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

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 during and at the end of a teaching period to make on-balance judgments about the qualities in student work that demonstrate the depth and breadth of their learning.

The Mathematics SEs have been organised using the Mathematical proficiencies. Performance across the five-point scale is frequently described in terms of complexity and familiarity of the standards descriptor being assessed. Across the standards elaborations in Year 7 to Year 10, this is described using: A — complex unfamiliar, B — complex familiar, C — simple familiar, D — some simple familiar, E — isolated and obvious.

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.

For all Queensland schools

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.

Note: The Mathematics SEs are organised by the Mathematical proficiencies. The proficiencies represent the actions students demonstrate when working mathematically. The proficiencies are embedded as verbs in the achievement standard and related content descriptions. For further information about the connections between the achievement standard aspects and the standard elaborations see Table 1 on page 4.

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	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 in simple familiar situations	partial identification, representation and description of mathematical concepts and relationships in some simple familiar situations	fragmented identification, representation and description of mathematical concepts and relationships in isolated and obvious situations
	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 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 in simple familiar situations	choice and use of partial facts, definitions, and procedures to find solutions in some simple familiar situations	choice and use of fragmented facts, definitions and procedures to find solutions in isolated and obvious situations
	Reasoning	comprehensive explanation of mathematical thinking, strategies used, and conclusions reached in complex unfamiliar, complex familiar, and simple familiar situations	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 in simple familiar situations	partial explanation of mathematical thinking, strategies used, and conclusions reached in some simple familiar situations	fragmented explanation of mathematical thinking, strategies used, and conclusions reached in isolated and obvious situations
	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 Mathematical proficiencies. The Mathematical proficiencies include Understanding, Fluency, Reasoning and Problem-solving. The Mathematical proficiencies represent the valued features or assessable elements.

For a specific assessment task, the standard elaborations description (in the previous table) can be modified to include task-specific content. Task-specific content can be drawn from an aspect of the achievement standard and the related content description/s which are aligned to the Mathematical proficiencies being assessed. Table 1 provides examples of how content can be related to the standard elaborations valued features for task-specific marking guides at a C standard.

Table 2 helps clarify key terms from the standard descriptors in the Mathematics SEs and 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: Examples of how content can be related to the SE valued features for task-specific marking guides at a C standard

Aspect of the achievement standard	Related content description/s	SE valued features (Mathematical proficiencies)	Examples of how content can be related to the SE valued features
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	Understanding	• recognising rational and irrational numbers to solve problems
		Fluency	• using rational and irrational numbers to solve problems
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	Fluency	• extending and applying the exponent laws with positive integers to variables
Students expand binomial products, and factorise monic quadratic expressions.	**Algebra** • simplify algebraic expressions, expand binomial products and factorise monic quadratic expressions AC9M9A02	Fluency	• expanding binomial products • factorising monic quadratic expressions
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	Fluency	• finding the distance between 2 points on the Cartesian plane • finding the gradient of a line segment • finding the midpoint of a line segment

Aspect of the achievement standard	Related content description/s	SE valued features (Mathematical proficiencies)	Examples of how content can be related to the SE valued features
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	Fluency	• solving problems involving change in financial and other applied contexts, choosing to use linear and quadratic functions
		Problem-solving	• using mathematical modelling to solve problems
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	Fluency	• graphing quadratic functions • solving monic quadratic equations with integer roots algebraically

Aspect of the achievement standard	Related content description/s	SE valued features (Mathematical proficiencies)	Examples of how content can be related to the SE valued features
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	Understanding	• describing the effects of variation of parameters on functions and relations, using digital tools, making connections between their graphical and algebraic representations
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	Fluency	• 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
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	Fluency	• solving problems involving ratio, similarity and scale in two-dimensional situations
They determine percentage errors in measurements.	**Measurement** • calculate and interpret absolute, relative and percentage errors in measurements, recognising that all measurements are estimates AC9M9M04	Fluency	• determining percentage errors in measurements

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Aspect of the achievement standard	Related content description/s	SE valued features (Mathematical proficiencies)	Examples of how content can be related to the SE valued features
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	Fluency	• applying Pythagoras' theorem to solve problems involving right-angled triangles • using 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.	**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, 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	Fluency	• solving practical problems involving direct proportion, ratio and scale
		Reasoning	• evaluating the mathematical model and communicating methods and findings
		Problem-solving	• using mathematical modelling to solve problems

Aspect of the achievement standard	Related content description/s	SE valued features (Mathematical proficiencies)	Examples of how content can be related to the SE valued features
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	Fluency	• expressing small and large numbers in scientific notation
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	Fluency	• applying the enlargement transformation to images of shapes and objects
		Reasoning	• interpreting results from the enlargement transformation
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	Fluency	• using and testing algorithms based on geometric constructions or theorems
		Problem-solving	• designing algorithms, based on geometric constructions or theorems

Aspect of the achievement standard	Related content description/s	SE valued features (Mathematical proficiencies)	Examples of how content can be related to the SE valued features
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	Understanding	• describing features of data sets using summary statistics and the shape of distributions, and considering the effect of outliers
		Fluency	• choosing representations of multiple numerical data sets
		Reasoning	• comparing distributions of multiple numerical data sets • analysing distributions of multiple numerical data sets
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	Reasoning	• explaining how sampling techniques and representation can be used to support or question conclusions or promote a point of view
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	Understanding	• determining sets of outcomes for compound events • representing outcomes in various ways

Aspect of the achievement standard	Related content description/s	SE valued features (Mathematical proficiencies)	Examples of how content can be related to the SE valued features
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	Fluency	• assigning probabilities to the outcomes of compound events
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	Problem-solving	• designing and conducting experiments or simulations for combined events using digital tools

Table 2: Key terms used in Mathematics SEs

Term	Description
Simple familiar	Problems of this degree of difficulty require students to demonstrate knowledge and understanding of the subject matter and application of skills in a situation 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	Problems of this degree of difficulty require students to demonstrate knowledge and understanding of the subject matter and application of skills in a situation 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. Creating complex familiar examples may include making changes to the: • number of steps required to solve the problem/situation • changes to increments, benchmarks or scale • number of attributes considered.
Complex unfamiliar	Problems of this degree of difficulty require students to demonstrate knowledge and understanding of the subject matter and application of skills in a situation 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. Creating unfamiliar examples 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.