WHAT HAS CHANGED AND WHY?

Proposed revisions to the Foundation – Year 10 (F–10) Australian Curriculum: Mathematics

Overview

This document summarises the proposed revisions to the F–10 Australian Curriculum: Mathematics presented in the consultation version and provides an explanation for the changes.

The Mathematics curriculum has been revised to clarify that, in addition to gaining necessary procedural knowledge and understanding of mathematical concepts, students need to develop the ability to apply that knowledge and understanding in real world situations. The proposed revisions therefore provide more opportunity for students to develop ways of thinking and reasoning which enable deep, connected and transferable learning. The proposed revisions make clear the essential mathematical knowledge, understanding and skills students need to be confident and creative individuals, successful lifelong learners and active, informed members of the community. These revisions also ensure our curriculum remains world class.

The current F–10 Australian Curriculum: Mathematics was first published in 2010, and since then, there have been significant developments and research into the learning area. The Review has drawn upon the recent work to improve the national numeracy learning progression, international student assessment frameworks for PISA and TIMSS; insights from the collaborative work with the Center of Curriculum Redesign; recent research into student learning of mathematics from Cambridge University, including engaging with the Cambridge Mathematics Framework; and the work of a range of Australian academics, including the Growing Mathematically project. Drawing on this body of knowledge, the revisions aim to remove outdated and non-essential content, add new content that has been identified as important for students to learn, better sequence student learning and give teachers greater clarity and guidance about what they are expected to teach.

A key criticism of the current F–10 Australian Curriculum: Mathematics is that the proficiency strands are separated from the content and are presented with little direction as to what a teacher is expected to do with them. This has resulted, in many cases, in implementation of the Australian Mathematics curriculum that focuses primarily on factual mathematical knowledge and associated procedures, without sufficient attention to other essential mathematical proficiencies. A key proposed change is to streamline the structure of the F–10 Australian Curriculum: Mathematics by removing sub-strands and separate proficiency strands and, instead, organising essential content in six clear strands – *number*, *algebra*, *measurement*, *space*, *statistics,* and *probability* – and embedding the interrelated proficiencies within those strands.

The content descriptions and the achievement standards in the consultation version now explicitly include the critical processes of mathematical reasoning and problem-solving from the proficiency strands. This results in a mathematics curriculum that supports deeper conceptual understanding to make mathematical learning more meaningful, applicable and transferable to students.

In other improvements, many of the content descriptions have been rewritten to remove ambiguity and give better guidance to teachers about what to teach. In some areas, content has been removed, new content added and the sequence in which content is presented has been realigned to ensure the curriculum specifies the essential mathematics content that students should learn.

Achievement standards are now presented in order of the six strands to make it easier for teachers to plan. Content descriptions and achievement standards are better aligned for both content and cognitive expectations. The content elaborations have also been reviewed and refined to ensure they provide enhanced support and clarification of content descriptions, offering authentic examples for teachers, as well as an opportunity to develop specific general capabilities such as Numeracy, and Critical and Creative Thinking through the learning area of Mathematics. New content elaborations have also been written, which illustrate how the cross-curriculum priority of Aboriginal and Torres Strait Islander Histories and Cultures can support the teaching and learning of mathematics.

Revisions have been made to the optional ‘10A’ content in the current Mathematics curriculum as this was also an area identified as needing improvement. Content beyond the scope of what is appropriate for all students in F–10, which may be advantageous for student pathways into Mathematical Methods and Specialist Mathematics courses at the senior secondary level, has been identified. The consultation version includes optional additional content and illustrative examples to replace the current 10A structure. This is optional content that follows on from Year 10 core content, which teachers may choose to support students electing these senior specialist pathways.

The consultation version of the F–10 Australian Curriculum: Mathematics does not include:

- the glossary, student work samples and other support resources – these materials will be revised once the consultation process has been completed
- ‘tagging’ to show where general capabilities and cross-curriculum priorities are incorporated in the content descriptions and elaborations – these connections will be made explicit when the updated curriculum is published on the website.

