, technology, health and wellbeing and finance. $s = ut + ½at^2$ E= ½mv2

Algebraic (Quadratic) Skills (A) ***The learner will be able to use the algebraic skills relating to quadratic relationships and apply them in context***		
2.1 Recognise and determine the equations of quadratics from their graphs	• Equations of the form $y = kx^2$ and $y = (x + p)^2 + q$; p, q, k ∈ Z	Use of graphics software may be beneficial
2.2 Sketching a quadratic function	• Equations of the form $y = (x - d)(x - e)$ and $y = (x + p)^2 + q$	Graphing packages can be used to investigate the graphs of quadratic functions including zooming in on non-integer solutions of roots.
2.3 Identifying features of a quadratic function	• Identify nature, coordinates of turning point and the equation of the axis of symmetry of quadratic of the form $y = k(x + p)^2 + q$ where k = 1 or -1; and know the meaning of the term 'roots of a quadratic equation'	Examples of quadratic functions should include real life contexts such as projectile motion.
2.4 Working with quadratic equations	• Factorising • Graphically • Quadratic formula	Emphasis should be made on the connection between these four aspects of quadratic equations.

	• Discriminant	
Geometric Skills (G) ***The learner will be able to use these geometric skills and apply them in context***		
3.1 Applying the Theorem of Pythagoras	• Using Theorem of Pythagoras in complex situations including converse and 3D	Link to three-dimensional co-ordinates. Contexts such as construction, engineering, home improvement, graphic design can be used. Distance between two points on a coordinate diagram.
3.2 Applying the properties of shapes	• Quadrilaterals/triangles/polygons/circles ➢ Relationship between the centre, chord and perpendicular bisector	Use of geometry software packages may be beneficial.
3.3 Using similarity	• Interrelationship of scale — length, area and volume	Link to surds and indices (eg volume to length or length to volume). Important to develop confidence in handling the closely related ideas of similarity, proportion and ratio. Many example areas, dilutions and reactions in chemistry, recipe scaling, power supply, but here the emphasis is on geometric cases, scale plans and engineering diagrams; angles stay the same, distances scale in simple proportion, areas in square proportion, volumes in cubic proportion. Real life contexts and problem solving approaches such as cost in proportion to volume could be used.

Trigonometry Skills(Trig) ***The learner will be able to use these trigonometric skills and apply them in context***		
4.1 Working with the graphs of trigonometric functions	• Basic curves • Scaling amplitude • Vertical translation • Multiple angle ➢ Phase angle	Use of graphing software packages is encouraged where possible. Real life contexts should be used including applications in wave theory. Introduce the CAST diagram linked to graphs as a possible method to find further solutions trig equations. Use the graphs of sine/cosine to increase understanding and using symmetry in these graphs to find further solutions. Consider including software displays involving addition (superposition/interference) of two waves (eg same wavelength, different phase or same phase at origin, slightly different wavelengths).
4.2 Working with trigonometric relationships in degrees	• Sine, cosine and tangent of angles 0-360^o • Period • Related angles • Solving basic equations ➢ Identities $\cos^2x + \sin^2x = 1$, tanx=sinx/cosx	
Reasoning Skills ***The learner will be able to use mathematical reasoning skills (these Assessment Standards can be used in combination or separately).***		
4.1 Interpreting a situation where mathematics can be used and identifying a strategy	Can be attached to any Assessment Standard in the other outcomes to require analysis of a situation.	This should be a mathematical or real life context problem in which some analysis is required. The learner should be required to choose an appropriate strategy and employ mathematics to the situation.

4.2 Explaining a solution and relating it to context	Can be attached to any other Assessment Standard to require explanation of the solution given.	The learner should be required to give meaning to the determined solution in everyday language.

Mathematics (National 5) Applications (App)		
Standard	**Description of Unit Standard and Added Value**	**Learning and Teaching Contexts**
Trigonometric Skills (Trig) ***The learner will be able to use the trigonometric skills relating to linear relationships and apply them in context***		
1.1 Calculating the area of a triangle using trigonometry	A=½ absinC	Real life contexts should be used such as in navigation and manufacturing.
1.2 Using the sine and cosine rules in a triangle	• Sine rule for side or angle • Cosine rule for side ➢ Cosine rule for angle	
1.3 Using bearings with trigonometry	To find a distance or direction	
Geometric Skills (G) ***The learner will be able to use the geometric skills relating to quadratic relationships and apply them in context***		
2.1 Working with 2D vectors	Adding or subtracting two-dimensional vectors using directed line segments	Real life contexts should be used such as: forces in the tethers of a mast

2.2 Working with 3D co-ordinates	Interpreting three-dimensional coordinates or directed line segments which are given in diagrams. Using skeleton diagrams.	crossing a stream in a boat collision of two snooker balls
2.3 Using vector components	Adding or subtracting two- or three-dimensional vectors using components.	
Numerical Skills (N) ***The learner will be able to use these numerical skills and apply them in context***		
3.1 Working with percentages	• Use reverse percentages to calculate an original quantity • Appreciation including compound interest • Depreciation	Use contexts such as finance, modern studies, demographics, science and technology. Health and wellbeing data such as BMI.
3.2 Working with fractions	Operations and combinations of operations of vulgar fractions including mixed numbers.	Links to probability, percentages and indices Use contexts in geometric problems such as fraction of a circle, volume of a cone. Use in finance, science and technology.
Statistical Skills (Stat) ***The learner will be able to use these statistical skills and apply them in context***		
4.1 Comparing data sets using statistics	Compare data sets using calculated/determined: • quartiles and interquartile range • standard deviation	Use a variety of contexts such as those drawn from science, health and wellbeing, environmental studies, geography, modern studies, economics, current affairs, factory production, failure in use data for automotive components, quality assurance, medical statistics, crime rates, government statistical data (food data/climate data/class data).

4.2 Forming a linear model from a given set of data	Determine the equation of a best-fitting straight line on a scattergraph and use it to estimate a y given x	Have a supply of examples of real experimental data where a linear model is approximately valid but the data has limited precision.
Reasoning Skills ***The learner will be able to use mathematical reasoning skills (these Assessment Standards can be used in combination or separately).***		
4.1 Interpreting a situation where mathematics can be used and identifying a strategy	Can be attached to any Assessment Standard in the other Outcomes to require analysis of a situation	This should be a mathematical or real life context problem in which some analysis is required. The learner should be required to choose an appropriate strategy and employ mathematics to the situation.
4.2 Explaining a solution and relating it to context	Can be attached to any other Assessment Standard to require explanation of the solution given	The learner should be required to give meaning to the determined solution in everyday language.

(Additional examples will be incorporated in future publications of this document.)

The following mathematical skills are developed in each of the Course Units. An overview of the Units in which they are developed is shown in the table below:

Mathematical skills	Expressions and Formulae	Relationships	Applications
Use algebraic skills	✓	✓	
Use geometric skills	✓	✓	✓
Use trigonometric skills		✓	✓
Use statistical techniques			✓
Use numerical skills	✓	✓	✓
Interpret a situation which requires the use of mathematics and select an appropriate strategy	✓	✓	✓
Explain a solution and relate it to context	✓	✓	✓

Teachers and lecturers should refer to the *Course Assessment Specification* for mandatory information about the skills, knowledge and understanding to be covered in this Course.

Progression from this Course

This Course or its components may provide progression to:

- Higher Mathematics
- further study or training
- employment

Hierarchies

Hierarchy is the term used to describe Courses and Units which form a structured sequence involving two or more SCQF levels.

It is important that any content in a Course and/or Unit at one particular SCQF level is not repeated if a learner progresses to the next level of the hierarchy. The skills and knowledge should be able to be applied to new content and contexts to enrich the learning experience. This is for centres to manage.

