



Dearbhú Cáilíochta
agus Cáilíochtaí Éireann
Quality and
Qualifications Ireland

QQI AWARDS STANDARDS.

Mathematical and Numerical Core Competence

February 2024





Foreword

The Qualifications and Quality Assurance Act 2012 requires QQI to ‘determine the standards of knowledge, skill or competence to be acquired, and where appropriate, demonstrated, by a learner before an award may be made by the Authority’. QQI award standards are based on the level indicators and award type descriptors of the National Framework of Qualifications (NFQ) and are governed by QQI Policy for the Determination of Award Standards.

Based on systematic engagement with subject matter expertise and public consultation, award standards for certain broad fields of learning were developed for QQI awards at level 1-4 on the NFQ. These standards represent an elaboration of the generic descriptors of the NFQ. They should facilitate experts in particular fields of learning to create the link between their programmes’ intended learning outcomes and the NFQ. Each award standard is cumulative, the statements of knowledge, skill and competence at NFQ levels 2, 3 and 4, build on the attainment of standards at lower levels, which are not necessarily reproduced at the higher level(s). The implementation and use of these standards is subject to QQI Policy and Criteria for the Validation of Programmes and QQI Policy for the Making of Awards. Whenever an award standard changes, programmes must be updated and validated against the new standards.

These standards are not programme specifications. It is through these, however, that the relationship between a programme, its component parts and the NFQ should be evident. The standards are a reference point and a point of comparison against which individual programmes may be justified.

They are intended to provide general guidance for articulating the learning outcomes associated with a particular field of learning. In designing programmes, providers must take cognisance of the standards for specific fields of learning where they generally relate to the programme being developed. It is, however, recognised that there is a significant growth in multi-disciplinary/inter-disciplinary programmes; there are emerging fields of learning; and in addition, within each field there is the vast spectrum of programmes possible based on a wide range of purpose. In this context, it is not possible to have a standard, or multiple standards, that cater for the complete range of programmes possible. It is therefore expected that the standards for specific fields of learning will be used as reference points for the design of programmes. In designing programmes, providers can draw from more than one standard.

In drafting the standards every effort has been made to ensure that they will provide for flexibility and variety in the design of programmes and therefore encourage innovation within an overall agreed framework. It



is not expected that all programmes will include every learning outcome identified in a standard. It is, however, expected that many programmes will include learning outcomes that are not included in the relevant standard.

When designing a programme, each learning outcome in the standard should be considered. Where departure from these is necessary, it should be justified in the context of the specific orientation of the programme and other facts pertaining to it. Each programme provider should be able to demonstrate how the design and content of its own programmes has been informed by the standard.

The level descriptors of the Framework, the award type descriptors and consequently the standards for the specific fields of learning are divided into three different types of learning outcomes - knowledge, skill and competence. These strands are further subdivided into eight sub-strands. Each strand/sub-strand is important. The relative weighting of each strand in a programme will vary from programme to programme. The weighting will be determined by many factors, including for example, the practical nature of a programme, or otherwise.

Each strand/sub-strand should be addressed appropriately in every programme. Where a programme is multidisciplinary or inter-disciplinary in nature, the use of more than one standard may be necessary. In such cases, the scope, depth and balance of knowledge, skill and competence should be attended to.

The titles of awards made by QQI on foot of these award standards shall be consistent with QQI Policy on the Making of Awards with an exception in the case of major awards where the named award stem shall have the following form: 'Level X Certificate in Lifelong Learning in' [specialisation].

These standards are determined by QQI under section 49(1) of the Qualifications (Education and Training) Act 2012.



DRAFT AWARD STANDARDS – MATHEMATICAL AND NUMERICAL (CORE COMPETENCE)

Purpose	The purpose of this draft broad standard is to enable design of a variety of programmes enabling the learner to develop the relevant mathematical and numerical knowledge, skill and competence in order to solve a range of problems in everyday situations.
References	<p>Please note that the above standard is aligned to the Key Competences for Lifelong Learning. This particular competence relates specifically to the “ Mathematical and Numerical Core Competence” European Commission, Directorate-General for Education, Youth, Sport and Culture, Key competences for lifelong learning, Publications Office, 2019 https://data.europa.eu/doi/10.2766/291008.</p> <p>Essential knowledge, skills and attitudes related to this competence*</p> <p>Necessary knowledge in mathematics includes a sound knowledge of numbers, measures and structures, basic operations and basic mathematical presentations, an understanding of mathematical terms and concepts, and an awareness of the questions to which mathematics can offer answers.</p> <p>An individual should have the skills to apply basic mathematical principles and processes in everyday contexts at home and work (For example, financial skills), and to follow and assess chains of arguments. An individual should be able to reason mathematically, understand mathematical proof and communicate in mathematical language, and to use appropriate aids including statistical data and graphs and to understand the mathematical aspects of digitalisation.</p> <p>A positive attitude in mathematics is based on the respect for truth and a willingness to look for reasons and to assess their validity.</p> <p>*EU Council Recommendation on Key Competences for Lifelong Learning, Official Journal of the European Union, 2018 C_2018189EN.01000101.xml (europa.eu)</p>

Note: The indicators at each level build on the skills from the previous one.

