Field **Sciences**

Review of *Mathematics* and *Statistics and Probability* Level 1 achievement and unit standards

Unit standards

Subfield	Domain	ID
Mathematics	Algebra	5223, 5226, 5238, 5239, 7568, 20659
	Geometry	5229, 5231, 5237, 5252
	Mathematical Processes	5233
	Mathematical Studies	7559, 7561, 7570, 12319-12322, 12328
	Measurement	5228, 5241, 8492, 20662
	Number	5224, 5225, 5227, 5234, 5235, 8489-8491, 20663, 23738, 23739
	Trigonometry	5236
Statistics and Probability	Probability	5232, 5242, 7571
	Statistics	5230, 5240, 7565

Achievement standards

Domain	ID	Subject reference
Algebra	90147, 90148, 90799, 90800	Mathematics 1.1, 1.2, CAS Mathematics 1.1, 1.2
Geometry	90150, 90152, 90153	Mathematics 1.4, 1.8, 1.9
Measurement	90149	Mathematics 1.3
Number	90151	Mathematics 1.7
Probability	90194	Mathematics 1.6
Statistics	90193	Mathematics 1.5

This report was republished in April 2011 to change the expiry date of unit standards categorised as category C or D from December 2012 to December 2013.

The Ministry of Education and NZQA National Qualifications Services (NQS) have completed the review of the unit standards and achievement standards listed above.

New registration date **December 2010**

Date new versions re-published **April 2011**

Date new versions published **December 2010**

Planned review date **December 2014**

Summary of review and consultation process

In 2008 the Ministry of Education (MoE) and NZQA began to review achievement and unit standards in light of the revised New Zealand Curriculum (NZC). This Alignment of Standards (AoS) review also addressed duplication of outcomes, credit parity, fairness, consistency, and coherence. The AoS review was guided by the revised NZC itself and the Standards Review Guidelines. A copy of the NZC is available at http://nzcurriculum.tki.org.nz/Curriculum-documents/The-New-Zealand-Curriculum,

Teacher subject associations were involved in the review, and draft achievement standards were the focus of wide consultation, especially with secondary schools and teachers. Extensive resources, including student exemplars, were also developed to support these standards, and are available on the MoE and/or the NZQA websites.

The review of unit standards included consultation with tertiary providers to assess continued relevance and likely future use of the standards. Unit standards that duplicate achievement standard outcomes and those without the likelihood of future use were recommended for expiry.

National consultation was undertaken in 2009, with the results analysed by Research New Zealand. The responses were generally positive.

The review of unit and achievement standards at Level 1 was completed in time for implementation in schools in 2011. Standards at Levels 2 and 3 will be implemented in 2012 and 2013 respectively.

Main changes resulting from the review

- All NZC Level 6 (NZQF Level 1) outcomes derived from the NZC are now assessed using achievement standards, and the three remaining unit standards are no longer linked to the NZC.
- Existing achievement standards were reviewed and new achievement standards were developed to align with the NZC. See table below.
- Grading criteria for achievement standards were reviewed in accordance with the Standards Review Guidelines.
- Unit standards that recognised similar outcomes as achievement standards were replaced or expired apart from unit standards 5223 and 5236; and unit standard 26567 which replaced unit standards 20662 and 20663. These three unit standards are required in the tertiary sector.
- The credit value of unit standards 5223 and 5236 was reduced from 2 to 1 to better reflect the required learning, practice, and assessment time.

In August 2010, unit standards 26623, 26626, and 26627 in the *Numeracy* domain were listed on the Directory of Assessment Standards (DAS). These unit standards are included in the *Review Categories and changes to classification, title, level, and credits* table in italics as recommended alternatives for expiring standards.

Appendix 1 includes a detailed description of the review of, and the changes to, standards in the *Mathematics* and *Statistics and Probability* domains.