The Mathematics (National 5) Course is in a hierarchy with the Mathematics (National 4) Course and the Higher Mathematics Course.

Mathematics (National 4)	**Mathematics (National 5)**	**Higher Mathematics**
Expressions and Formulae	Expressions and Formulae	Expressions and Functions
Relationships	Relationships	Relationships and Calculus
*Numeracy	*Applications	Applications
Added Value Unit	Course assessment	Course assessment

This hierarchical structure aims to provide a mechanism for fall-back and to enable learners to be given recognition for their best achievement. Achievement of the component Units at National 5 but not the Course assessment would provide the potential for fall-back to Mathematics at National 4.

*The *Applications* Unit at SCQF level 5 by itself does not cover all the skills necessary to achieve the *Numeracy* Unit at National 4. Evidence of all the skills associated with Outcome 2 of the *Numeracy* Unit at SCQF level 4 is not covered by this, or the combination of all Units, in Mathematics at National 5. There are a number of ways of generating this evidence. SQA will provide further guidance on these additional Evidence Requirements for *Numeracy* Units at SCQF levels 4 and 5 which will clarify the situation where they are being used in conjunction with the Mathematics Courses at National 4 and National 5. SQA Co-ordinators should be able to provide advice on combinations of Units necessary to achieve the Mathematics Course at National 4.

The fall-back from Higher to National 5 does not require evidence of specific skills associated with the *Numeracy* Units. Achievement of the component Units at Higher, without achievement of the Course assessment, would provide the potential for fall-back to Mathematics at National 5. The learner would only need to complete the Course assessment at National 5 to be given credit for the National 5 Course.

Approaches to learning and teaching

The purpose of this section is to provide general advice and guidance on approaches to learning and teaching across the Course.

The overall aim of the Course is to develop a range of mathematical operational and reasoning skills that can be used to solve mathematical and real-life problems. Approaches to learning and teaching should be engaging with opportunities for personalisation and choice built in where possible.

A rich and supportive learning environment should be provided to enable a learner to achieve the best they can. This could include learning and teaching approaches such as:

- investigative or project-based tasks such as investigating the graphs of quadratic functions, perhaps using calculators or other technologies
- a mix of collaborative and independent tasks which engage learners, for example by encouraging learners to identify gradient and y-intercept values from various forms of the equation of a straight line
- using materials available from service providers and authorities eg working with real-life plans and drawings, use trigonometric skills to calculate line lengths and angle sizes
- problem solving and critical thinking
- explaining thinking and presenting strategies and solutions to others eg in groups, learners work with the former Standard Grade investigation 'display boxes' to solve the problem(s) using simultaneous equations, making a group poster or other form of presentation to share their strategies with others
- effective use of questioning and discussion to engage more learners in explaining their thinking and on testing quickly their understanding of fundamental concepts
- making links across the curriculum to encourage transferability of skills, knowledge and understanding such as technology, social subjects and health and wellbeing eg liaison with physics to connect applications of appropriate formulae eg f=ma, v= u +at, s=ut +1/2 at2 and shared understanding of approaches to changing the subject
- using technology where appropriate and to extend experience and confidence eg use of advanced calculators to investigate a range of appropriate types of graphs, in particular to investigate the effects of change of variables

The development of mathematical skills is an active and productive process building on learner's current knowledge, understanding and capabilities. Existing knowledge should form the starting point for any learning and teaching situation with new knowledge being linked to existing knowledge and built on. Presenting learners with an investigative or practical task is a useful way of allowing learners to appreciate how a new idea relates to their existing knowledge and understanding.

Exposition by the teacher is an important technique. However, learners should be engaged as much as possible in all learning and teaching approaches. The engagement of learners could be enhanced by teachers/lecturers providing opportunities for personalisation and choice where appropriate.

Probing questions could be used to ascertain a learner's level of understanding and provide a basis for consolidation or remediation where necessary. Examples of probing questions could include:

1 How did you decide what to do?
2 How did you approach exploring and solving this task or problem?
3 Could this task or problem have been solved in a different way? If yes, what would you have done differently?

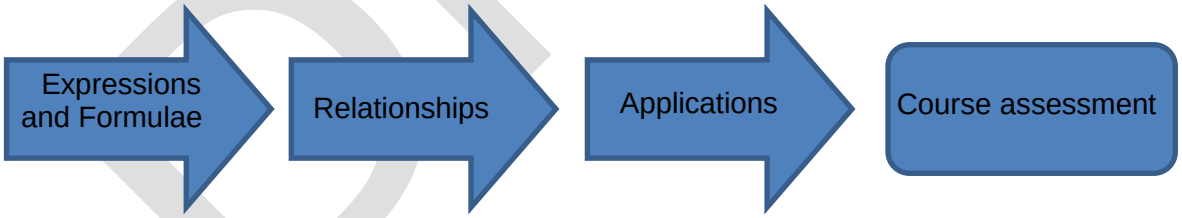
As learners develop concepts in mathematics, they will benefit from continual reinforcement and consolidation to build a foundation for progression.

Sequencing and integration of Units within the Course
Sequencing and integration of the delivery and assessment of the Units within the Course is at the discretion of the centre.

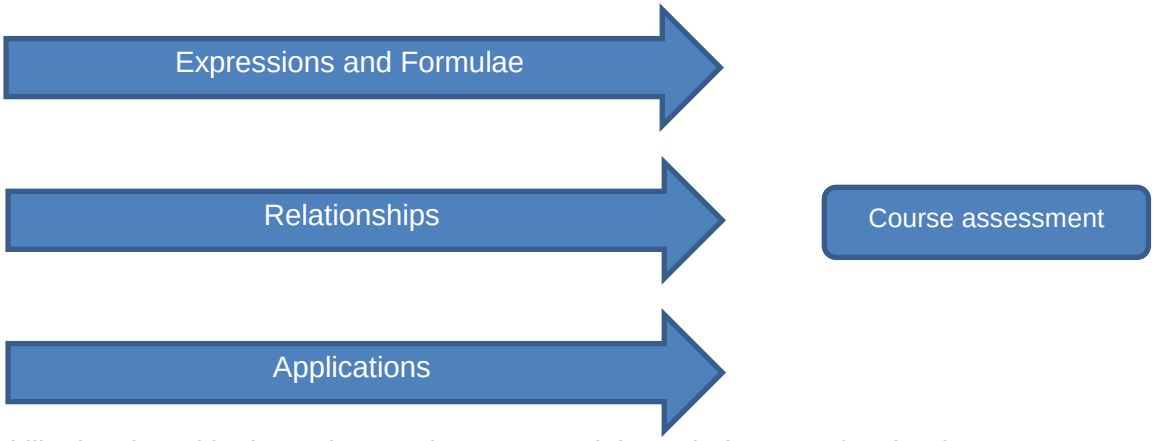
The models which follow exemplify possible approaches which may be adopted. Please note that other combinations are also possible.

In these and other possible models of delivery, the development of numeracy skills should take place naturally in the learning and teaching of these Units. This should be recognised as contributing to the overall numeracy skills of the learner.

Model 1:
This model shows the possibility of delivering the *Expressions and Formulae* Unit, the *Relationships* Unit and the *Applications* Unit sequentially. This sequence would allow for the development of skills associated with expressions and formulae to be applied in relationships, both of which could then be applied and reinforced in the *Applications* Unit. Completion of all three Units would lead on to the Course assessment which draws on the skills, knowledge and understanding from across the Course.



Model 2:
This model shows the possibility of delivering all three Units — *Expressions and Formulae*, *Relationships* and *Applications* — concurrently. This approach would be suitable if learning and teaching is organised by grouping Outcomes, for example, combining aspects of algebraic Outcomes; combining aspects of geometric or trigonometric Outcomes or combining statistical Outcomes. This model has the potential of maximising the relevance and transferability of learning and teaching. Completion of all three Units at the same time would lead to the Course assessment which draws on the skills, knowledge and understanding from across the Course.



