

The AusVELS Curriculum

Domain	Mathematics
Level	Students with disabilities (Level A), Students with disabilities (Level B), Students with disabilities (Level C), Students with disabilities (Level D), Foundation level, Level 1, Level 2, Level 3, Level 4, Level 5, Level 6, Level 7, Level 8, Level 9 and Level 10
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Rationale

Learning mathematics creates opportunities for and enriches the lives of all Australians. AusVELS Mathematics provides students with essential mathematical skills and knowledge in **Number and Algebra**, **Measurement and Geometry**, and **Statistics and Probability**. It develops the numeracy capabilities that all students need in their personal, work and civic life, and provides the fundamentals on which mathematical specialties and professional applications of mathematics are built.

Mathematics has its own value and beauty and the AusVELS Mathematics aims to instil in students an appreciation of the elegance and power of mathematical reasoning. Mathematical ideas have evolved across all cultures over thousands of levels, and are constantly developing. Digital technologies are facilitating this expansion of ideas and providing access to new tools for continuing mathematical exploration and invention. The curriculum focuses on developing increasingly sophisticated and refined mathematical understanding, fluency, logical reasoning, analytical thought and problem-solving skills. These capabilities enable students to respond to familiar and unfamiliar situations by employing mathematical strategies to make informed decisions and solve problems efficiently.

AusVELS Mathematics ensures that the links between the various components of mathematics, as well as the relationship between mathematics and other disciplines, are made clear. Mathematics is composed of multiple but interrelated and interdependent concepts and systems which students apply beyond the mathematics classroom. In science, for example, understanding sources of error and their impact on the confidence of conclusions is vital, as is the use of mathematical models in other disciplines. In geography, interpretation of data underpins the study of human populations and their physical environments; in history, students need to be able to imagine timelines and time frames to reconcile related events; and in English, deriving quantitative and spatial information is an important aspect of making meaning of texts.

The curriculum anticipates that schools will ensure all students benefit from access to the power of mathematical reasoning and learn to apply their mathematical understanding creatively and efficiently. The mathematics curriculum provides students with carefully paced, in-depth study of critical skills and concepts. It encourages teachers to help students become self-motivated, confident learners through inquiry and active participation in challenging and engaging experiences.

Aims

AusVELS Mathematics aims to ensure that students:

- are confident, creative users and communicators of mathematics, able to investigate, represent and interpret situations in their personal and work lives and as active citizens
- develop an increasingly sophisticated understanding of mathematical concepts and fluency with processes, and are able to pose and solve problems and reason in **Number and Algebra**, **Measurement and Geometry**, and **Statistics and Probability**
- recognise connections between the areas of mathematics and other disciplines and appreciate mathematics as an accessible and enjoyable discipline to study.

Content structure

AusVELS Mathematics is organised around the interaction of three content strands and four proficiency strands.

The content strands are **Number and Algebra**, **Measurement and Geometry**, and **Statistics and Probability**. They describe what is to be taught and learnt.

The proficiency strands are **Understanding**, **Fluency**, **Problem Solving**, and **Reasoning**. They describe how content is explored or developed, that is, the thinking and doing of mathematics. They provide the language to build in the developmental aspects of the learning of mathematics and have been incorporated into the content descriptions of the three content strands described above. This approach has been adopted to ensure students' proficiency in mathematical skills develops throughout the curriculum and becomes increasingly sophisticated over the levels of schooling.

Content strands

Number and Algebra

Number and Algebra are developed together, as each enriches the study of the other. Students apply number sense and strategies for counting and representing numbers. They explore the magnitude and properties of numbers. They apply a range of strategies for computation and understand the connections between operations. They recognise patterns and understand the concepts of variable and function. They build on their understanding of the number system to describe relationships and formulate generalisations. They recognise equivalence and solve equations and inequalities. They apply their number and algebra skills to conduct investigations, solve problems and communicate their reasoning.

Measurement and Geometry

Measurement and Geometry are presented together to emphasise their relationship to each other, enhancing their practical relevance. Students develop an increasingly sophisticated understanding of size, shape, relative position and movement of two-dimensional figures in the plane and three-dimensional objects in space. They investigate properties and apply their understanding of them to define, compare and construct figures and objects. They learn to develop geometric arguments. They make meaningful measurements of quantities, choosing appropriate metric units of measurement. They build an understanding of the connections between units and calculate derived measures such as area, speed and density.