The terms of reference for the Australian Curriculum Review also directed ACARA to improve the digital presentation of the Australian Curriculum in line with agreed revisions and teachers’ user experience. In parallel with the content review process, ACARA is undertaking a redesign to improve the functionality of the current Australian Curriculum website. The aim is for the updated version of the F–10 Australian Curriculum to be available on a new Australian Curriculum website for the start of 2022. The current Australian Curriculum website will also remain live to support jurisdictions and teachers to plan for transition to the updated curriculum.

Proposed revisions to the introductory sections of the F–10 Australian Curriculum: Mathematics

	Nature of the revision	Rationale for the revision
Rationale	Minor revisions	The current rationale has been updated to reflect the importance of mathematical skills to STEM and other areas, as well as the importance of students being able to transfer mathematical skills, knowledge and understanding to unfamiliar contexts.
Aims	Minor revisions	The aims have been updated to include the connections across all strands to future pathways and to numeracy.
Organisation of the learning area	This section still describes how the curriculum is structured. It now also includes an overview of the learning area core concepts – those big ideas, understandings, skills or processes, central to the Mathematics curriculum. Curriculum content is now organised under six interrelated strands – *number, algebra, measurement, space, statistics,* and *probability*. This is different from the current structure, where content is organised under three paired content strands and 13 sub-strands, with four separate proficiency strands. The proficiency strands have been embedded into the content descriptions and achievement standards – so there is no need for the proficiency strands to exist as separate strands in the revised structure.	The terms of reference for the Review require ACARA to refine and reduce content by identifying core concepts. In the Review process, core concepts have helped identify the essential content students should learn to develop a deep and increasingly sophisticated understanding of, and proficiency in, mathematics. The proposed revisions improve the organisation of the Mathematics curriculum, giving the content a logical and coherent structure. The original intent of the four proficiency strands has been explicitly embedded in the content descriptions and achievement standards under the six new strands. This approach will help students gain a deeper conceptual understanding of core mathematical knowledge and skills. It will also remove the need for teachers to consider additional information and will address their current uncertainty as to what to do with the proficiency strands. The six strands reflect well-understood and internationally recognised organisers for essential mathematical content. The current pairing of content strands reflects some of the particular connections between content (e.g. *space* and *measurement*). However, it is important that students develop the capability to see and apply the many connections that exist within and across all strands of Mathematics to develop their deep understanding of mathematical core concepts.

	Nature of the revision	Rationale for the revision
Key connections	This is a new section in the introduction. It replaces the learning area-specific information sheets on general capabilities and the learning area-specific advice on the cross-curriculum priorities, currently published separately from the Mathematics curriculum. This section also outlines key connections to other learning areas.	This new section makes transparent the connections across the three dimensions of the Australian Curriculum – learning areas, general capabilities and cross-curriculum priorities. It provides teachers with clear information to the key relationships of Mathematics to the general capabilities and cross-curriculum priorities, specifically highlighting those that have the most authentic fit and will provide meaningful learning using the learning area context. It also highlights the important opportunities to connect Mathematics with other learning areas' content and the National Numeracy Learning Progression. This will be particularly useful for primary teachers.
Key considerations	This section has been retitled. It contains similar information to what exists under the 'key ideas' section in the current introduction to the curriculum.	The information contained in this section covers what teachers should consider when planning for and teaching the curriculum. In the case of Mathematics, these key considerations relate to the breadth of opportunities that teachers should plan and use to support students to develop mathematical proficiency.

Proposed revisions to the curriculum content of the F–10 Australian Curriculum: Mathematics