Skills developed in the Units may be supported through the use of technology such as a calculator or other electronic means. The use of technology is particularly appropriate when this is a naturally occurring feature of the context in which learning is taking place.

Throughout learning and teaching, the ability to process numbers without using a calculator should also be encouraged and developed. Skills associated with mental calculations should be practised and applied wherever possible and appropriate. Learners should be encouraged to develop and improve their skills in completing both written and mental calculations in order to develop a degree of fluency and efficiency. The use of a calculator should complement development of these skills, not replace them.

Developing skills for learning, skills for life and skills for work

Learners are expected to develop broad generic skills as an integral part of their learning experience. The *Course Specification* lists the skills for learning, skills for life and skills for work that learners should develop through this Course. These are based on SQA's *Skills Framework: Skills for Learning, Skills for Life and Skills for Work* and must be built into the Course where there are appropriate opportunities. The level of these skills will be appropriate to the level of the Course. The following skills for learning, skills for life and skills for work are developed in this Course:

2 Numeracy
2.1 Number processes
2.2 Money, time and measurement
2.3 Information handling

5 Thinking skills
5.3 Applying
5.4 Analysing and evaluating

It is suggested that opportunities for developing the above skills for learning, skills for life and skills for work are built into learning and teaching wherever possible.

During the delivery of the Course there will also be opportunities for learners to develop their literacy skills and employability skills.

Literacy skills are particularly important as these skills allow learners to access, engage in and understand their learning and to communicate their thoughts, ideas and opinions. This Course will provide learners with the opportunity to develop their literacy skills by analysing real-life contexts and communicating their thinking by presenting mathematical information in a variety of ways. This could include the use of numbers, formulae, diagrams, graphs, symbols and words.

Employability skills are the personal qualities, skills, knowledge, understanding, and attitudes required in changing economic environments. The mathematical operational and reasoning skills developed in this Course aim to enable learners to confidently respond to mathematical situations that can arise in the workplace. It aims to achieve this by providing learners with the opportunity to analyse a situation, decide which mathematical strategies to apply, work through those strategies effectively and make informed decisions based on the results.

Further guidance on the development of skills for life, skills for learning and skills for work can be found in the *Unit Support Notes*.

Approaches to assessment

General guidance on assessment
A wide variety of approaches can be used to assess learners and gather evidence in the Mathematics (National 5) Course. The examples given here are not exhaustive.

Assessments must be valid, reliable and fit for purpose for the subject and the level and should fit with the learning and teaching approaches adopted.

Each assessment should therefore:

- be designed to allow learners to produce evidence to show they have achieved the required skills, knowledge and understanding for the Unit or Outcomes being assessed
- allow consistent judgements to be made by all assessors
- be appropriate for the Outcomes and the Assessment Standards in the Unit

Combining assessment across Units
When the Units are delivered as part of a Course, the assessment of Units can be combined.

The pattern of combined assessment can mirror that for integrated delivery as suggested in models shown in the section on ‘Approaches to learning and teaching’.

A combined approach to assessment has the advantage of:

- enriching the assessment process for both learners and teachers/lecturers by bringing together elements of different Units
- avoiding duplication of assessment
- making learning and assessment more coherent and relevant for learners

Suggested approaches to assessment
The skills-based focus of the Course readily lends itself to a variety of approaches to assessment.

The following table gives some suggested approaches to assessment and examples of how they could be used to combine assessment across the Course.

Suggested assessment approach	Units, Outcomes and Assessment Standards	An example of how this approach could be used across the Course
Problem solving tasks or activities	Rel 1.1 – 1.3 R [1] Reasoning 4.1, 4.2	Problem solving tasks could be used to combine elements of linear algebra from the *Relationships* Unit with reasoning skills. For example, learners could be asked to solve contextualised problems requiring the use of linear equations to produce a solution algebraically. In addition the learner could then be required to explain the meaning of the solution in everyday language.
Projects or investigations	EF 1.1 R 3.1	An investigation into the dimensions of a shape involving a right-angled triangle could combine the application of numerical (working with surds) and geometric (Pythagoras' Theorem) standards from the *Expressions and Formulae* and *Relationships* Units. For example, investigating the dimensions of a television screen or working with space diagonals.
Short/extended response tests	App 3.1 and 3.2 EF A 2.1 – 2.5 R Trig 4.1 and 4.2	The use of short answer/extended response tests may be appropriate for the combined assessment of algebraic and numerical skills. Online or paper-based tests could be used for example to assess a learner's ability to work with percentages and fractions, to work with algebraic expressions and to work with the graphs of trigonometric functions.

Whatever assessment approach is used teachers/lecturers are encouraged to ensure that they are in line with guidance provided in the 'Equality and inclusion' section of this document.

Further guidance on approaches to assessment and gathering evidence for the Units can be found in the *Unit Support Notes*.

Exemplification of assessment is provided in the *National Assessment Resource*.

[1] Refer to table of learning and teaching notes in the section entitled 'Approaches to Learning and Teaching' for the key to abbreviations.

Gathering evidence
Evidence for assessment purposes could take a variety of forms such as:

- written evidence including calculations and graphics generated during supervised class work or discrete mathematical tests
- oral evidence arising from discussion between learners and the teacher which shows learner ability and understanding across the Assessment Standard
- computer-generated assessment records or printouts from simulations eg 'solar' or online tests
- photographs of project or investigative work
- a product which could be a spreadsheets or computer-generated graphic

This list is not exhaustive and other types of evidence are also possible.

When evidence for the Course is collected using a combined approach, the use of an assessment tracking sheet to record learners' achievement may be helpful. An exemplar tracking sheet is provided in Appendix 1. Evidence must be generated for all Outcomes and Assessment Standards.

Achievement is on a pass/fail basis for the Outcomes. Learners who fail to achieve all of the Assessment Standards within the Outcomes will only require to be re-assessed on those Assessment Standards not achieved. Re-assessment should only follow after further work or remediation has been undertaken. Centres may consider it appropriate to delay re-assessment until further learning has taken place. Opportunities may exist for this by building it into other tasks within or across Units.

Authentication
Assessment should be carried out under supervision.

Evidence should be authenticated if generated beyond the direct observation of the teacher/lecturer. The following authentication strategies could be used:

- The teacher/lecturer could question the learner about what they have done and how they have carried out the task. Prompt questions could be used to elicit detail or specific responses.
- Peer reviews, asking each other what contribution a learner has made, especially in collaborative tasks.
- Witness testimony by a supervising adult. It is important that if someone else is involved in recording competence, this person understands the assessment process and the purpose of any checklists and/or other technique, and that the teacher/lecturer is the person who makes the assessment judgement and takes overall responsibility for the assessment process.

Teachers/lecturers should use their professional judgement to decide which approaches to assessment and contexts are appropriate for the learners and to make judgements about the sufficiency of the evidence produced.

Preparation for Course assessment

Each Course has additional time (40 hours) which may be used at the discretion of the teacher or lecturer to enable learners to prepare for Course assessment. This time may be used near the start of the Course and at various points throughout the Course for consolidation and support. It may also be used for preparation for Unit assessment, and towards the end of the Course, for further integration, revision and preparation and/or gathering evidence for Course assessment.

Information given in the *Course Specification* and the *Course Assessment Specification* about the assessment of added value is mandatory.

Courses from National 4 to Advanced Higher include assessment of added value. At National 5 the added value will be assessed in the Course assessment.

The *Course Assessment Specification* addresses the key purposes and aims of the Course as defined in the Course Rationale.

