Year 9 standard elaborations — Australian Curriculum v9.0: Mathematics

ACiQ | v9.0

Purpose

The standards elaborations (SEs) have been designed to support teachers to connect curriculum to evidence in assessment so that students are assessed on what they have had the opportunity to learn. The SEs can be used to:

- make consistent and comparable judgments, on a five-point scale, about the evidence of learning in a folio of student work across a year/band
- develop task-specific standards (or marking guides) for individual assessment tasks
- quality assure planning documents to ensure coverage of the achievement standard across a year/band.

Structure

The SEs have been developed using the Australian Curriculum achievement standard. The achievement standard for Mathematics describes what students are expected to know and be able to do at the end of each year. Teachers use the SEs to inform the development of assessment tasks and to make on-balance judgments about the qualities in student work that demonstrate the depth and breadth of their learning.

In Queensland, the achievement standard represents the C standard — a sound level of knowledge and understanding of the content, and application of skills. The SEs are presented in a matrix where the discernible differences and/or degrees of quality between each performance level are highlighted. Teachers match these discernible differences and/or degrees of quality to characteristics of student work to make judgments across a five-point scale. Terms are described in the Notes section following the matrix.

Year 9 Australian Curriculum: Mathematics achievement standard

By the end of Year 9, students recognise and use rational and irrational numbers to solve problems. They extend and apply the exponent laws with positive integers to variables. Students expand binomial products, and factorise monic quadratic expressions. They find the distance between 2 points on the Cartesian plane, and the gradient and midpoint of a line segment. Students use mathematical modelling to solve problems involving change in financial and other applied contexts, choosing to use linear and quadratic functions. They graph quadratic functions and solve monic quadratic equations with integer roots algebraically. Students describe the effects of variation of parameters on functions and relations, using digital tools, and make connections between their graphical and algebraic representations.

They apply formulas to solve problems involving the surface area and volume of right prisms and cylinders. Students solve problems involving ratio, similarity and scale in two-dimensional situations. They determine percentage errors in measurements. Students apply Pythagoras' theorem and use trigonometric ratios to solve problems involving right-angled triangles. They use mathematical modelling to solve practical problems involving direct proportion, ratio and scale, evaluating the model and communicating their methods and findings. Students express small and large numbers in scientific notation. They apply the enlargement transformation to images of shapes and objects, and interpret results. Students design, use and test algorithms based on geometric constructions or theorems.

They compare and analyse the distributions of multiple numerical data sets, choose representations, describe features of these data sets using summary statistics and the shape of distributions, and consider the effect of outliers. Students explain how sampling techniques and representation can be used to support or question conclusions or to promote a point of view. They determine sets of outcomes for compound events and represent these in various ways. Students assign probabilities to the outcomes of compound events. They design and conduct experiments or simulations for combined events using digital tools.

Source: Australian Curriculum, Assessment and Reporting Authority (ACARA), *Australian Curriculum Version 9.0 Mathematics for Foundation–10*
https://v9.australiancurriculum.edu.au/f-10-curriculum/learning-areas/mathematics/year-9?view=quick&detailed-content-descriptions=0&hide-ccp=0&hide-gc=0&side-by-side=1&strands-start-index=0&subjects-start-index=0&load-extra-subject=MATMATY9&achievement-standard=6138ebb7-0cf3-401c-b9fd-7aee52d236c8

Year 9 Mathematics standard elaborations

		A	B	C	D	E
		The folio of student work contains evidence of the following:				
Mathematical proficiencies	**Understanding**	• accurate and consistent identification, representation, description and connection of mathematical concepts and relationships • in complex unfamiliar, complex familiar, and simple familiar situations, identification, representation, description and connection of mathematical concepts and relationships	• accurate identification, representation, description and connection of mathematical concepts and relationships • in complex familiar and simple familiar situations, identification, representation, description and connection of mathematical concepts and relationships	• identification, representation, description and connection of mathematical concepts and relationships • in simple familiar situations, identification, representation, description and connection of mathematical concepts and relationships	• partial identification, representation and description of mathematical concepts and relationships • in some simple familiar situations, identification, representation, description and connection of mathematical concepts and relationships	• fragmented identification, representation and description of mathematical concepts and relationships • in isolated and obvious situations, identification, representation, description and connection of mathematical concepts and relationships
	Fluency	• choice, use and application of comprehensive facts, definitions, and procedures to find solutions • in complex unfamiliar, complex familiar, and simple familiar situations, choice, use and application of facts, definitions, and procedures to find solutions	• choice, use and application of effective facts, definitions, and procedures to find solutions • in complex familiar and simple familiar situations, choice, use and application of facts, definitions, and procedures to find solutions	• choice, use and application of facts, definitions, and procedures to find solutions • in simple familiar situations, choice, use and application of facts, definitions, and procedures to find solutions	• choice and use of partial facts, definitions, and procedures to find solutions • in some simple familiar situations, choice, use and application of facts, definitions, and procedures to find solutions	• choice and use of fragmented facts, definitions and procedures to find solutions • in isolated and obvious situations, choice, use and application of facts, definitions, and procedures to find solutions