Statistics and Probability

Statistics and Probability initially develop in parallel and the curriculum then progressively builds the links between them. Students recognise and analyse data and draw inferences. They represent, summarise and interpret data and undertake purposeful investigations involving the collection and interpretation of data. They assess likelihood and assign probabilities using experimental and theoretical approaches. They develop an increasingly sophisticated ability to critically evaluate chance and data concepts and make reasoned judgments and decisions, as well as building skills to critically evaluate statistical information and develop intuitions about data.

Proficiency strands

The proficiency strands describe the actions in which students can engage when learning and using the content. While not all proficiency strands apply to every content description, they indicate the breadth of mathematical actions that teachers can emphasise. They are represented across and within the Level Descriptions, Content Descriptions and Achievement Standards.

Understanding

Students build a robust knowledge of adaptable and transferable mathematical concepts. They make connections between related concepts and progressively apply the familiar to develop new ideas. They develop an understanding of the relationship between the 'why' and the 'how' of mathematics. Students build understanding when they connect related ideas, when they represent concepts in different ways, when they identify commonalities and differences between aspects of content, when they describe their thinking mathematically and when they interpret mathematical information.

Fluency

Students develop skills in choosing appropriate procedures, carrying out procedures flexibly, accurately, efficiently and appropriately, and recalling factual knowledge and concepts readily. Students are fluent when they calculate answers efficiently, when they recognise robust ways of answering questions, when they choose appropriate methods and approximations, when they recall definitions and regularly use facts, and when they can manipulate expressions and equations to find solutions.

Problem Solving

Students develop the ability to make choices, interpret, formulate, model and investigate problem situations, and communicate solutions effectively. Students formulate and solve problems when they use mathematics to represent unfamiliar or meaningful situations, when they design investigations and plan their approaches, when they apply their existing strategies to seek solutions, and when they verify that their answers are reasonable.

Reasoning

Students develop an increasingly sophisticated capacity for logical thought and actions, such as analysing, proving, evaluating, explaining, inferring, justifying and generalising. Students are reasoning mathematically when they explain their thinking, when they deduce and justify strategies used and conclusions reached, when they adapt the known to the unknown, when they transfer learning from one context to another, when they prove that something is true or false and when they compare and contrast related ideas and explain their choices.

Content descriptions

The mathematics curriculum includes content descriptions at each level. These describe the knowledge, concepts, skills and processes that teachers are expected to teach and students are expected to learn. However, they do not prescribe approaches to teaching. The content descriptions are intended to ensure that learning is appropriately ordered and that unnecessary repetition is avoided. However, a concept or skill introduced at one level may be revisited, strengthened and extended at later levels as needed.

Sub-strands

Content descriptions are grouped into sub-strands to illustrate the clarity and sequence of development of concepts through and across the levels. They support the ability to see the connections across strands and the sequential development of concepts from Foundation (including Levels A to D for Students with Disabilities) to Level 10.

Number and Algebra	Measurement and Geometry	Statistics and Probability
Number and place value (F–8)	Using units of measurement (F–10)	Chance (1–10)
Fractions and decimals (1–6)	Shape (F–7)	Data representation and interpretation (F–10)
Real numbers (7–10)	Geometric reasoning (3–10)	

Money and financial mathematics (1–10)	Location and transformation (F–7)	
Patterns and algebra (F–10)	Pythagoras and trigonometry (9–10)	
Linear and non-linear relationships (8–10)		

Level descriptions

Level descriptions emphasise the importance of working mathematically within the content. They provide an overview of the relationship between the proficiencies (**Understanding, Fluency, Problem Solving** and **Reasoning**) and the content for each level.

Content elaborations

Content elaborations are provided for all levels to illustrate and exemplify content and assist teachers to develop a common understanding of the content descriptions. They are not intended to be comprehensive content points that all students need to be taught.

Glossary

A [glossary](#) is provided to support the common understanding of key terms in the content descriptions.

This [support document](#) contains additional information to support the glossary.

Mathematics across Foundation to Level 10

The AusVELS curriculum is described by levels. This document provides advice on the nature of learners, by level and age and the relevant curriculum:

- Foundation to Level 2: typically students from 5 to 8 years of age
- Levels 3–6: typically students from 8 to 12 years of age
- Levels 7–10: typically students from 12 to 16 years of age.