In this Course, the Course assessment will focus on breadth, challenge and application. The learner will draw on and extend the skills they have learned during the Course. This will be assessed through two question papers, non-calculator and calculator, which will offer opportunities to demonstrate the breadth and depth of knowledge and skills acquired from across the other Units.

In preparation for the Course assessment, it is recommended that learners are the given the opportunity to:

- analyse a range of real-life problems and situations involving mathematics
- select and adapt appropriate mathematical process and strategies
- adapt and apply mathematical process and strategies to solve problems or tackle situations both with and without the aid of a calculator
- draw conclusions based on the results of the processes and strategies and explain solutions
- present mathematical information in an appropriate format

The question papers will assess a selection of knowledge and skills acquired in the Course and will provide opportunities to apply skills in a wide range of situations, some of which may be new to the learner.

Exemplification of the added value assessment is given in the *National Assessment Resource*.

E-assessment

E-assessment can play an important role in the design and delivery of National Courses and Units by supporting integration and learners' personalisation and choice. While it is important not to introduce new, additional ICT skills or knowledge, it may be that learners may be using ICT in working towards their assessment.

Where resources permit, centres could use technology to support learning, teaching and assessment. Across the Course this may include:

- online interactive tasks or simulated exercises
- e-portfolios to collect and build up evidence over time
- web-based resources
- online mathematical software packages
- CAD software for geometry
- use of computers or advanced calculators to generate graphical forms
- use of data handling software

Equality and inclusion

At all times, teachers/lecturers should use inclusive approaches to assessment, taking into account the needs and experiences of their learners.

The following requirements within the Course may present potential barriers to some disabled learners:

- Making generalisations and thinking logically, abstractly or creatively could be a barrier for autistic learners and those with other cognitive difficulties.
- Practical measurement activities could present barriers to visually impaired candidates or those with physical disability, especially where manual dexterity is required.
- Some learners with neurotypical conditions, eg dyscalculia, may have difficulties in performing calculations without recourse to a numerical aid/formula.
- Some learners with communication difficulties may not be able to record, manipulate or present mathematical information, eg those with difficulties in reading and writing text, symbolic representation and diagrams.

If a learner has a disability affecting their ability to engage in learning or generate evidence for the Course, centres could provide, where appropriate, the following support:

- learners could be asked to talk about possible generalisations by the teacher/lecturer using prompt questions
- learners could be asked to talk about possible operational skills that would be appropriate through the use of prompt questions
- practical helpers under direct learner instruction could assist with practical measurement activities
- adapted equipment would also be appropriate for measuring tasks
- the use of a calculator or similar aid except where non-calculator evidence is explicitly required in the non-calculator paper. In this case a reasonable adjustment would need to be requested
- ICT and assistive technologies

Further details about equality and inclusion relevant to each Unit can be found in the *Unit Support Notes*.

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Course Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Course.

It is important that centres are aware of and understand SQA's assessment arrangements for disabled learners, and those with additional support needs, when making requests for adjustments to published assessment arrangements. Centres will find more guidance on this in the series of publications on Assessment Arrangements on SQA's website: www.sqa.org.uk/sqa//14977.html.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications are available on SQA's website at: www.sqa.org.uk/sqa//14977.html.
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- *Course Specifications*
- Design Principles for National Courses
- *Guide to Assessment* (June 2008)
- Overview of Qualification Reports
- Principles and practice papers for curriculum areas
- *SCQF Handbook: User Guide* (published 2009) and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- *SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*
- *Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool*

Appendix 2: Exemplar tracking sheet

EF – *Expressions and Formulae* Unit; R – *Relationships* Unit;
App – *Applications* Unit

Standards	Y/ N	Comment
Numerical Standards ♦ Working with surds (EF) ♦ Simplifying expressions using the laws of indices (EF) ♦ Rounding to a given number of significant figures (EF) ♦ Working with percentages (App) ♦ Working with fractions (App)		
Algebraic Standards ♦ Working with algebraic expressions involving brackets (EF) ♦ Factorising an algebraic expression (EF) ♦ Completing the square in a quadratic expression with unitary x^2 coefficient (EF) ♦ Reducing an algebraic fraction to its simplest form (EF) ♦ Applying the four operations to algebraic fractions (EF) ♦ Determining the equation of a straight line (R) ♦ Working with linear equations and inequations (R) ♦ Working with simultaneous equations (R) ♦ Changing the subject of a formula (R) ♦ Recognise and determine the equations of quadratics from their graphs (R) ♦ Sketching a quadratic function (R) ♦ Identifying features of a quadratic function (R) ♦ Working with quadratic equations (R)		
Geometric Standards ♦ Determining the gradient of a straight line given two points (EF) ♦ Working with the length of arc or the area of a sector of a circle (EF) ♦ Working with the volume of a standard solid (EF) ♦ Applying the Theorem of Pythagoras (R) ♦ Applying the properties of shapes (R) ♦ Using similarity (R) ♦ Working with 2D vectors (App) ♦ Working with 3D co-ordinates (App) ♦ Using vector components (App)		

Statistical Standards ♦ Comparing data sets using statistics (App) ♦ Forming a linear model from a given set of data (App)		
Trigonometry Standards ♦ Working with the graphs of trigonometric functions (R) ♦ Working with trigonometric relationships in degrees (R) ♦ Calculating the area of a triangle using trigonometry (App) ♦ Using the sine and cosine rules in a triangle (App) ♦ Using bearings with trigonometry (App)		
Reasoning Outcomes ♦ Interpreting a situation where mathematics can be used and identifying a strategy (EF) & (R) & (App) ♦ Explaining a solution and relating it to context (EF) & (R) & (App)		

Administrative information

Published: January 2012 (draft version 1.0)

Superclass: to be advised

History of changes to Course Support Notes

Course details	Version	Description of change	Authorised by	Date

Draft Unit Support Notes — Expressions and Formulae (National 5)

For general advice and guidance on the Unit.

This edition: January 2012, draft version 1.0

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the *Expressions and Formulae* (National 5) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Specification*
- the *Course Specification*
- the *Course Assessment Specification*
- the *Course Support Notes*
- appropriate assessment support materials

If the *Unit Support Notes* have been developed for a Unit which is not part of a Course, then it is only necessary to read them in conjunction with the *Unit Specification*.

General guidance on the Unit

Aims

The *Expressions and Formulae* (National 5) Unit is a mandatory Unit in the Mathematics (National 5) Course. The *Expressions and Formulae* Unit is also available as a free-standing Unit and is designed to meet the needs of a broad range of learners who may choose to study it.

The general aim of this Unit is to develop skills linked to mathematical expressions and formulae. These include the manipulation of abstract terms, the simplification of expressions and the evaluation of formulae.

The Outcomes cover aspects of number, algebra and geometry and also develop skills in reasoning.

Learners who successfully complete this Unit will be able to:

1 Use numerical skills linked to expressions and formulae
2 Use algebraic skills linked to expressions and formulae
3 Use geometric skills linked to expressions and formulae
4 Use mathematical reasoning skills linked to expressions and formulae

Progression into this Unit

Entry into this Unit is at the discretion of the Centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- Mathematics (National 4) Course or its component Units

Prior learning, life and work experiences may also provide an appropriate basis for entry into this Unit. This could include relevant skills, knowledge and understanding and appropriate experiences and outcomes at the fourth level from the Mathematics Curriculum Area.

The most relevant of these are:

Curriculum for Excellence organiser	**Experiences and outcomes**
Expressions and Equations	Having explored the distributive law in practical contexts, I can simplify, multiply and evaluate simple algebraic terms involving a bracket. **MTH 4-14a**
Expressions and Equations	I can find the factors of algebraic terms, use my understanding to identify common factors and apply this to factorise expressions. **MTH 4-14b**
Measurement	I have explored with others the practicalities of the use of 3D objects in everyday life and can solve problems involving the volume of a prism, using a

	formula to make related calculations when required. **MTH 4-11c**

Centres wishing to establish the suitability of learners without prior qualifications and/or experiences and outcomes may benefit from carrying out a diagnostic review of prior life and work experiences. This approach may be particularly useful for adults returning to education.