		A	B	C	D	E
		The folio of student work contains evidence of the following:				
	Reasoning	• comprehensive explanation of mathematical thinking, strategies used, and conclusions reached • in complex unfamiliar, complex familiar, and simple familiar situations, explanation of mathematical thinking, strategies used, and conclusions reached	• detailed explanation of mathematical thinking, strategies used, and conclusions reached • in complex familiar and simple familiar situations, explanation of mathematical thinking, strategies used, and conclusions reached	• explanation of mathematical thinking, strategies used, and conclusions reached • in simple familiar situations, explanation of mathematical thinking, strategies used, and conclusions reached	• partial explanation of mathematical thinking, strategies used, and conclusions reached • in some simple familiar situations, explanation of mathematical thinking, strategies used, and conclusions reached	• fragmented explanation of mathematical thinking, strategies used, and conclusions reached • in isolated and obvious situations, explanation of mathematical thinking, strategies used, and conclusions reached
	Problem-solving	• purposeful use of problem-solving approaches to find solutions to problems.	• effective use of problem-solving approaches to find solutions to problems.	• use of problem-solving approaches to find solutions to problems.	• partial use of problem-solving approaches to make progress towards finding solutions to problems.	• fragmented use of problem-solving approaches to make progress towards finding solutions to problems.

Key	shading emphasises the qualities that discriminate between the A–E descriptors

Notes

The SEs for Mathematics are organised using the four Mathematical proficiencies, Understanding, Fluency, Reasoning and Problem-solving. The proficiencies represent the actions students demonstrate when working mathematically. The proficiencies are embedded as verbs in the achievement standard and related content descriptions.

Table 1 shows how aspects of the Australian Curriculum achievement standard can be demonstrated as evidence (at the C standard) and related to the proficiencies.

In the Mathematics SEs, there are two types of qualifiers to describe performance across the five-point scale: those describing degrees of quality, and those describing degrees of difficulty. Table 2 describes degrees of difficulty, in terms of the complexity and familiarity of situations.

Tables 1 and 2 should be used in conjunction with the ACARA Australian Curriculum Mathematics glossary: https://v9.australiancurriculum.edu.au/content/dam/en/curriculum/ac-version-9/downloads/mathematics/mathematics-glossary-v9.docx

Table 1: Relationship between Australian Curriculum achievement standard and Mathematical proficiencies

Aspect of the achievement standard	Related content description/s	Examples of evidence	Mathematical proficiencies
Students recognise and use rational and irrational numbers to solve problems.	**Number** • recognise that the real number system includes the rational numbers and the irrational numbers, and solve problems involving real numbers using digital tools AC9M9N01	• recognising rational and irrational numbers	Understanding
		• using rational and irrational numbers to solve problems	Fluency
They extend and apply the exponent laws with positive integers to variables.	**Algebra** • apply the exponent laws to numerical expressions with integer exponents and extend to variables AC9M9A01	• extending and applying the exponent laws with positive integers to variables	Fluency
Students expand binomial products, and factorise monic quadratic expressions.	**Algebra** • simplify algebraic expressions, expand binomial products and factorise monic quadratic expressions AC9M9A02	• expanding binomial products • factorising monic quadratic expressions	Fluency
They find the distance between 2 points on the Cartesian plane, and the gradient and midpoint of a line segment.	**Algebra** • find the gradient of a line segment, the midpoint of the line interval and the distance between 2 distinct points on the Cartesian plane AC9M9A03	• finding the distance between 2 points on the Cartesian plane • finding the gradient of a line segment • finding the midpoint of a line segment	Fluency