The 'Towards Foundation Level AusVELS' Levels A to D (Students with Disabilities) focusses on progressing students from a pre-intentional to intentional state, and are not associated with any set age or year level that links chronological age to cognitive progress.

Foundation to Level 2

These levels lay the foundation for learning mathematics. Students at this level can access powerful mathematical ideas relevant to their current lives and learn the language of mathematics, which is vital to future progression.

Children have the opportunity to access mathematical ideas by developing a sense of number, order, sequence and pattern; by understanding quantities and their representations; by learning about attributes of objects and collections, position, movement and direction, and by developing an awareness of the collection, presentation and variation of data and a capacity to make predictions about chance events.

Understanding and experiencing these concepts in the early levels provides a foundation for algebraic, statistical and numerical thinking, that will develop in subsequent levels. These foundations also enable children to pose basic mathematical questions about their world, to identify simple strategies to investigate solutions, and to strengthen their reasoning to solve personally meaningful problems.

Levels 3–6

These levels emphasise the importance of students studying coherent, meaningful and purposeful mathematics that is relevant to their lives. Students still require active experiences that allow them to construct key mathematical ideas, but also gradually move to using models, pictures and symbols to represent these ideas.

The curriculum develops key understandings by extending the number, measurement, geometric and statistical learning from the early levels; by building foundations for future studies through an emphasis on patterns that lead to generalisations; by describing relationships from data collected and represented; by making predictions; and by introducing topics that represent a key challenge in these levels, such as fractions and decimals.

In these levels of schooling, it is particularly important for students to develop a deep understanding of whole numbers to build reasoning in fractions and decimals and to develop a conceptual understanding of place value. These concepts allow students to develop proportional reasoning and flexibility with number through mental computation skills, and to extend their number sense and statistical fluency.

Levels 7–10

These levels of school mark a shift in mathematics learning to more abstract ideas. Through key activities such as the exploration, recognition and application of patterns, the capacity for abstract thought can be developed and the ways of thinking associated with abstract ideas can be illustrated.

The foundations built in previous levels prepare students for this change. Previously established mathematical ideas can be drawn upon in unfamiliar sequences and combinations to solve non-routine problems and to consequently develop more complex mathematical ideas. However, students of this age also need an understanding of the connections between mathematical concepts and their application in their world as a motivation to learn. This means using contexts directly related to topics of relevance and interest to this age group.

During these levels, students need to be able to represent numbers in a variety of ways; to develop an understanding of the benefits of algebra, through building algebraic models and applications and the various applications of geometry; to estimate and select appropriate units of measure; to explore ways of working with data to allow a variety of representations; and to make predictions about events based on their observations.

The intent of the curriculum is to encourage the development of important ideas in more depth, and to promote the interconnectedness of mathematical concepts. An obvious concern is the preparation of students intending to continue studying mathematics in the senior secondary levels. Teachers will, in implementing the curriculum, extend the more mathematically able students by using appropriate challenges and extensions within available topics. A deeper understanding of mathematics in the curriculum enhances a student's potential to use this knowledge to solve non-routine problems, both at this level of study and at later stages.

Level 10A content descriptors indicate **optional** additional content suitable for development of student mathematical background in preparation for further study of functions, algebra, and calculus; as well as other additional content related to statistics and trigonometry.

Teachers can incorporate a **selection** of this and other additional content in Level 10 mathematics courses, as applicable for extension and enrichment purposes, and to prepare students for subsequent study of various implementations of General Mathematics Units 1 and 2 and/or Mathematical Methods (CAS) Units 1 and 2 in Level 11.

Where additional material is included in particular as preparation for subsequent study of Mathematical Methods (CAS) Units 1 and 2, content relating to an introductory treatment of logarithmic functions and circular functions (as functions of a real variable) will be helpful. This could include related algebra and solving simple equations, as well as some simple transformations of graphs, especially in modelling contexts. Students should also be familiar with corresponding work on sets, including relevant notation, that underpins the study of functions, algebra, calculus and probability; as well as the use of technology for numeric, graphic and symbolic computation.

The [AusVELS - Mathematics Scope and Sequence chart](#) is available from the VCAA website.