Impact on existing accreditations

Current Accreditation for			Accreditation extended to		
Nature of accreditation	**Classification or ID**	**Level**	**Nature of accreditation**	**ID**	**Level**
Field	Sciences	Any	Standards	26623, 26626, 26627	1
Subfield	Mathematics	Any	Standards	26623, 26626, 26627	1
Domain	Measurement	Any	Standard	26627	1
Domain	Measurement	1	Standard	26567	1
Domain	Number	Any	Standards	26623, 26627	1
Standard	5224	1	Standard	26623	1
Standard	5225	1	Standard	26623	1
Standard	5227	1	Standard	26623	1
Standard	5228	1	Standard	26627	1
Standard	5229	1	Standard	26623	1
Standard	5235	1	Standard	91026	1
Standard	5240	1	Standards	91035, 91036	1
Standard	5241	1	Standard	91030	1
Standard	5252	1	Standard	91031	1
Standard	8489	1	Standard	26623	1
Standard	8490	1	Standard	26623	1
Standard	8491	1	Standard	26626	1
Standard	8492	1	Standard	26627	1
Standard	20662	1	Standard	26567	1
Standard	23738	1	Standard	26623	1
Standard	23739	1	Standard	26623	1

Impact on Accreditation and Moderation Action Plan (AMAP)

All new achievement standards have been registered on AMAP 0233.

All unit standards have been registered on AMAP 0071.

Impact on registered qualifications

Key to type of impact	
Affected	The qualification lists a reviewed classification (domain or subfield) in an elective set The qualification lists a standard that has changes to level or credits The qualification lists a C or D category standard
Not materially affected	The qualification lists a standard that has a new title The qualification lists a standard that has a new classification

The following NZQA National Qualifications Services qualification is *Affected* by the outcomes of this review and will be updated when it is reviewed in 2011.

Ref	Qualification Title	ID
0231	National Certificate in Employment Skills	8489, 8490, 8491

The following table identifies qualifications developed by other SSBs that are *Affected* by the outcomes of this review. The SSBs have been advised that the qualifications require revision.

Ref	Qualification Title	ID	SSB Name
0147	National Certificate in Leather Garment Manufacture (Level 3) with specialist strands in Material Selection and Cutting, Sewing and Garment Assembly, and Garment Finishing and Inspection	8489, 8492	Apparel and Textile Industry Training Organisation
0877	National Certificate in Boatbuilding (Level 4) with strands in Marine Cabinetmaking, Composite Sparmaking, Alloy Boatbuilding, Marine Rigging, Marine Painting, Composite Boatbuilding, Steel Boatbuilding, Wooden Boatbuilding, Marine Systems Engineering, Metal Sparmaking, Composite Production Trailer Boats, and Alloy Production Trailer Boats	5231	Boating Industry Training Organisation
0272	National Certificate in Fibre Cement Linings (Level 4) with strands in Fixing, and Finishing	8492	Building and Construction Industry Training Organisation
0273	National Certificate in Fibrous Plaster (Installation) (Level 4) with an optional strand in Specialist Systems	8492	
0274	National Certificate in Fibrous Plaster (Manufacture) (Level 4) with optional strands in Panels and Tiles, and Specialist Models and Mould Making	8492	
0275	National Certificate in Plaster Board (Level 4) with strands in Fixing, and Finishing, and with an optional strand in Specialist	8492	
0786	National Certificate in Proprietary Plaster Cladding Systems (Level 4) with strands in Rebated Fibre Cement, Lightweight Fibre Cement, and External Insulation Finishing Systems (EIFS)	8492	
1390	National Certificate in Specialist Interiors (Installation) (Level 3) with strands in Suspended Ceilings, and Proprietary Partitions, and with an optional strand in Access Floors	8492	
1450	National Certificate in Basic Residential Property Maintenance (Level 2) with an optional strand in Basic Construction Project Work	8492	
1452	National Certificate in Concrete Core Skills (Level 2)	8492	
0129	National Certificate in Metal Casting (Technology)	5223, 5226, 5228	Competenz
0342	National Certificate in Food and Related Products Processing (Level 2)	8489, 8491	