Aspect of the achievement standard	Related content description/s	Examples of evidence	Mathematical proficiencies
Students use mathematical modelling to solve problems involving change in financial and other applied contexts, choosing to use linear and quadratic functions.	**Algebra** • simplify algebraic expressions, expand binomial products and factorise monic quadratic expressions AC9M9A02 • identify and graph quadratic functions, solve quadratic equations graphically and numerically, and solve monic quadratic equations with integer roots algebraically, using graphing software and digital tools as appropriate AC9M9A04 • use mathematical modelling to solve applied problems involving change including financial contexts; formulate problems, choosing to use either linear or quadratic functions; interpret solutions in terms of the situation; evaluate the model and report methods and findings AC9M9A05	• solving problems involving change in financial and other applied contexts, choosing to use linear and quadratic functions	Fluency
		• using mathematical modelling to solve problems	Problem-solving
They graph quadratic functions and solve monic quadratic equations with integer roots algebraically.	**Algebra** • simplify algebraic expressions, expand binomial products and factorise monic quadratic expressions AC9M9A02 • identify and graph quadratic functions, solve quadratic equations graphically and numerically, and solve monic quadratic equations with integer roots algebraically, using graphing software and digital tools as appropriate AC9M9A04	• graphing quadratic functions • solving monic quadratic equations with integer roots algebraically	Fluency
Students describe the effects of variation of parameters on functions and relations, using digital tools, and make connections between their graphical and algebraic representations.	**Algebra** • experiment with the effects of the variation of parameters on graphs of related functions, using digital tools, making connections between graphical and algebraic representations, and generalising emerging patterns AC9M9A06	• making connections between graphical and algebraic representations	Understanding
		• describing the effects of variation of parameters on functions and relations, using digital tools	Reasoning

Aspect of the achievement standard	Related content description/s	Examples of evidence	Mathematical proficiencies
They apply formulas to solve problems involving the surface area and volume of right prisms and cylinders.	**Measurement** • solve problems involving the volume and surface area of right prisms and cylinders using appropriate units AC9M9M01	• applying formulas to solve problems involving the surface area of – right prisms – cylinders • applying formulas to solve problems involving the volume of – right prisms – cylinders	Fluency
Students solve problems involving ratio, similarity and scale in two-dimensional situations.	**Measurement** • solve spatial problems, applying angle properties, scale, similarity, Pythagoras' theorem and trigonometry in right-angled triangles AC9M9M03	• solving problems involving ratio, similarity and scale in two-dimensional situations	Fluency
They determine percentage errors in measurements.	**Measurement** • calculate and interpret absolute, relative and percentage errors in measurements, recognising that all measurements are estimates AC9M9M04	• determining percentage errors in measurements	Fluency
Students apply Pythagoras' theorem and use trigonometric ratios to solve problems involving right-angled triangles.	**Measurement** • solve spatial problems, applying angle properties, scale, similarity, Pythagoras' theorem and trigonometry in right-angled triangles AC9M9M03 **Space** • recognise the constancy of the sine, cosine and tangent ratios for a given angle in right-angled triangles using properties of similarity AC9M9SP01	• applying Pythagoras' theorem to solve problems involving right-angled triangles • using trigonometric ratios to solve problems involving right-angled triangles	Fluency
They use mathematical modelling to solve practical problems involving direct proportion, ratio and scale, evaluating the model and communicating their methods and findings.	**Measurement** • solve spatial problems, applying angle properties, scale, similarity, Pythagoras' theorem and trigonometry in right-angled triangles AC9M9M03 • use mathematical modelling to solve practical problems involving direct proportion, rates, ratio and scale,	• solving practical problems involving direct proportion, ratio and scale	Fluency
		• evaluating the mathematical model and communicating methods and findings	Reasoning

Aspect of the achievement standard	Related content description/s	Examples of evidence	Mathematical proficiencies
	including financial contexts; formulate the problems and interpret solutions in terms of the situation; evaluate the model and report methods and findings AC9M9M05 **Space** • recognise the constancy of the sine, cosine and tangent ratios for a given angle in right-angled triangles using properties of similarity AC9M9SP01 • apply the enlargement transformation to shapes and objects using dynamic geometry software as appropriate; identify and explain aspects that remain the same and those that change AC9M9SP02	• using mathematical modelling to solve problems	Problem-solving
Students express small and large numbers in scientific notation.	**Measurement** • solve problems involving very small and very large measurements, time scales and intervals expressed in scientific notation AC9M9M02	• expressing small and large numbers in scientific notation	Fluency
They apply the enlargement transformation to images of shapes and objects, and interpret results.	**Space** • apply the enlargement transformation to shapes and objects using dynamic geometry software as appropriate; identify and explain aspects that remain the same and those that change AC9M9SP02	• applying the enlargement transformation to images of shapes and objects	Fluency
		• interpreting results from the enlargement transformation	Reasoning
Students design, use and test algorithms based on geometric constructions or theorems.	**Space** • design, test and refine algorithms involving a sequence of steps and decisions based on geometric constructions and theorems; discuss and evaluate refinements AC9M9SP03	• using and testing algorithms based on geometric constructions or theorems	Fluency
		• designing algorithms, based on geometric constructions or theorems	Problem-solving