Achievement Standards

Achievement standards indicate the quality of learning students should typically demonstrate by a particular point in their schooling. Achievement standards comprise a written description and student work samples.

An achievement standard describes the quality of learning (the extent of knowledge, the depth of understanding and the sophistication of skills) that would indicate the student is well placed to commence the learning required at the next level of achievement.

The sequence of achievement standards across the levels describes progress in the learning area. This sequence provides teachers with a framework of growth and development in the learning area.

Student work samples play a key role in communicating expectations described in the achievement standards. Each work sample includes the relevant assessment task, the student's response, and annotations identifying the quality of learning evident in the student's response in relation to relevant parts of the achievement standard. Together, the description of the achievement standard and the accompanying set of annotated work samples help teachers to make judgments about whether students have achieved the standard.

Diversity of Learners

The AusVELS curriculum has been developed to ensure that curriculum content and achievement standards establish high expectations for all students. Every student is entitled to enriching learning experiences across all areas of the curriculum. Students in Australian classrooms have multiple, diverse and changing needs that are shaped by individual learning histories and abilities as well as cultural language backgrounds and socio-economic factors.

Students with Disabilities

The objectives of AusVELS are the same for all students. The curriculum offers flexibility for teachers to tailor their teaching in ways that provide rigorous, relevant and engaging learning and assessment opportunities for students with disabilities.

Most students with disabilities can engage with the curriculum provided the necessary adjustments are made to the complexity of the curriculum content and to the means through which students demonstrate their knowledge, skills and understanding.

For some learners, making adjustments to instructional processes and to assessment strategies enables students to achieve educational standards commensurate with their peers.

For other students, teachers will need to make appropriate adjustments to the complexity of the curriculum content, focusing instruction on content different to that taught to others in their age group. It follows that adjustments will also need to be made to how the student's progress is monitored, assessed and reported.

For a small percentage of students with disabilities, their learning will be well below the AusVELS Foundation standards. Most of these students have a significant intellectual disability. 'Towards Foundation Level AusVELS' provides this cohort of students with access to curriculum content and standards that enables students to move toward the learning described at Foundation level.

For AusVELS English, Mathematics, Science and History, the 'Towards Foundation Level AusVELS' materials are integrated directly into the AusVELS curriculum and are referred to as 'Levels A to D'. These materials include learning area-specific level descriptions, content descriptions and elaborations, achievement standards and scope and sequence charts.

About Levels A to D (Students with Disabilities)

Levels A to D (Students with Disabilities) focus on progressing students from a pre-intentional to intentional engagement in learning. They support students to develop their independence as they explore, participate and engage in the world around them. As students' progress through these levels, the amount of support decreases as they proceed towards becoming independent learners.

'Levels A to D' are not associated with any set age or year level that links chronological age to cognitive progress. Rather the learning descriptions for levels A to D are structured by the following continuum:

Level A: Beginning to Explore

At this level students experience a range of learning activities that will assist them to attend to and explore the world around them with as much independence as possible. Experiences are designed to move students from a pre-intentional level of responding to a level where the response indicates beginning intention. Students need high levels of coactive support and focused attention from the teacher to help them initiate and refine their responses. Students demonstrate some awareness and recognition of familiar people and routine activities.

Level B: Active Exploration

Students at this level become less reliant on high levels of coactive support and become more reliant on verbal prompts and gestures to facilitate their learning. They begin to explore their world independently and engage in simple cause-and-effect play activities. Students are able to focus on structured learning activities for short periods of time. They respond to familiar people and events and begin to use 'yes/no' responses.

Level C: Intentional Participation

Students at this level are less dependent on coactive support and respond more consistently to prompts and simple clear directions from the teacher to support them in their learning. They are displaying the first signs of independence and becoming more peer focused. Students participate in structured learning activities with others and they begin to use pictures, photos and objects to communicate personal interests and experiences. They start to use and link some familiar words and images to construct a meaningful communication.

Level D: Building Independence

With teacher support and curriculum scaffolding, students at this level participate cooperatively in group learning activities. They express their feelings, needs and choices in increasingly appropriate ways and combine and sequence key words and images to communicate personal interests and to recount significant experiences. They indicate beginning understanding of social rules and expectations and are beginning to reflect on their own behaviour.