The outcomes at each NFQ level include those of all the lower levels in the same sub-strand unless stated otherwise.



NFQ	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
KNOWLEDGE BREADTH	Elementary knowledge	Knowledge that is narrow in range	Knowledge Moderately Broad in Range	Broad Range of Knowledge
Scope of knowledge	Elementary knowledge and understanding of Mathematical concepts; Quantity, Patterns and Relationship, Measures, Dimension and Space, Data and Chance.	Narrow range of knowledge and understanding of Quantity, Pattern and Relationship, Measures, Dimension and Space, Data and Chance.	Moderately broad knowledge and understanding of Quantity, Pattern and Relationship, Measures, Dimension and Space, Data and Chance.	Broad knowledge and understanding of Quantity, Pattern and Relationship, Measures, Dimension and Space, Data and Chance.
KNOWLEDGE KIND	Demonstrable by recognition or recall	Concrete in reference and basic in comprehension	Mainly concrete in reference and with some comprehension of relationship between knowledge elements	Mainly concrete in reference and with some elements of abstraction or theory
Foundations	Identify mathematical language and representation.	Recognise mathematical language and representation.	Describe a combination of both informal and formal oral and written mathematical language and representation.	Understand a range of informal and formal oral and written mathematical language and symbols. Understand complex numbers. Calculus, Differentiation.
Geometry	Identify and name common shapes.	Recognise the properties of common shapes.	Describe the properties of common shapes.	Understand the properties of common shapes.
Algebra			Knowledge of how laws and rules can be used to simplify expressions, solve equations and transpose formulae.	Understand how laws and rules can be used to simplify expressions, solve equations and transpose formulae.



			Knowledge of the laws of indices. and logs.	Understand the laws of indices. and logs.
Probability			Knowledge of basis statistical concepts.	Explain basic statistical concepts.

NFQ	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
KNOW-HOW AND SKILL RANGE	Demonstrate basic practical skills and carry out directed activity using basic tools.	Demonstrate limited range of basic practical skills, including the use of relevant tools.	Demonstrate a limited range of practical and cognitive [skills and tools].	Demonstrate a moderate range of practical and cognitive skills and tools.
KNOW-HOW AND SKILL SELECTIVITY	Perform processes that are repetitive and predictable	Perform a sequence of routine tasks given clear direction	Select from a limited range of varied procedures and apply known solutions to a limited range of predictable problems	Select from a range of procedures and apply known solutions to a variety of predictable problems
Number	Use basic numerical notation.	Work with basic numerical notation.	Work confidently with basic numerical notation.	Work confidently with standard and basic scientific notation.
	Carry out very simple numerical calculations.	Carry out simple numerical calculations (add, subtract, multiple, divide, recognise fractions).	Carry out a range of straightforward numerical calculations.	Work confidently to convert currencies, different measurement systems and different number formats (including decimal, fraction and percentages).
	Generate results which make sense.	Generate results to a given level of accuracy using given methods and given checking procedures appropriate to the specified purpose.	Generate results to a given level of accuracy using given methods, measures and checking procedures appropriate to the specified purpose.	Generate results to a given level of accuracy using a variety of methods, measures and checking procedures appropriate to the specified purpose.



	Choose one numerical operation to carry out.	Select appropriate methods to be applied to particular tasks.	Select appropriate numerical methods to be applied to a predictable range of problems.	Select appropriate numerical methods to be applied to a varied range of problems.
	Sort and classify objects using a single criterion.	Sort and classify objects using two criteria.	Sort and classify objects according to their properties.	Make numerical comparisons with more complex numerical data in a range of formats
Algebra			Solve basic algebraic equations including linear equations and linear inequalities.	Solve algebraic equations including linear equations, quadratic equations and linear inequalities.
Geometry		Use mathematical language of shape and space.	Sort 2-D and 3-D shapes to solve practical problems using properties (For example, lines of symmetry, side length, angles). understand how to use tools of geometry plotting on the Cartesian Plane.	Sort 2-D and 3-D shapes to solve a variety of practical problems using properties (For example, lines of symmetry, side length, angles). Functions on the Cartesian Plane. Complex trigonometry,
Probability			Calculate statistics to include averages, dispersion (For example, standard deviation), mean, mode and median. Present information from data collected.	Calculate statistics to include averages, dispersion, mean, mode and median. Present information from data collected. Probability.