Aspect of the achievement standard	Related content description/s	Examples of evidence	Mathematical proficiencies
They compare and analyse the distributions of multiple numerical data sets, choose representations, describe features of these data sets using summary statistics and the shape of distributions, and consider the effect of outliers.	**Statistics** • represent the distribution of multiple data sets for numerical variables using comparative representations; compare data distributions with consideration of centre, spread and shape, and the effect of outliers on these measures AC9M9ST03 • choose appropriate forms of display or visualisation for a given type of data; justify selections and interpret displays for a given context AC9M9ST04 • plan and conduct statistical investigations involving the collection and analysis of different kinds of data; report findings and discuss the strength of evidence to support any conclusions AC9M9ST05	• describing features of data sets using summary statistics and the shape of distributions	Understanding
		• choosing representations of multiple numerical data sets	Fluency
		• comparing distributions of multiple numerical data sets • analysing distributions of multiple numerical data sets • considering the effect of outliers, using summary statistics and the shape of distributions	Reasoning
Students explain how sampling techniques and representation can be used to support or question conclusions or to promote a point of view.	**Statistics** • analyse reports of surveys in digital media and elsewhere for information on how data was obtained to estimate population means and medians AC9M9ST01 • analyse how different sampling methods can affect the results of surveys and how choice of representation can be used to support a particular point of view AC9M9ST02	• explaining how sampling techniques and representation can be used to support or question conclusions or promote a point of view	Reasoning
They determine sets of outcomes for compound events and represent these in various ways.	**Probability** • list all outcomes for compound events both with and without replacement, using lists, tree diagrams, tables or arrays; assign probabilities to outcomes AC9M9P01	• representing outcomes in various ways	Understanding
		• determining sets of outcomes for compound events	Fluency

Aspect of the achievement standard	Related content description/s	Examples of evidence	Mathematical proficiencies
Students assign probabilities to the outcomes of compound events.	**Probability** • list all outcomes for compound events both with and without replacement, using lists, tree diagrams, tables or arrays; assign probabilities to outcomes AC9M9P01 • calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and', inclusive 'or' and exclusive 'or' AC9M9P02	• assigning probabilities to the outcomes of compound events	Fluency
They design and conduct experiments or simulations for combined events using digital tools.	**Probability** • list all outcomes for compound events both with and without replacement, using lists, tree diagrams, tables or arrays; assign probabilities to outcomes AC9M9P01 • calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and', inclusive 'or' and exclusive 'or' AC9M9P02 • design and conduct repeated chance experiments and simulations, using digital tools to compare probabilities of simple events to related compound events, and describe results AC9M9P03	• designing and conducting experiments or simulations for combined events using digital tools	Problem-solving

Table 2: Key terms used in Mathematics SEs

Term	Description
Simple familiar	In questions of this degree of difficulty, students respond to situations where: • relationships and interactions are obvious and have few elements; and • all of the information to solve the problem is identifiable, that is – the required procedure is clear from the way the problem is posed, or – in a context that has been a focus of prior learning. Students are not required to interpret, clarify and analyse problems to develop responses.
Complex familiar	In questions of this degree of difficulty, students respond to situations where: • relationships and interactions have a number of elements, such that connections are made with subject matter within and/or across the strands of mathematics; and • all of the information to solve the problem is identifiable, that is – the required procedure is clear from the way the problem is posed, or – in a context that has been a focus of prior learning. Some interpretation, clarification and analysis will be required to develop responses. Shifting the level of complexity may include making changes to the: • amount of scaffolding • number of steps required to solve the problem/situation • changes to increments, benchmarks or scales on axes • number of attributes considered.
Complex unfamiliar	In questions of this degree of difficulty, students respond to situations where: • relationships and interactions have a number of elements, such that connections are made with subject matter within and/or across the strands of mathematics; and • all the information to solve the problem is not immediately identifiable, that is – the required procedure is not clear from the way the problem is posed, and – in a context in which students have had limited prior experience. Students interpret, clarify and analyse problems to develop responses. Shifting the level of familiarity may include making changes to the: • context for application, e.g. financial, measurement, spatial or statistical • type of representation, e.g. physical, visual or symbolic • orientation of representation, e.g. horizontal or vertical • merge of subject matter/concepts from across different strands.