Specific level descriptions for AusVELS Mathematics are integrated with the AusVELS curriculum, i.e., see <http://ausvels.vcaa.vic.edu.au/Mathematics/Curriculum/F-10>.

For more advice in regard to curriculum provision and students with disabilities, please see the [AusVELS Students with Disabilities Guidelines](#) (PDF). Additional advice and support is also available from the DEECD [Abilities Based Learning and Education Support \(ABLES\) website](#).

English as an additional language

Many students in Australian schools are learners of English as an additional language (EAL). Learners of EAL are students whose first language is a language other than Standard Australian English and who require additional support to assist them to develop English language proficiency. While many EAL learners do well in school, there is a significant group of these learners who leave school without achieving their potential.

EAL students come from diverse backgrounds and may include:

- children whose first language is a language other than English
- Aboriginal and Torres Strait Islander students whose first language is an Indigenous language, including traditional languages, creoles and related varieties, or Aboriginal English.

EAL learners enter Australian schools at different ages and at different stages of English language learning and have various educational backgrounds in their first languages. For some, school is the only place they use English.

The aims of AusVELS Mathematics are ultimately the same for all students. However, EAL learners are simultaneously learning a new language and the knowledge, understanding and skills of the mathematics curriculum through that new language. They require additional time and support, along with informed teaching that explicitly addresses their language needs, and assessments that take into account their developing language proficiency.

A national EAL document is being produced that will support the AusVELS curriculum. It will provide a description of how language proficiency develops, and will be a valuable reference for all teachers. It will allow mathematics teachers to identify the language levels of the EAL learners in their classrooms and to address their specific learning requirements when teaching, ensuring equity of access to the mathematics learning area for all.

In the interim, advice about how to use the curriculum with EAL students is [available here](#).

Cross-curriculum priorities

There are three cross curriculum priorities in the AusVELS Mathematics:

- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability.

The cross curriculum priorities are embedded in the curriculum and will have a strong but varying presence depending on their relevance to each of the learning areas.

Aboriginal and Torres Strait Islander histories and cultures

Aboriginal and Torres Strait Islander communities are strong, rich and diverse. Aboriginal and Torres Strait Islander Identity is central to this priority and is intrinsically linked to living, learning Aboriginal and Torres Strait Islander communities, deep knowledge traditions and holistic world view.

A conceptual framework based on Aboriginal and Torres Strait Islander Peoples' unique sense of Identity has been developed as a structural tool for the embedding of Aboriginal and Torres Strait Islander histories and cultures within AusVELS Mathematics. This sense of Identity is approached through the interconnected aspects of Country/Place, People and Culture. Embracing these elements enhances all areas of the curriculum.

The Aboriginal and Torres Strait Islander priority provides opportunities for all learners to deepen their knowledge of Australia by engaging with the world's oldest continuous living cultures. This knowledge and understanding will enrich their ability to participate positively in the ongoing development of Australia.

AusVELS Mathematics values Aboriginal and Torres Strait Islander histories and cultures. It provides opportunities for students to appreciate that Aboriginal and Torres Strait Islander societies have sophisticated applications of mathematical concepts.

Students will explore connections between representations of number and pattern and how they relate to aspects of Aboriginal and Torres Strait Islander cultures. They will investigate time, place, relationships and measurement concepts in Aboriginal and Torres Strait Islander contexts. Students will deepen their understanding of the lives of Aboriginal and Torres Strait Islander Peoples through the application and evaluation of statistical data.

Asia and Australia's engagement with Asia

AusVELS Mathematics, the priority of Asia and Australia's engagement with Asia provides rich and engaging contexts for developing students' mathematical knowledge, skills and understanding.

AusVELS Mathematics provides opportunities for students to learn about the understandings and applications of Mathematics in Asia. Mathematicians from Asia continue to contribute to the ongoing development of Mathematics.

In this learning area, students develop mathematical understanding in fields such as number, patterns, measurement, symmetry and statistics by drawing on knowledge of and examples from the Asia region. These could include calculation, money, art, architecture, design and travel. Investigations involving data collection, representation and analysis can be used to examine issues pertinent to the Asia region.

Sustainability

AusVELS Mathematics, the priority of sustainability provides rich, engaging and authentic contexts for developing students' abilities in number and algebra, measurement and geometry, and statistics and probability.