Ref	Qualification Title	ID	SSB Name
0568	National Certificate in Hand Operated Fire Fighting Equipment (Level 3)	8490, 8492	
0570	National Certificate in Fixed Fire Protection Systems (Level 4)	8490	
0765	National Certificate in Architectural Aluminium Joinery (Entry Skills) (Level 2)	8489	
0863	National Certificate in Fixed Fire Protection Systems (Level 3) with strands in Installation, and Testing	8490	
0958	National Certificate in Rail Transport (Level 2)	8489	
1112	National Certificate in Rail Infrastructure (Level 3)	8489	
1262	National Certificate in Mechanical Engineering (Level 4) with strands in Fitting and Machining, General Engineering, Machining, Maintenance Engineering, Toolmaking, and Electricity Supply	5223, 5226, 5228	
1386	National Certificate in Manufacturing (Metal and Related Products) (Level 2)	8489, 8491	
1387	National Certificate in Manufacturing (Metal and Related Products) (Level 3)	8489	
1581	National Certificate in Manufacturing (Core Skills) (Level 2)	8489	
0432	National Certificate in Surveying (Assistant) (Level 3)	5236	InfraTrain New Zealand
1326	National Certificate in Civil Construction Works with strands in Concrete Kerb and Channel; Concrete Work; Culverts and Drainage Systems; Interlocking Paving; Retaining Structures; Road Construction; Road Maintenance; Road Safety Barrier; Roadside Amenities; and Traffic Signage	5225, 5228, 5235, 5241, 8491, 8492, 20662, 20663	
0955	National Certificate in Meat Processing (Smallgoods) (Level 1)	8489, 8491, 8492	New Zealand Industry Training Organisation
0956	National Certificate in Meat Processing (Smallgoods) (Level 2) with strands in Raw Processing; Cooked Processing; and Slicing, Packaging and Dispatching; and with optional strands in Workplace Safety and Health; and Workplace Communications	8489, 8491, 8492	
1078	National Certificate in Amenity Turf Maintenance (Level 3)	8492	New Zealand Sports Turf Industry Training Organisation
1340	National Certificate in Industrial Textile Fabrication (Level 3) with strands in Canvas Fabrication; Sailmaking; and Vehicle Trimming and Upholstery	8492	NZ Motor Industry Training Organisation (Incorporated)
0110	National Certificate in Scaffolding (Level 4) with strands in Advanced Scaffolding, and Suspended Scaffolding	5228, 8489	Opportunity – The Training Organisation

Ref	Qualification Title	ID	SSB Name
0111	National Certificate in Rigging with strands in Basic Rigging, Intermediate Rigging, and Advanced Rigging	5228, 5236, 8489	
0118	National Certificate in Cranes (Mobile Crane Supervision) (Level 5)	5228, 5236	
0119	National Certificate in Cranes (Mobile Crane Dispatch Supervision) (Level 3)	5228, 5236	
0120	National Certificate in Cranes (Tower Crane Supervision) (Level 5)	5228, 5236	
1016	National Certificate in Industrial Rope Access (Elementary Rope Skills) (Level 3)	8489	
1352	National Certificate in Scaffolding (Elementary) (Level 3)	5228, 8489	
1520	National Certificate in Cranes (Advanced Crane Operation) (Level 5)	5228, 5236	
0566	National Certificate in Cablemaking (Level 2) with strands in Wiredrawing, Conductor Assembly, Extrusion, Cable Assembly, and Cable Testing	8489, 8490	Plastics and Materials Processing Industry Training Organisation
1233	National Certificate in Pharmaceutical and Allied Products Manufacturing (Level 1)	5228, 5240, 8490, 8491, 8492	
1235	National Certificate in Engineering and Technology (Pharmaceutical and Allied Products) (Level 2)	5223, 5226, 5228	
1361	National Certificate in Plastics Processing Technology (Production) (Level 1) with strands in General, Injection Moulding, Extrusion, Blow Moulding, Thermoforming, Blown Film Extrusion, Film Conversion, Injection Stretch-Blow Moulding, Rotational Moulding	8489, 8490	
0990	National Certificate in Distribution (Level 2)	8489, 8490	Retail Institute
0180	National Certificate in Passenger Service (Small Passenger Vehicle) with an optional strand in Taxi Driving	5234	Tranzqual ITO
0189	National Certificate in Commercial Road Transport (Introductory Skills)	8489, 8490, 8492	
0190	National Certificate in Passenger Service (Large Passenger Vehicle) with strands in School Bus; Urban and Local Route; and Long Distance	8489, 8491	
1010	National Certificate in Stevedoring and Ports Industry (Cargo Handling) (Level 3)	8489	
1451	National Certificate in Stevedoring and Ports Industry (Cargo Handling) (Level 2)	8490	
1505	National Certificate in Relocation Operations (Level 2) with strands in Domestic Relocation Operations, and International Relocation Operations	8492	

Impact of changes on NCEA Exclusions List

For transition purposes, the following exclusions will apply for new achievement standards. This transition will apply until December 2011 only.