	Nature of the revision	Rationale for the revision
Year level descriptions	The year level descriptions have been revised to improve their quality and to provide a description of what students are doing at the year level, rather than referencing the proficiency strands.	The current year level descriptions provide a limited and separated representation of some aspects of mathematical proficiencies. The proposed changes ensure year level descriptions give teachers a clear overview of the nature of student learning experiences at each year level. They also highlight the important interrelationships between the six strands.
Achievement standards	The achievement standards have been revised to improve their quality and alignment to the content descriptions. Expectations for reasoning and other processes have been embedded in the achievement standards. For each year level, the achievement standard is presented in the same order of the six strands.	Clear alignment between the content described in the content descriptions and achievement standards provides a coherent framework for planning and assessment. Presenting the achievement standards in the same order in each year level supports teachers to see the progression of expected achievement across the year levels. This consistent approach to presenting the information particularly supports primary school teachers.
Content descriptions	Many of the content descriptions have been revised, refined and realigned to ensure they specify the essential mathematics content that students should learn, and to give greater clarity to teachers about what to teach. The proficiencies have been embedded. This means that many content descriptions have been rewritten. Some content has been removed, added and de-emphasised, while other content has been given more emphasis. In some instances, the sequence in which content is presented has been realigned. The clarity and consistency of language has been improved in the content descriptions. In some cases, this has meant splitting one content description into two.	The revised content descriptions clearly specify the essential knowledge, understanding and skills in each year. They have been improved to: • remove ambiguity and ensure the meaning is clear to teachers • remove unnecessary duplication • ensure consistency and clarity of language • embed the previously separate proficiencies • embed the procedures of investigation, simulation, experiments, computation and mathematical modelling explicitly • better align the cognitive demand described in the content descriptions to that in the achievement standards • reflect new evidence and research developments in mathematics and mathematics education. *Details of the specific content changes are presented separately in Table 1 below.*

	Nature of the revision	Rationale for the revision
Content elaborations	Content elaborations have been revised or deleted and new elaborations that align with revised content descriptions have been developed.	The revised content elaborations provide teachers with improved suggestions and illustrations of ways to teach the content descriptions. They illustrate the content descriptions with diverse relevant examples, clearly unpacking the content description. They target the general capabilities and cross-curriculum priorities that provide the most appropriate and authentic opportunities to enrich the content of Mathematics. In particular, new content elaborations have been added to provide examples of how the teaching and learning of the content of Mathematics can be supported using contexts drawn from the Aboriginal and Torres Strait Islander Histories and Cultures cross-curriculum priority.

Table 1: Details of proposed content revisions to the F–10 Australian Curriculum: Mathematics

Nature of the content revision	Rationale for the revision
Content removed or reduced	
Year 1 Description of Australian coins	This is not essential mathematical content. Representing and ordering numbers to 100 using Australian coins as a context are relevant and supportive of financial literacy and have been retained, but the description of Australian coins has been removed.
Year 1 Tell the time to half hour	Moving this to Year 2 provides more time for students to develop understanding of time as a duration that can be measured. This provides opportunity to learn to tell the time with understanding (supported by their introduction to fractions) in Year 2.
Year 1 Number sequences formed by skip counting by twos, fives and tens in *number*	This content is duplicated in *algebra* where students are investigating number patterns formed by skip-counting. Retaining it in *algebra* emphasises the understanding and pattern recognition.
Year 2 Number sequences increasing and decreasing by twos, threes, fives and tens from any starting point	This is duplicated in *algebra* and is captured in additive patterns in the sequence for developing understanding of growing patterns.
Year 2 Name and order the seasons	This is not essential mathematical content. It is adequately covered in the content of HASS Year 1 and Science.
Year 2 Compare volume of objects informally	Capacity is retained as an attribute of 3D objects that can be compared directly and measured directly using informal units. The concept of volume as a measure has not yet been introduced in this year. Hence including comparing volumes of objects informally beyond capacity is not essential and can be misleading at this year level.
Year 3 Number patterns resulting from performing addition or subtraction	Removes duplication as students are skip-counting to create number patterns in Year 1 and using addition and subtraction in Year 2. This allows for students to explore a broader set of patterns.
Year 4 Recognise, represent and order numbers to at least tens of thousands	In Year 3, students recognise, model, represent and order numbers to at least 10,000. The focus in Year 4 is on using knowledge of place value to operate with larger numbers and model situations.
Year 4 Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to	In Year 3, students apply place value to partition, rearrange and regroup numbers to at least 10,000 to assist calculations and solve problems. In Year 4, they apply this knowledge to model situations and solve problems. Hence this is not essential content in Year 4.