AusVELS Mathematics provides opportunities for students to develop the proficiencies of problem solving and reasoning essential for the exploration of sustainability issues and their solutions. Mathematical understandings and skills are necessary to measure, monitor and quantify change in social, economic and ecological systems over time. Statistical analysis enables prediction of probable futures based on findings and helps inform decision making and actions that will lead to preferred futures.

Mathematics

In this learning area, students can observe, record and organise data collected from primary sources over time and analyse data relating to issues of sustainability from secondary sources. They can apply spatial reasoning, measurement, estimation, calculation and comparison to gauge local ecosystem health and can cost proposed actions for sustainability.

Students with disabilities (Level A)

The proficiency strands *Understanding*, *Fluency*, *Problem Solving* and *Reasoning* are an integral part of the mathematics content across the three content strands: *Number and Algebra*, *Measurement and Geometry*, *Statistics and Probability*. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of Mathematics.

At this level:





Understanding develops from becoming aware of their physical state and encountering, reacting and responding to the world around them and to some everyday events and routines

Fluency includes students learning to control their behaviour and internal state and developing a repertoire of reactions to everyday experiences and events

Problem Solving includes students attending to and exploring the world around them with as much independence as possible

Reasoning includes students coactively exploring and manipulating objects in their immediate environment and experiencing the language associated with Maths activities.

Number and Algebra

Number and place value	Elaborations
Respond to objects being counted and distributed (ACMNA001a)  	<ul style="list-style-type: none"> experiencing number names and number sequence in everyday experiences, for example birthdays, distributing equipment, collecting materials experiencing number and its use in stories, songs and rhythm, chosen for their interest and relevance to the student's age attending to number and counting in daily routines, for example cups of flour in the bowl, number of times an action or event is repeated or experienced reacting to everyday situations where objects are counted, for example number of items on a plate or tray, steps to the door, eggs in the carton, bounces of a ball being supported as they touch, feel or move over objects as they are being counted
Respond to situations where counting is involved (ACMNA002a)  	<ul style="list-style-type: none"> experiencing to number name, numerals and quantities in everyday experiences experiencing activities that use number names, numerals and quantities, for example stories, songs, cooking, music attending to and being aware of number as objects are being counted reacting to objects moving, disappearing and re-appearing within the context of everyday situations responding to wanting more or less of an object

Respond to groups of personally relevant objects (ACMNA003a)

- experiencing objects and groups of objects, for example through sensory activities
- experiencing groups of objects of significantly different sizes
- reacting to collections within the context of everyday familiar situations, for example collections of favourite food, jewellery, utensils, or collections based on colour or texture

Respond to situations where the comparison of two collections or objects are involved (ACMNA289a)



- experiencing objects being collected and grouped together
- using objects which are personally relevant to create collections
- reacting to the comparison of everyday objects and collections of objects, for example using one-to-one correspondence to compare art equipment, cooking utensils, balls, sensory objects

Respond to the removal and addition of familiar items and objects in practical situations (ACMNA004a)



- experiencing changes in quantity that occur during addition and subtraction within everyday experiences
- attending to the adding and subtraction of familiar objects
- reacting to changes in a collection when objects are added or subtracted

Patterns and algebra

Elaborations

Respond to the identification of objects (ACMNA005a)

- experiencing patterns and the sorting of objects in everyday situations, for example repeated rhythm, pattern on textured material or objects, sorting of materials and utensils
- becoming aware of ready-made visual, musical and multimodal patterns, for example, computer programs, stripes, dots, textures, sounds

Measurement and Geometry

Using units of measurement

Elaborations

Respond to objects based on length (ACMMG006a)

- experiencing objects of various lengths
- experiencing measurement attributes through the use of sensory input and objects
- reacting to various measurement attributes of familiar objects, and being introduced to the names of those attributes, in the context of everyday experiences

Respond to personally relevant everyday events (ACMMG007a)

- experiencing everyday events and their associated equipment and sensory elements
- reacting to changes in their environment associated with everyday events
- experiencing visuals being used to represent regular events
- reacting to objects and tools associated with routine everyday events

Respond to personally relevant routine events (ACMMG008a)

- experiencing events and their equipment, staff, and sensory elements
- experiencing events and their characteristics being represented by images or augmentative and alternative communication (AAC)
- reacting to routine events with the support of objects, sounds and textures
- reacting and responding to daily events within the context of a range of practical situations, for example reacting to the bell for lunch time, responding to the timer, staff or an image for maths