New achievement standard	Existing achievement standard
91030	90149
91033	90150
91034	90150
91035	90193
91036	90193

For transition purposes where there is impact on qualifications, the following exclusions will apply for new achievement standards. This transition will apply until December 2013 only, when the unit standards will expire.

New achievement standard	Existing unit standards
91026	5235
91027 [Externally assessed]	5239
91028 [Externally assessed]	5238
91029	5238
91030	5241
91031 [Externally assessed]	5252
91032	5236
91033	5231, 5237
91034	5237
91035	5240
91036	5240

Review Categories and changes to classification, title, level, and credits

The following summary shows the changes made to the standards as a result of the review. All changes are in **bold**. Recommended alternatives for Category D unit standards are shown in *italics*.

Key to review category	
A	Dates changed, but no other changes are made - the new version of the standard carries the same ID and a new version number
B	Changes made, but the overall outcome remains the same - the new version of the standard carries the same ID and a new version number
C	Major changes that necessitate the registration of a replacement standard with a new ID
D	Standard will expire and not be replaced

Externally assessed achievement standards categorised as category C or D expire at the end of	**December 2010**

Internally assessed achievement standards categorised as category C or D expire at the end of	**December 2011**

Unit standards categorised as category C or D expire at the end of	**December 2013**

Sciences > Mathematics > Algebra

ID	Title	Level	Credit	Review Category
5223	Use formulae and equations to solve problems	1	2	B
1	**Use formula and equations to solve problems in the workplace**	**1**	**1**	
5226	Construct and use tables and graphs	1	2	D
5238	Draw and describe graphs involving two variables	1	4	C
91028	**Investigate relationships between tables, equations and graphs [Externally assessed]**	**1**	**4**	
91029	**Apply linear algebra in solving problems**	**1**	**3**	
5239	Describe patterns and solve problems and equations	1	3	C
91027	**Apply algebraic procedures in solving problems [Externally assessed]**	**1**	**4**	
7568	Use formulae to solve problems and describe rates from graphs	1	2	D
20659	Demonstrate basic algebra skills	1	2	D
90147	Use straightforward algebraic methods and solve equations	1	4	D
90148	Sketch and interpret graphs	1	3	D
90799	Demonstrate an understanding of straightforward algebraic methods	1	4	D
90800	Demonstrate an understanding of the features of graphs	1	3	D

Sciences > Mathematics > Geometry

ID	Title	Level	Credit	Review Category
5229	Use geometry to describe situations and solve problems	1	2	D
5231	Use constructions and make drawings for geometrical situations	1	2	C
5237	Describe situations using transformations and loci	1	3	C
90150	Use geometric techniques to produce a pattern or object	1	2	C
91033	**Apply knowledge of geometric representations in solving problems**	**1**	**3**	
91034	**Apply transformation geometry in solving problems**	**1**	**2**	
5252	Derive angle properties of circles and use them to solve mathematical problems	1	3	C
91031	**Apply geometric reasoning in solving problems [Externally assessed]**	**1**	**4**	
90152	Solve right-angled triangle problems	1	2	C
91032	**Apply right-angled triangles in solving measurement problems**	**1**	**3**	
90153	Use geometric reasoning to solve problems	1	2	D

Sciences > Mathematics > Mathematical Processes

ID	Title	Level	Credit	Review Category
5233	Use mathematical processes and skills in a variety of contexts	1	7	D

Sciences > Mathematics > Mathematical Studies

ID	Title	Level	Credit	Review Category
7559	Demonstrate knowledge of the mathematics of geometry patterns	1	2	D
7561	Demonstrate knowledge of the mathematics of number patterns	1	2	D
7570	Carry out and report on a given mathematical study	1	2	D
12319	Find relationships between measurements	1	2	D
12320	Demonstrate knowledge of finite arithmetic systems	1	2	D
12321	Describe mathematical algorithms and use them to solve problems	1	2	D
12322	Use mathematics in the design of a given object or process	1	2	D
12328	Demonstrate knowledge of the history of a mathematical topic or mathematician	1	2	D