Skills, knowledge and understanding covered in the Unit

Information about skills, knowledge and understanding is given in the Mathematics (National 5) *Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- other Units within Mathematics (National 5)
- other Units within Lifeskills Mathematics (National 5)
- Higher Mathematics
- Core Skills Numeracy (SCQF level 6)
- National Certificate Group Awards
- further study, employment and/or training

The skills, knowledge and understanding developed in this Unit could support both breadth and depth of learning in other curriculum areas in addition to life and work contexts.

Approaches to learning and teaching

The purpose of this section is to provide advice and guidance on the sequencing, integration and approaches to learning and teaching for this Unit.

Sequencing and integration of learning and teaching
The *Expressions and Formulae* Unit consists of four Outcomes which can be delivered in a variety of ways. The Outcomes are neither mutually dependent nor exclusive and could be delivered sequentially or concurrently. Teachers/lecturers can choose to deliver the Outcomes in any order. There is no specific amount of time allocated to the delivery of each Outcome. This will often depend on the needs of the learners and their prior skills, knowledge and understanding.

Integration of Outcomes

Example 1
Outcomes could be integrated by combining the reasoning skills Outcome with any of the other Outcomes.

Expressions in Outcome 1 could be derived from a mathematical problem before simplification.

In Outcome 2, compound solids could be required to be broken down into simple solids to enable an area to be calculated. This could be enclosed in a design problem.

In Outcome 3, deriving an algebraic fraction from a mathematical situation before simplifying.

Rounding a calculation in Outcome 1 could be required to be appropriate to the given situation and an explanation given.

Example 2
For centres delivering this Unit as part of the (Mathematics National 5) Course then Outcomes of this Unit may be integrated with Outcomes in the other Units.

Expressions (Outcome 1) with equations in Outcomes 1 and 2 of the *Relationships* Unit.

Gradient (Outcome 3) with the equation of a straight line in Outcome 1 of the *Relationships* Unit.

Indices (Outcome 1) with fractions in Outcome 3 of the *Applications* Unit.

Completing the square (Outcome 2) with sketching a quadratic function in Outcome 2 of the *Relationships* Unit.

The Mathematics (National 5) *Course Support Notes* provide further advice and guidance on approaches to learning and teaching which apply to all component Units of the Course.

Developing skills for learning, skills for life and skills for work

For this Unit there are significant opportunities to develop the following skills for learning, skills for life and skills for work, example of some of these opportunities are described in the table below:

SQA skills for learning, skills for life and skills for work framework definition	Suggested approaches for learning and teaching
Numeracy is the ability to use numbers to solve problems by counting, doing calculations, measuring, and understanding graphs and charts. This is also the ability to understand the results.	Learners have the opportunity to develop their numerical skills throughout the Unit. For example, by using number to solve mathematical problems involving surds and simplifying expressions using the laws of indices and rounding to a given number of significant figures.
Applying is the ability to use existing information to solve a problem in a different context, and to plan, organise and complete a task.	Learners have the opportunity to develop their ability to apply skills across the Unit. This could be done by encouraging learners to think about how they are going to tackle given mathematical problems, decide which skills to use and then carry out the processes and/or calculations to complete the task. At level 5, learners could be encouraged to think creatively to adapt strategies to suit the given problem or situation. Learners should be encouraged to show and explain their thinking where appropriate.
Analysing and evaluating This covers the ability to identify and weigh-up the features of a situation or issue and to use your judgement of them in coming to a conclusion. It includes reviewing and considering any potential solutions.	Learners have the opportunity to develop their ability to analyse and evaluate. For example, learners could be encouraged to identify real-life tasks or situations which require the use of mathematics, analyse the situation to decide how it can be tackled and decide what mathematical skills will need to be applied. Learners could also be provided with opportunities to interpret the results of calculations to draw conclusions. These conclusions could be evaluated and used to form the basis of any reasoning to support choices or decisions.

There may also be further opportunities for the development of additional skills for learning, skills for life and skills for work in the delivery of this Unit. These opportunities may vary and are at the discretion of the centre.

Approaches to assessment

The purpose of this section is to give advice and guidance on approaches to integrating assessment within this Unit.

The *Expressions and Formulae* Unit can be assessed in a variety of ways and could include for example:

- specific assessment tasks or activities
- practical assignments such as a project or investigation
- discrete tests

These approaches are not exhaustive and other possibilities also exist.

The following table gives some examples of how these approaches could be used within the Unit to provide a varied and integrated assessment experience. This approach aims to make the assessment process more coherent and meaningful for learners.

The sequencing and integration of assessment for this Unit could also mirror the models described in the section on 'Approaches to learning and teaching'.

Approach to assessment	Outcomes	Examples of approaches to assessment
Project/ investigation	Outcome 3 Outcome 4	Learners could be given a project or investigation which would provide the opportunity to gather evidence for Outcomes 3 and 4 together. This could include, for example, an investigation on gradient, exploring positive, negative, zero, fractional values and their graphical representations and possibly connections. The learner could produce a summary of findings.
Assessment tasks/activities	Outcome 1 Outcome 3 Outcome 4	Learners could be given a discrete task or activity which would provide the opportunity to gather evidence for Outcomes 1, 3 and 4 together. This could include, for example, an activity which involves area or volume with perhaps use of surds or rounding. This could be in a context requiring analysis of the problem.
Discrete test	Outcome 1 Outcome 2	Learners could be given a short answer or extended response test which would provide the opportunity to gather evidence for Outcomes 1 and 2 together. This could include, for example, a test which involves working with surds, simplifying expressions and rounding to a given number of significant figures. It could also require the learner to demonstrate their numerical skills while working with and factorising algebraic expressions, completing the square and reducing an algebraic fraction to its simplest form. This type of assessment could

		also be used to assess a learner's ability to apply mathematics without the aid of a calculator in preparation for the Course assessment.

It would normally be expected that considerable learning and teaching would have taken place prior to the collection of evidence for assessment purposes.

Further advice and guidance on assessment for the Mathematics Course and its components Units is contained within the *Course Support Notes.*

Exemplification of assessment is provided in the *National Assessment Resource.*

When delivering this Unit as part of the Mathematics (National 5) Course, reference should be made to the appropriate content statements within the 'Further mandatory information on Course coverage' section in the *Course Assessment Specification*.

E-assessment

E-assessment can play an important role in the design and delivery of National Courses and Units by supporting integration and learners' personalisation and choice. While it is important not to introduce new, additional ICT skills or knowledge, it may be that learners may be using ICT in working towards their assessment.

Where resources permit, centres could use technology to support learning, teaching and assessment. Further advice and guidance on e-assessment can be found in the *Course Support Notes*.

Equality and inclusion

This Unit may present a number of barriers to achievement for disabled learners:

- Practical measurement activities could present barriers to visually impaired candidates or those with physical disability, especially where manual dexterity is required.
- Some learners with neurotypical conditions, eg dyscalculia, may have difficulties in performing calculations without recourse to a numerical aid/formula.
- Some learners with communication difficulties may not be able to record, manipulate or present mathematical information, eg those with difficulties in reading and writing text, symbolic representation and diagrams.