Abstraction	Select key mathematical information in simple activities or texts.	Identify relevant mathematical information in familiar activities or texts.	Select and interpret mathematical information that may be partly embedded in a range of familiar, and some less familiar, tasks and texts.	Select the mathematical information embedded in a range of tasks and texts.
	Locate key mathematical information in simple activities or texts.	Identify relevant mathematical information in familiar activities or texts.	Select and interpret mathematical information that may be partly embedded in a range of familiar, and some less familiar, tasks and texts.	Extract and apply mathematical information embedded in a range of tasks and texts.
Communicate using quantitative forms	Extract simple graphical information from a simple table or diagram.	Extract information from simple tables, graphs, charts, or diagrams.	Extract information from straightforward tables, graphs, charts, or diagrams.	Interpret graphical forms, analyse and present outcomes for a range of information formats.
	Communicate in simple table or diagram.	Communicate information appropriately through simple tables, graphs, charts, or diagrams.	Use appropriate graphical forms to convey particular types of information.	Use appropriate graphical forms to convey particular types of information in specific contexts.
	Construct simple representations or diagrams, using knowledge of numbers, measures or shape and space.	Represent information so that it makes sense to others (For example, in lists, tables and diagrams).	Communicate information in straightforward tables, graphs, charts, or diagrams.	Use mathematical language and representations to communicate information correctly.
	Use everyday informal oral language or highly familiar written representation to communicate simple mathematical information.	Use informal and some formal oral and written mathematical language and representation to communicate mathematically.	Use a combination of both informal and formal oral and written mathematical language and representation to communicate mathematically.	Use a range of informal and formal oral and written mathematical language and symbols to communicate mathematically.



Present and explain results	Present results which show an understanding of the intended purpose using appropriate numbers, measures, objects or pictures.	Present results which meet the intended purpose using appropriate numbers, simple diagrams and symbols.	Explain results which meet the intended purposes using appropriate numbers, diagrams, charts and symbols.	Interpret results using appropriate numbers, diagrams, charts and symbols.
Observation and data collection	Collect simple numerical information.	Identify simple numerical information.	Make observations and record numerical information.	Interpret numerical information.
Select and apply problem solving strategies	Select simple mathematical processes and procedures that are appropriate to given tasks found in the context of daily living.	Select the appropriate mathematical processes to solve a given problem that is appropriate to the level outlined above.	Select the appropriate formulae and correctly apply to appropriate calculations for example, volume, area of 2D and 3D shapes. Select appropriate numerical methods to be carried out.	Differentiate between formulae and correctly select and apply to appropriate calculations to solve practical problems: for example, volume, area capacity ensuring the answer is given in the correct format and using the correct terminology.
Draw conclusions	Make simple numerical comparisons.	Draw simple conclusions from results produced.	Draw straightforward conclusions from results.	Analyse findings and interpret results based on data presented.

NFQ	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4
COMPETENCE CONTEXT	Act in closely defined and highly structured contexts	Act in a limited range of predictable and structured contexts	Act within a limited range of contexts	Act in familiar and unfamiliar contexts
	Locate mathematical information and carry out mathematical functions processes that are very concrete, real-life activities that are familiar to most in daily life.	Demonstrate the ability to understand mathematical information given by numbers, symbols, simple diagrams and charts in graphical, numerical and written material.	Apply information given by numbers, symbols, diagrams and charts for different purposes and in different ways in graphical, numerical and written material.	Analyse information given by numbers, symbols, diagrams and charts used for different purposes and in different ways in graphical, numerical and written material.



COMPETENCE ROLE	Act in a limited range of roles	Act in a range of roles under direction	Act under direction with limited autonomy; function within familiar, homogenous groups	Act with considerable amount of responsibility and autonomy
	Carry out a simple range of mathematical processes that can be applied to concrete and familiar real-life situations.	Carry out mathematical processes and procedures that will aid with solving mathematical problems in real-life familiar situations.	Carry out a range of straightforward numerical calculations.	Confidently manipulate everyday mathematical problems in modern society.
COMPETENCE LEARNING TO LEARN	Learn to sequence learning tasks; learn to access and use a range of learning resources	Learn to learn in a disciplined manner in a well-structured and supervised environment	Learn to learn within a managed environment	Learn to take responsibility for own learning within a supervised environment
	Exercise curiosity and willingness to learn.	Seek opportunities for self-development and to apply basic mathematical and numerical skills in everyday life.	Seek opportunities for self-development and to apply mathematical principles and numerical skills in everyday contexts.	Seek opportunities for self-development and apply a range of mathematical and numerical skills in everyday contexts to broaden skills that facilitate further learning and progression.
COMPETENCE INSIGHT	Begin to demonstrate awareness of independent role for self	Demonstrate awareness of independent role for self	Assume limited responsibility for consistency of self-understanding and behaviour	Assume partial responsibility for consistency of self-understanding and behaviour
	Demonstrate the ability to see mathematics as a creative pursuit.	Demonstrate the ability to see mathematics within the environment and within familiar tasks.	Identify and select the correct maths skills or tools (For example, using technology in Mathematics - excel, calculators, graphical apps) and to competently apply them to a limited range of contexts.	Identify and select the correct maths skills or tools and to competently apply them to a variety of contexts (For example, Maths in personal finance, Maths in everyday life).



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