Sciences > Mathematics > Measurement

ID	Title	Level	Credit	Review Category
5228	Take measurements and use calculations to solve measurement problems	1	3	D
8492	Use standard units of measurement	1	3	D
26627	*Use measurement to solve problems*	*1*	*3*	
5241	Use strategies to solve measurement problems	1	3	C
90149	Solve problems involving measurement of everyday objects	1	3	C
91030	**Apply measurement in solving problems**	**1**	**3**	

Sciences > Mathematics > Number

ID	Title	Level	Credit	Review Category
5224	Use decimals and percentages to solve problems	1	2	D
5225	Use fractions, ratio, and proportion to solve problems	1	2	D
5227	Solve problems involving money	1	3	D
8489	Solve problems which require calculation with whole numbers	1	2	D
8490	Solve problems using calculations with numbers expressed in different forms	1	2	D
23738	Use numeracy strategies to solve problems involving whole numbers	1	2	D
23739	Use numeracy strategies to solve number problems involving decimals, percentages and fractions	1	2	D
26623	*Use number to solve problems*	*1*	*4*	
5234	Use calculations in money situations	1	3	D
5235	Use strategies to solve number problems	1	2	C
91026	**Apply numeric reasoning in solving problems**	**1**	**4**	
8491	Read and interpret information presented in tables and graphs	1	2	D
26626	*Interpret statistical information for a purpose*	*1*	*3*	
90151	Solve straightforward number problems in context	1	3	D

Sciences > Mathematics > Trigonometry

ID	Title	Level	Credit	Review Category
5236	Use Pythagoras' Theorem and trigonometry to find unknowns in right-angled triangles	1	2	B
	Use Pythagoras' theorem and trigonometry to solve problems related to right-angled triangles in the workplace	**1**	**1**	

Sciences > Statistics and Probability > Probability

ID	Title	Level	Credit	Review Category
5232	Determine probabilities in practical situations	1	2	D
5242	Determine probabilities	1	2	D
7571	Use simulation techniques to determine probability and solve problems	1	2	D
90194	Determine probabilities	1	2	D
91038	**Investigate a situation involving elements of chance**	**1**	**3**	**New**

Sciences > Statistics and Probability > Statistics

ID	Title	Level	Credit	Review Category
5230	Carry out a statistical investigation and interpret data	1	3	D

ID	Title	Level	Credit	Review Category
5240	Explore data and evaluate reports	1	3	C
90193	Use statistical methods and information	1	3	C
91035	**Investigate a given multivariate data set using the statistical enquiry cycle**	**1**	**4**	
91036	**Investigate bivariate numerical data using the statistical enquiry cycle**	**1**	**3**	
7565	Carry out and report on a given statistical investigation	1	2	D
91037	**Demonstrate understanding of chance and data [Externally assessed]**	**1**	**4**	**New**

Sciences > Mathematics

ID	Domain	Title	Level	Credit	Review Category
20662	Measurement	Make estimates of measurements with common units	1	2	C
20663	Number	Use a strategy to estimate the solution to number problems	1	2	C
26567	**Number**	**Use a strategy to estimate the solutions to number problems and make estimates of measurements in the workplace**	**1**	**2**	

Appendix 1

Development of L1 Mathematics and Statistics Standards

Process of Aligning Standards with the New Zealand (NZC)

The reviewed standards are derived from the achievement objectives from the Mathematics and Statistics learning area in the NZC. Various ways of grouping the achievement objectives of the NZC into standards for assessment were considered. The decision was made by the writing group to stay with the current split into the traditional topic based standards. This has the advantage of the title of each standard succinctly conveying the content of the standard. The most NZC change has occurred in the statistics strand and the standards reflect this.

Addressing Duplication

All of the existing registered mathematics achievement standards are replaced by the aligned standards. In addition, some unit standards based on the old NZC at Levels 6, 7, or 8 duplicate new standards and are therefore recommended for expiry. Unit standards which do not duplicate achievement standards and have high usage in the tertiary sector have been reviewed and retained.

Addressing Credit Parity

The guideline of 10 hours of learning for each credit has been applied to the standards. It should be noted that this time includes time both in class and out of class for teaching, practice, study and assessment for a notional average student. It was assumed that about 5 hours of in class time could be associated with each credit which in most schools would mean more than one week per credit. In general, credit values are similar to the previous standards, with some increases where it was considered that the learning programme would need more time.