If a learner has a disability affecting their ability to engage in learning or generate evidence for this Unit, centres could provide, where appropriate, the following support:

- practical helpers under direct learner instruction could assist with practical measurement activities
- adapted equipment would also be appropriate for measuring tasks
- the use of a calculator or similar aid
- ICT and assistive technologies

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Unit Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications on SQA's website: http://www.sqa.org.uk/sqa/14976.html
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- Course Specifications
- Design Principles for National Courses
- *Guide to Assessment* (June 2008)
- Overview of Qualification Reports
- *Principles and practice papers for curriculum areas*
- *Research Report 4 — Less is More: Good Practice in Reducing Assessment Time*
- *Coursework Authenticity — a Guide for Teachers and Lecturers*
- *SCQF Handbook: User Guide (published 2009)* and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- *SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*
- *Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool*
- SQA Guidelines on e-assessment for Schools
- SQA Guidelines on Online Assessment for Further Education
- SQA e-assessment web page: www.sqa.org.uk/sqa/5606.html

Administrative information

Published: January 2012 (draft version 1.0)

Superclass: to be advised

History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date

Draft Unit Support Notes — Relationships (National 5)

For general advice and guidance on the Unit.

This edition: January 2012, draft version 1.0

Introduction

These support notes are not mandatory. They provide advice and guidance on approaches to delivering and assessing the *Relationships* (National 5) Unit. They are intended for teachers and lecturers who are delivering this Unit. They should be read in conjunction with:

- the *Unit Specification*
- the *Course Specification*
- the *Course Assessment Specification*
- the *Course Support Notes*
- appropriate assessment support materials

If the *Unit Support Notes* have been developed for a Unit which is not part of a Course, then it is only necessary to read them in conjunction with the *Unit Specification*.

General guidance on the Unit

Aims

The *Relationships* (National 5) Unit is a mandatory Unit in the Mathematics (National 5) Course. The *Relationships* Unit is also available as a free-standing Unit and is designed to meet the needs of a broad range of learners who may choose to study it.

The general aim of this Unit is to develop skills linked to mathematical relationships. These include solving equations, analysing graphs and making reasoned deductions.

The Outcomes cover aspects of algebra, geometry and trigonometry and also assess skills in reasoning.

Learners who successfully complete this Unit will be able to:

1 Use algebraic skills linked to linear relationships
2 Use algebraic skills linked to quadratic relationships
3 Use geometric skills linked to relationships
4 Use trigonometric skills linked to relationships
5 Use mathematical reasoning skills linked to relationships

Progression into this Unit

Entry into this Unit is at the discretion of the Centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- Mathematics (National 4) Course or its component Units

Prior learning, life and work experiences may also provide an appropriate basis for entry into this Unit. This could include relevant skills, knowledge and understanding and appropriate experiences and outcomes at Fourth level from the mathematics curriculum area.

The most relevant of these are:

Curriculum for Excellence organiser	**Experiences and outcomes**
Patterns and relationships	I can use a given formula to generate points lying on a straight line, plot them to create a graphical representation then use this to answer related questions. **MTH 4-13d**

Expressions and equations	Having discussed the benefits of using mathematics to model real-life situations, I can construct and solve inequalities and an extended range of equations. **MTH 4-15a**
Properties of 2D shapes and 3D objects	I have explored the relationships that exist between the sides, or sides and angles, in right-angled triangles and can select and use an appropriate strategy to solve related problems, interpreting my answer for the context. **MTH 4-16a**

Centres wishing to establish the suitability of learners without prior qualifications and/or experiences and outcomes may benefit from carrying out a diagnostic review of prior life and work experiences. This approach may be particularly useful for adults returning to education.

Skills, knowledge and understanding covered in the Unit

Information about skills, knowledge and understanding is given in the Mathematics (National 5) *Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- other Units within Mathematics (National 5)
- other Units within Lifeskills Mathematics (National 5)
- Higher Mathematics
- Core Skills Numeracy (SCQF level 6)
- National Certificate Group Awards
- further study, employment and/or training

The skills, knowledge and understanding developed in this Unit could support both breadth and depth of learning in other curriculum areas in addition to life and work contexts.

Approaches to learning and teaching

The purpose of this section is to provide advice and guidance on sequencing, integration and approaches to learning and teaching for this Unit.

Sequencing and integration of learning and teaching
The *Relationships* Unit consists of five Outcomes which can be delivered in a variety of ways. The Outcomes are neither mutually dependent nor exclusive and could be delivered sequentially or concurrently. Teachers/lecturers can choose to deliver the Outcomes in any order. There is no specific amount of time allocated to the delivery of each Outcome. This will often depend on the needs of the learners and their prior skills, knowledge and understanding.

Integration of Outcomes

Example 1
Outcomes could be integrated by combining the reasoning skills Outcome with any of the other Outcomes.

Simultaneous equations in Outcome 1 could be derived from a mathematical problem before solution.

In Outcome 2, a quadratic equation and graph could be used in a context-based problem.

In Outcome 3, a problem could be set in a real life context which involves the use of Pythagoras' Theorem.

In Outcome 3, a problem could be set in a real-life context which involves the use of similarity.

Example 2
For centres delivering this Unit as part of the (Mathematics National 5) Course, Outcomes of this Unit may be integrated with Outcomes in the other Units.

Equations (Outcomes 1 and 2) with expressions in Outcome 1 of the *Expressions and* Formulae Unit.

Gradient (Outcome 3) with the equation of a straight line (Outcome 1) with gradient in the *Expressions and Formulae* Unit.

Sketching a quadratic function (Outcome 2) with completing the square in Outcome 2 of the *Expressions and Formulae* Unit.

Related angles (Outcome 4) with sine and cosine rules of Outcome 1 of the *Applications* Unit.

The Mathematics (National 5) *Course Support Notes* provide further advice and guidance on approaches to learning and teaching which are relevant to all component Units of the Course.

Developing skills for learning, skills for life and skills for work

For this Unit there are significant opportunities to develop the following skills for learning, skills for life and skills for work; some of these opportunities are described in the table below:

SQA skills for learning, skills for life and skills for work framework definition	**Suggested approaches for learning and teaching**
Numeracy is the ability to use numbers to solve problems by counting, doing calculations, measuring, and understanding graphs and charts. This is also the ability to understand the results.	Throughout this Unit learners will have ample opportunities to use number to solve contextualised problems involving STEM-based subjects (science, technology, engineering and mathematics). As the level of detail and size of number in the calculations increases, it will become increasingly important that learners are able to use both graphing and scientific calculators with confidence. Learners should be encouraged as much as possible to manage problems, tasks and case studies involving numeracy by analysing the context, carrying out calculations, drawing conclusions, making deductions and informed decisions.
Applying is the ability to use existing information to solve a problem in a different context, and to plan, organise and complete a task.	Wherever possible, learners should be given the opportunity to apply the skills, knowledge and understanding they have developed to solve mathematical problems in a range of real-life contexts. Learners should be encouraged to think about how they are going to tackle problems or situations, decide which skills to use and then carry out the calculations necessary to complete the task, for example solving a quadratic equation. To determine a learner's level of understanding, learners should be encouraged to show and explain their thinking. At level 5, learners could be encouraged to think creatively to adapt strategies to suit the given problem or situation.
Analysing and evaluating This covers the ability to identify and weigh-up the features of a situation or issue and to use your judgement of them in coming to a conclusion. It includes reviewing and considering any potential solutions.	Wherever possible, learners should be given the opportunity to identify real-life tasks or situations which require the use of mathematics. Learners should be encouraged to analyse the task, situation or case to decide how it can be addressed and what mathematical skills will need to be applied. Learners should also be provided with opportunities to interpret the results of their calculations and to draw conclusions. Conclusions drawn by the learner could be used to form the basis of any reasoning by making choices or decisions to solve the problem, or tackle the situation, for example, analysing a situation involving the use linear or simultaneous equations. Where the opportunity arises, learners could be given

	the chance to identify and analyse situations involving mathematics which are of personal interest to themselves.

There may also be further opportunities for the development of additional skills for learning, skills for life and skills for work in the delivery of this Unit. These opportunities may vary and are at the discretion of the centre.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice and guidance on approaches to integrating assessment within this Unit.