Nature of the content revision	Rationale for the revision
assist calculations and solve problems	
Year 4 Investigate number sequences involving multiples of 3, 4, 6, 7, 8 and 9	This is covered in Year 4 in *algebra*, so it has been removed from *number*.
Year 4 Make connections between fractions and decimal notation	Research supports an approach to decimals through place value, partitioning the whole into 10 parts, using part–whole; the relationship to fractions comes later when students have developed the concept that decimals are an extension of the base 10 place value system. Connections between fractions and decimal notation are included in Year 5.
Years 2–5 2D maps	There is currently an over-emphasis on maps as 2D representations of a 3D space and duplicating content descriptions in HASS. Refined content descriptions expand representations to include other representations and to focus on building understanding of the mathematical concepts of dimension, position and location.
Year 5 Apply the enlargement transformation	Understanding the concepts that underpin the enlargement transformation requires proportional reasoning related to ratios and scales. Research indicates that many students do not develop conceptual understanding of this form of reasoning until around Years 7 and 8.
Year 5 Choose appropriate units of measurement for area and volume	Students have not established the formal concepts of area and volume in Year 5. Choosing appropriate units is not sensible before the concept of what they are measuring is soundly understood.
Year 5 Use fractions to represent probabilities	Students are developing an understanding of relative frequency through experimentation in Year 5 as a precursor to numerical representation of probabilities (in Year 6).
Year 6 Square and triangular numbers	Prime and composite numbers are maintained as an important focus for multiplicative representation of natural numbers in Year 6. Square numbers are covered in Year 7, triangular numbers can be used as an example for generating patterns in *algebra* but are not essential content.
Year 7 Given coordinates, plot points on the Cartesian plane and find coordinates for a given point	This is redundant as it is already covered in Year 6.
Year 7 Solving simple linear equations	Focus in Year 7 is familiarity with variables and relationships. Solving linear equations is covered in Year 8 when students are better

Nature of the content revision	Rationale for the revision
	prepared to deal with the connections between numerical, graphical and symbolic forms of relationships.
Year 10 Solve problems involving linear equations	This is redundant as it is already covered in Years 8 and 9.
Year 10 Solve simple quadratic equations	This is redundant as it is already covered in Year 9.
Year 10 Solving linear equations with algebraic fractions	Not essential for all students to learn in Year 10.
Year 10 Operations with algebraic fractions	Not essential for all students to learn in Year 10.
Content resequenced	
From Year 1 to Foundation Introduction to probability moved	Provides an initial introduction to what outcomes of chance events are prior to being asked to identify and describe outcomes in Year 1.
From Year 1 to Year 2 Introduction to reading time on an analogue clock moved	Students are more conceptually ready for interpreting an analogue clock in Year 2. It is also conceptually better to teach more than just half-hour representations of time if trying to teach underlying concepts required for telling time on an analogue clock.
From Year 1 to Year 2 Introduction to fractions moved	Students are more conceptually ready when they have a solid grasp of natural numbers prior to moving into parts of a whole.
From Year 3 to Year 2 Introduction to additive patterns moved	The current curriculum does not provide a coherent sequence, this builds upon the sequence of learning from skip-counting to generate sequences in Year 1.
From Year 3 to Year 4 Multiplication facts for 2, 5 and 10 moved	Recognising the patterns in multiplication facts is in *algebr*a in Year 4; in Year 3, students are developing their understanding of multiplication through computational thinking approaches and modelling, groups and arrays rather than rote learning facts.
In Year 5 Introduction to percentages included	Percentages first appear in Year 6 in a content description about converting between fraction, decimals and percentages. The concept of a percentage needs to be introduced prior to converting between equivalent representations.
From Year 5 to Year 6 Recognising probabilities range from 0 to 1	Students are developing an understanding of relative frequency through experimentation in Year 5 as a precursor to numerical representation of probabilities in Year 6. Introducing this at Year 5 limits thinking that probabilities are numbers rather than ratios that can be represented on numerical scales (0–1, 0.0–1.0, or 0% – 100%).