External and Internal Assessment:

The Principles for Standards Review recommend that there be a maximum of three externally assessed standards in a three hour examination. This is to provide students with a reasonable amount of time to provide their best evidence. The limit of three externally assessed standards was a big change from the previous six externally assessed standards at this level. After considerable discussion it was decided to develop one external standard derived from each of the three strands of the learning area. Various factors were considered in the discussions leading to this decision.

- Given strong feedback in the early consultation that technology restrictions should be placed on externals rather than internals, it was decided to choose standards for external assessment that were suitable for assessment under examination conditions where students are restricted to the use of a graphic calculator. For internally assessed standards there are more options for project work, assignments, and the use of Computer Algebra System (CAS) or computer technology, which would be particularly appropriate for practical work in geometry or statistics.
- The equity issues associated with technology particularly apply to the standards which are algebraic in nature, where a graphic or CAS calculator would give an unfair advantage. For this reason it was decided to make the algebra standard at Level 1 (AS 1.2) a technology free standard, which can be assessed by a Common Assessment Task (CAT), set externally, but marked and moderated as for an internal. This standard has now been designated external to acknowledge the external setting.

The Level 2 and 3 algebra and calculus standards are recommended to be external and limited to graphic calculators.

- The new standard involving graphs (AS 1.3) has a new emphasis on linking graphs, tables and equations.

What has changed?

- All the standards assessing outcomes from the NZC are now achievement standards
- The format and design of the standards has changed (see below)
- There are sufficient achievement standards at each level to offer a choice of assessment tools for different learning programmes.

Format of the standards

The titles of these standards are identical to the achieved criterion in each standard because this is the level of performance which must be reached to gain credit. Each standard has a single outcome. This will enable a more holistic approach in assessment design and in making judgements against the standard.

The steps up to merit and excellence grades are described in terms of the quality of thinking (not in terms of content). Current practice, and the direction for teaching and learning described in the NZC, was taken into consideration when trying to describe the quality of thinking for each grade level. It was decided that a generic description across all mathematics standards was possible. The challenge was to find a short word or phrase which would describe each grade level. Some terminology has been borrowed from the Structure of Observed Learning Outcomes (SOLO) taxonomy. It was considered that "relational thinking" is a good summary of merit level thinking, and that "extended abstract thinking" could apply to excellence level thinking. These descriptions are written into the achievement criteria and explanatory note 2 in each standard. A similar generic distinction and label was arrived at for statistics, where "justification" is required for merit and "statistical insight" for excellence.

This terminology is included in the assessment resources, and exemplars of student work, developed for each of the standards.

Programmes of learning

It is not expected that schools will include all of the NZC objectives in a learning programme or course nor would schools use all of the standards to assess the outcomes of such a programme or course. Schools have a choice, and should offer pathways, including courses and assessments, appropriate for the needs and capabilities of their students. In several consultations about mathematics assessment in recent years there has been a consistent message that it is unrealistic to try to cover all curriculum outcomes in one course. The new mathematics and statistics learning area in the NZC has an increased emphasis on statistics but very little has been removed from the other parts of the NZC to make room for this. Teachers now have the option of choosing which aspects of the NZC are best suited to various groups of students. The matrix of aligned standards offers sufficient choice to provide for a variety of courses appropriate for a range of students.

Issues arising from national consultation included:

- credit allocation
- mode of assessment
- the lack of detail about mathematical content in the standards
- the need for examples of assessment tasks
- a perception that there is a lot to be assessed in a one year course.

Changes to all mathematics standards as a result of feedback from consultation included the following:

- The explanatory notes have been adjusted to clarify the distinction between the mathematical process and the communication elements of the description. Both the application and the communication are required.
- Explanatory note 2 may include the words “a range of” indicating that at least three different methods should be demonstrated.
- In the definition for relational thinking the words “selecting and” have been added to “carrying out a logical sequence of steps” to clarify that giving a list of steps for students to follow is not acceptable, and that at merit level students are expected to be selecting the sequence of steps.
- The stems to these definitions have been clarified by changing “could involve” to “must involve”.
- The definition of “problem” has been modified so that it does not include the word “modelling” because modelling is not generally required by the criterion for Achieved.