The *Relationships* Unit can be assessed in a variety of ways and could include for example:

- specific assessment tasks or activities
- practical assignments such as a project or investigation
- discrete tests

These approaches are not exhaustive and other possibilities also exist.

The following table gives some examples of how these approaches could be used within the Unit to provide a varied and integrated assessment experience. This approach aims to make the assessment more coherent and meaningful for learners.

The sequencing and integration of assessment for this Unit could also mirror the models described in the section on 'Approaches to learning and teaching'.

Approach to assessment	**Outcomes**	**Examples of approaches to assessment**
Project/ investigation	Outcome 4	Learners could be given a mathematical project involving related trigonometric functions.
Assessment tasks/activities	Outcome 2 Outcome 5	For example, learners could be asked to apply their knowledge of quadratics in a task or activity to explore graphs of quadratic functions, determining their turning points from different forms of their equation.
Discrete test	Outcome 1 Outcome 2 Outcome 5	Learners could be given a test which includes short response and extended response questions. For Outcomes 1 and 2 this may include solving linear and quadratic equations. Extended response questions may allow assessment of reasoning by posing a problem or requiring interpretation of a solution.

It would normally be expected that considerable learning and teaching would have taken place prior to the collection of evidence for assessment purposes.

Further advice and guidance on assessment for the Mathematics Course and its components Units is contained within the *Course Support Notes.*

Exemplification of assessment is provided in the *National Assessment Resource.*

When delivering this Unit as part of the Mathematics (National 5) Course, reference should be made to the appropriate content statements within the 'Further mandatory information on Course coverage' section in the *Course Assessment Specification*.

E-assessment

E-assessment can play an important role in the design and delivery of National Courses and Units by supporting integration and learners' personalisation and choice. While it is important not to introduce new, additional ICT skills or knowledge, it may be that learners may be using ICT in working towards their assessment.

Where resources permit, centres could use technology to support learning, teaching and assessment. Further advice and guidance on e-assessment can be found in the *Course Support Notes*.

Equality and inclusion

This Unit may present a number of barriers to achievement for disabled learners:

- Practical measurement activities could present barriers to visually impaired candidates or those with physical disability, especially where manual dexterity is required.
- Some learners with neurotypical conditions, eg dyscalculia, may have difficulties in performing calculations without recourse to a numerical aid/formula.
- Some learners with communication difficulties may not be able to record, manipulate or present mathematical information, eg those with difficulties in reading and writing text, symbolic representation and diagrams.

If a learner has a disability affecting their ability to engage in learning or generate evidence for this Unit, centres could provide, where appropriate, the following support:

- practical helpers under direct learner instruction could assist with practical measurement activities
- adapted equipment would also be appropriate for measuring tasks
- the use of a calculator or similar aid
- ICT and assistive technologies

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Unit Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications on SQA's website: http://www.sqa.org.uk/sqa/14976.html
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- Course Specifications
- Design Principles for National Courses
- *Guide to Assessment* (June 2008)
- Overview of Qualification Reports
- *Principles and practice papers for curriculum areas*
- *Research Report 4 — Less is More: Good Practice in Reducing Assessment Time*
- *Coursework Authenticity — a Guide for Teachers and Lecturers*
- *SCQF Handbook: User Guide (published 2009)* and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- *SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*
- *Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool*
- SQA Guidelines on e-assessment for Schools
- SQA Guidelines on Online Assessment for Further Education
- SQA e-assessment web page: www.sqa.org.uk/sqa/5606.html

Administrative information

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Superclass: to be advised

History of changes to Unit Support Notes

Unit details	Version	Description of change	Authorised by	Date

Draft Unit Support Notes — Applications (National 5)

For general advice and guidance on the Unit.

This edition: January 2012, draft version 1.0

Please refer to the note of changes at the end of this document for details of changes from previous version (where applicable).

Introduction

These support notes provide advice and guidance to support the delivery and assessment of the *Applications* (National 5) Unit. They are intended for teachers and lecturers who are delivering the Unit. They should be read in conjunction with the:

- Applications (National 5) *Unit Specification*
- Mathematics (National 5) *Course Specification*
- Mathematics (National 5) *Course Assessment Specification*
- Mathematics (National 5) *Course Support Notes*

If the *Unit Support Notes* have been developed for a Unit which is not part of a Course, then it is only necessary to read them in conjunction with the *Unit Specification*.

General guidance on the Unit

Aims

The *Applications* (National 5) Unit is a mandatory Unit in the Mathematics (National 5) Course. The *Applications* Unit is also available as a free-standing Unit and is designed to meet the needs of a broad range of learners who may choose to study it.

The general aim of this Unit is to develop skills linked to mathematical applications. These include the ability to interpret information, use diagrams and select appropriate techniques to produce a solution. The Outcomes cover aspects of trigonometry, geometry, number processes and statistics and also assess skills in reasoning.

Learners who complete this Unit will be able to:

1 Use trigonometric skills linked to applications
2 Use geometric skills linked to applications
3 Use numerical skills linked to applications
4 Use statistical skills linked to applications
5 Use mathematical reasoning skills linked to applications

Progression into this Unit

Entry into this Unit is at the discretion of the Centre. However, learners would normally be expected to have attained the skills, knowledge and understanding required by one or more of the following or equivalent qualifications and/or experience:

- Mathematics (National 4) Course or its component Units

Prior learning, life and work experiences may also provide an appropriate basis for entry into this Unit. This could include relevant skills, knowledge and understanding and appropriate experiences and outcomes at Fourth level from the mathematics curriculum area.

The most relevant of these are:

Curriculum for Excellence organiser	**Experiences and outcomes**
Properties of 2D shapes and 3D objects	I have explored the relationships that exist between the sides, or sides and angles, in right-angled triangles and can select and use an appropriate strategy to solve related problems, interpreting my answer for the context. **MTH 4-16**
Fractions, decimal fractions and percentages	I can solve problems involving fractions and mixed numbers in context, using addition, subtraction or multiplication. **MTH 4-07b**

Data and analysis	In order to compare numerical information in real-life contexts, I can find the mean, median, mode and range of sets of numbers, decide which type of average is most appropriate to use and discuss how using an alternative type of average could be misleading. **MTH 4-20b**

Centres wishing to establish the suitability of learners without prior qualifications and/or experiences and outcomes may benefit from carrying out a diagnostic review of prior life and work experiences. This approach may be particularly useful for adults returning to education.

Skills, knowledge and understanding covered in the Unit

Information about skills, knowledge and understanding is given in the Mathematics (National 5) *Course Support Notes*.

If this Unit is being delivered on a free-standing basis, teachers and lecturers are free to select the skills, knowledge, understanding and contexts which are most appropriate for delivery in their centres.

Progression from this Unit

This Unit may provide progression to:

- other Units within Mathematics (National 5)
- other Units within Lifeskills Mathematics (National 5)
- Higher Mathematics
- Core Skills Numeracy (SCQF level 6)
- National Certificate Group Awards
- further study, employment and/or training

The skills, knowledge and understanding developed in this Unit could support both breadth and depth of learning in other curriculum areas in addition to life and work contexts.

Approaches to learning, teaching and assessment

The purpose of this section is to provide general advice and guidance on approaches to learning and teaching.

Sequencing and integration of learning and teaching
The *Applications* Unit consists of five Outcomes which can be delivered in a variety of ways. The Outcomes are neither mutually dependent nor exclusive and could be delivered sequentially or concurrently. Teachers/lecturers can choose to deliver the Outcomes in any order. There is no specific amount of time allocated to the delivery of each Outcome. This will often depend on the needs of the learners and their prior skills, knowledge and understanding.