Nature of the content revision	Rationale for the revision
From Year 6 to Year 8 Connect volume and capacity, and their units of measurement moved	The proportional thinking required to understand and apply the conversion between volume and capacity is more appropriate in Year 8, and the formal introduction to measuring the volume of an object is in Year 7.
From Year 8 to Year 7 Introduction to features of a circle, circumference radius and diameter of a circle moved, leaving the area and use of formulas to solve problems in Year 8	This allows time for students to develop an understanding of the relationships between features of a circle, and a deeper understanding of π prior to using formulas to solve problems. π is currently mentioned in the curriculum as an irrational number in Year 8 and used in measurement formulas but not explicitly introduced as a ratio.
From Year 9 to Year 8 Introduction to Pythagoras moved	The TIMSS assessment framework assesses Pythagoras in Grade 8. Comparative studies of other international curricula and the OECD mathematics framework also have Pythagoras in Year 8. Currently in the Australian Curriculum, students are learning about irrational numbers in Year 8, but have no application to connect it to. Pythagoras provides a purpose for learning about or application for irrational numbers. Students have been introduced to square numbers and square roots in Year 7 as the necessary prior knowledge for this content.
Content separated	
Foundation The current content description – represent practical situations to model addition and sharing – has been split into two content descriptions: • model practical situations involving addition and subtraction with physical and virtual materials, using counting or subitizing strategies to determine the total or the number of objects remaining • model practical situations that involve equal sharing, through role play and games, using physical and virtual materials	The current content description has two large foundational concepts combined into one and misses the important connections between addition and subtraction that can be forged early through exploration of additive situations. Equal sharing is part of the development sequence that is a precursor to multiplication and division, building multiplicative thinking.

Nature of the content revision	Rationale for the revision
Year 1 The current content description – count collections to 100 by partitioning numbers using place value – has been split into two content descriptions: • quantify larger sets of objects, to at least 100, by partitioning collections into groups to facilitate more efficient counting. Continue the count, using knowledge place value and skip-counting, recognising that the last number said in the count represents the total quantity of objects • recognise that two-digit numbers are composed of groups of tens and ones and can be partitioned into other number groupings	The current content description emphasises the counting procedures using place value grouping to assist, but not the important underlying concepts of place value, partitioning and quantifying collections where counting is one strategy. Students need to understand that they can partition numbers and quantify collections in different ways.
Year 1 The current content description – represent data with objects and drawings, where one object or drawing represents one data value, and describe the displays – has been split into two content descriptions: • acquire data and record in various ways (objects, images, drawings, lists, tally marks and symbols) using digital tools where appropriate • represent collected categorical data using one-to-one displays (including pictographs and tally charts) using digital tools where appropriate. Quantify and compare the data using total frequencies and discuss the findings	The current content description includes representation of data in both the recording process as well as the analysis and reporting process. These are distinct components to the investigation process – data collection, data interpretation and data visualisation. Separating the content description into two provides clarity for teachers and a clear sequence of development from Foundation to Year 6 for collection of data, then the analysis and interpretation of data. This also allows better alignment to teaching data within the Digital Technologies curriculum.

Nature of the content revision	Rationale for the revision
Content added	
Year 8 Three-dimensional coordinate systems	It is important for students to develop the spatial recognition skills to work in 3D. Learning the mathematical foundations complements and supports applications in Design and Technologies, The Arts, Science and other learning areas.
Year 10 Logarithmic scales	Logarithmic scales are important for representing data in contexts involving very large and small numbers and are commonly used in reports in the media and incorporated in other learning areas such as HASS and Science (e.g. time, Richter and Ph scales, electromagnetic and light spectrums).
Years 7–10 Error and approximation	Errors are inherent in all measurements, so they need to be considered. Being able to approximate and knowing when it is appropriate are currently not sufficiently emphasised within the current curriculum.
Years 9–10 Networks and Planar graphs	Networks are a pervasive visual representation of relations that form part of daily life, including use of the internet, social networks, wireless and electrical wiring networks, transport graphs (train, subway, bus, air routes, etc.).
Years 3–10 Computational thinking content in *algebra*, *space*, and *probability*	ACARA's program of research identified the need for a greater emphasis on computational thinking in response to the needs and practices of contemporary society. Computational thinking is important for a deep understanding of mathematics; it underpins the central role of computation and algorithms in mathematics and their application to inquiry, modelling and problem-solving in mathematics and other fields.