Integration of Outcomes

Example 1
Outcomes could be integrated by combining the reasoning skills Outcome with any of the other Outcomes.

Sine and cosine rules in Outcome 1 in a problem situation involving bearings.

In Outcome 2 vectors could be used in a context-based problem.

In Outcome 3, a problem could be set in a scientific context which involves the use of line of best fit.

Example 2
For centres delivering this Unit as part of the Mathematics (National 5) Course, Outcomes of this Unit may be integrated with Outcomes in the other Units.

Vectors (Outcome 2) with Pythagoras' Theorem in Outcome 3 of the *Relationships* Unit for vectors at right angles.

Area of a triangle (Outcome 1) with area of sector in Outcome 3 of *Expressions and Formulae.*

Sine and cosine rules (Outcome 1) with related angles of the *Relationships* Unit.

The Mathematics (National 5) *Course Support Notes* provide advice and guidance on approaches to learning and teaching which apply to all component Units of the Course.

Developing skills for learning, skills for life and skills for work

For this Unit there are significant opportunities to develop the following skills for learning, skills for life and skills for work; some of these opportunities are described in the table below:

SQA skills for learning, skills for life and skills for work framework definition	**Suggested approaches for learning and teaching**
Numeracy is the ability to use numbers to solve problems by counting, doing calculations, measuring, and understanding graphs and charts. This is also the ability to understand the results.	Throughout this Unit learners will have ample opportunities to use number to solve contextualised problems involving STEM-based subjects (science, technology, engineering and mathematics). As the level of detail and size of number in the calculations increases, it will become increasingly important that learners are able to use both graphing and scientific calculators with confidence. Learners should be encouraged as much as possible to manage problems, tasks and case studies involving numeracy by analysing the context, carrying out calculations, drawing conclusions, making deductions and informed decisions.
Applying is the ability to use existing information to solve a problem in a different context, and to plan, organise and complete a task.	Wherever possible, learners should be given the opportunity to apply the skills, knowledge and understanding they have developed to solve mathematical problems in a range of real-life contexts. Learners should be encouraged to think about how they are going to tackle problems or situations, decide which skills to use and then carry out the calculations necessary to complete the task, for example using the sine rule. To determine a learner's level of understanding, learners should be encouraged to show and explain their thinking. At level 5, learners could be encouraged to think creatively to adapt strategies to suit the given problem or situation.
Analysing and evaluating This covers the ability to identify and weigh-up the features of a situation or issue and to use your judgement of them in coming to a conclusion. It includes reviewing and considering any potential solutions.	Wherever possible, learners should be given the opportunity to identify real-life tasks or situations which require the use of mathematics. Learners should be encouraged to analyse the task, situation or case to decide how it can be addressed and what mathematical skills will need to be applied. Learners should also be provided with opportunities to interpret the results of their calculations and to draw conclusions. Conclusions drawn by the learner could be used to form the basis of any reasoning by making choices or decisions to solve the problem, or tackle the situation, for example, by analysing a situation involving the use of bearings and trigonometry. Where the opportunity arises, learners could be given the chance to identify and analyse situations involving

	mathematics which are of personal interest to themselves.

There may also be further opportunities for the development of additional skills for learning, skills for life and skills for work in the delivery of this Unit. These opportunities may vary and are at the discretion of the centre.

Approaches to assessment and gathering evidence

The purpose of this section is to give advice and guidance on approaches to integrating assessment within this Unit.

The *Applications* Unit can be assessed in a variety of ways and could include for example:

- specific assessment tasks or activities
- practical assignments such as a project or investigation
- discrete tests

These approaches are not exhaustive and other possibilities also exist.

The following table gives some examples of how these approaches could be used within the Unit to provide a varied and integrated assessment experience. This approach aims to make the assessment more coherent and meaningful for learners.

The sequencing and integration of assessment for this Unit could also mirror the models described in the section on 'Approaches to learning and teaching'.

Approach to assessment	**Outcomes**	**Examples of approaches to assessment**
Project/ investigation	Outcome 3 Outcome 5	Learners could be given a mathematical project involving compound interest or depreciation.
Assessment tasks/activities	Outcome 1 Outcome 5	For example, learners could be asked to apply their knowledge of trigonometry to problems of navigation.
Discrete test	Outcome 2 Outcome 3 Outcome 5	Learners could be given a test which includes short response and perhaps extended response questions. For Outcome 2 this may include addition and subtraction of vectors. For Outcome 3 this may include working with fractions. Extended response questions may allow assessment of reasoning by posing a problem or requiring interpretation of a solution.

It would normally be expected that considerable learning and teaching would have taken place prior to the collection of evidence for assessment purposes.

Further advice and guidance on assessment for the Mathematics Course and its components Units is contained within the *Course Support Notes.*

Exemplification of assessment is provided in the *National Assessment Resource.*

When delivering this Unit as part of the Mathematics (National 5) Course, reference should be made to the appropriate content statements within the

'Further mandatory information on Course coverage' section in the *Course Assessment Specification*.

E-assessment

E-assessment can play an important role in the design and delivery of National Courses and Units by supporting integration and learners' personalisation and choice. While it is important not to introduce new, additional ICT skills or knowledge, it may be that learners may be using ICT in working towards their assessment.

Where resources permit, centres could use technology to support learning, teaching and assessment. Further advice and guidance on e-assessment can be found in the *Course Support Notes*.

Equality and inclusion

This Unit may present a number of barriers to achievement for disabled learners:

- Practical measurement activities could present barriers to visually impaired candidates or those with physical disability, especially where manual dexterity is required
- Some learners with neurotypical conditions, eg dyscalculia, may have difficulties in performing calculations without recourse to a numerical aid/formula.
- Some learners with communication difficulties may not be able to record, manipulate or present mathematical information, eg those with difficulties in reading and writing text, symbolic representation and diagrams.

If a learner has a disability affecting their ability to engage in learning or generate evidence for this Unit, centres could provide, where appropriate, the following support:

- practical helpers under direct learner instruction could assist with practical measurement activities
- adapted equipment would also be appropriate for measuring tasks
- the use of a calculator or similar aid
- ICT and assistive technologies

It is recognised that centres have their own duties under equality and other legislation and policy initiatives. The guidance given in these *Unit Support Notes* is designed to sit alongside these duties but is specific to the delivery and assessment of the Unit.

Alternative approaches to Unit assessment to take account of the specific needs of learners can be used. However, the centre must be satisfied that the integrity of the assessment is maintained and that the alternative approach to assessment will, in fact, generate the necessary evidence of achievement.

Appendix 1: Reference documents

The following reference documents will provide useful information and background.

- Assessment Arrangements (for disabled candidates and/or those with additional support needs) — various publications on SQA's website: http://www.sqa.org.uk/sqa/14976.html
- *Building the Curriculum 4: Skills for learning, skills for life and skills for work*
- *Building the Curriculum 5: A framework for assessment*
- Course Specifications
- Design Principles for National Courses
- *Guide to Assessment* (June 2008)
- Overview of Qualification Reports
- *Overview of Qualification Reports*
- *Principles and practice papers for curriculum areas*
- *Research Report 4 — Less is More: Good Practice in Reducing Assessment Time*
- *Coursework Authenticity — a Guide for Teachers and Lecturers*
- *SCQF Handbook: User Guide (published 2009)* and SCQF level descriptors (to be reviewed during 2011 to 2012): www.sqa.org.uk/sqa/4595.html
- *SQA Skills Framework: Skills for Learning, Skills for Life and Skills for Work*
- *Skills for Learning, Skills for Life and Skills for Work: Using the Curriculum Tool*
- SQA Guidelines on e-assessment for Schools
- SQA Guidelines on Online Assessment for Further Education
- SQA e-assessment web page: www.sqa.org.uk/sqa/5606.html

Administrative information

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