Shape

Elaborations

Respond to familiar everyday shapes and objects (ACMMG009a)

- experiencing a variety of objects and their characteristics, and being introduced to the names of shapes through interaction with objects
- reacting to three-dimensional objects in everyday situations with the use of sensory input, for example touching, feeling, looking, shaking, rolling
- responding to objects and shapes as they are identified in the classroom and environment in everyday situations

Location and transformation

Elaborations

Respond to movement of an object (ACMMG010a)

- experiencing movement and position within various environments and everyday events, for example exploring the concept of 'inside and outside' during structured activities
- experiencing the language used to name movement and changes in position during everyday experiences, such as up, down, over, under
- reacting to a variety of body positions and movements within the context of everyday activities
- using everyday language of location and position to assist students to react to changes to objects and their body, for example, 'arms up', 'I am moving your bag', 'Where did it go?'
- reaching for or looking for a desired object by moving head or body for a better view

Statistics and Probability

Data representation and interpretation

Elaborations

Respond to objects relevant to a given context (ACMSP011a)

- experiencing the collection, sorting and displaying of information and data, for example visual display of who is here today with photos of class members' present
- associating objects with familiar events, within the context of practical situations, for example recognising connection between own bag and lunchtime, equipment for art, sport, or cooking and the associated activity
- experiencing the phenomena of chance by attending to activities and toys that demonstrate chance occurrences

Level A achievement standard

Number and Algebra

Students observe the use of number within their daily life. They begin to respond to numbers in everyday experiences. Students demonstrate awareness of counting by responding to number rhymes, songs, stories and finger games. They experience and respond to 'one for you, one for me', 'gone', 'no more left' and 'give me more'. Students participate in making piles, groups or bundles of familiar everyday objects and respond to objects being put together and taken apart.

Measurement and Geometry

Students observe and explore objects within daily life. They react and respond to objects and experience measurement attributes in practical situations. Students explore objects of varying weights, lengths, capacities and materials. They show an awareness of time and daily routine by responding to a signal from the teacher, and items being brought out or removed. Students respond to a signal from a timer, used to indicate the end of an activity. Students explore and respond to objects of varying textures, colours, sizes and shapes. Students explore space by moving and changing position and location, and respond to changes in position.

Statistics and Probability

Students observe objects and events within their daily life. Students begin to display a similar and predictable reaction to regular events. They respond to major changes to regular games and activities associated with chance, surprise and predictability, such as hitting a switch to activate a toy.

Students with disabilities (Level B)

The proficiency strands *Understanding*, *Fluency*, *Problem Solving* and *Reasoning* are an integral part of the mathematics content across the three content strands: *Number and Algebra*, *Measurement and Geometry*, *Statistics and Probability*. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this level:





Understanding develops through participating in a variety of everyday activities that involve objects, events and number

Fluency includes following regular routines, and matching objects using a repertoire of responses

Problem Solving includes students attending to, exploring and sorting objects in the world around them

Reasoning includes manipulating and playing with objects to develop links between their immediate environment, everyday language and mathematical activity.

Number and Algebra

Number and place value	Elaborations
Use number names 'one', 'two' and 'three' in sequence to count in everyday situations (ACMNA001b)  	<ul style="list-style-type: none"> • assisting to count objects initially to three, by participating in activities, stories, songs and rhymes that involve number. This could include nodding as objects are counted, tapping an object as it is counted, tracking objects being counted, repeating some number names as objects are being counted • responding to number of names in everyday situations, for example waiting for counting down or up before starting an action, sound, activity; stepping, clapping, making a sound, tapping a switch for each number • exploring and using some number names by 'repeating' number name either verbally or through a communication system or augmentative and alternative communication (AAC)
Correspond 'one' with a single object (ACMNA002b)  	<ul style="list-style-type: none"> • showing understanding of object permanency, by tracking and finding an object • exploring 'oneness' and indicate one, for example one clap, experiencing one object, giving out materials one at a time, requesting one, hearing one sound or beat • distributing objects and materials with support, using basic one-to-one correspondence

Explore the concept of 'none', 'one' and 'more' (ACMNA003b)

- recognising a change in a collection's size within the context of familiar, everyday objects, for example a group of cars, toys, lollies, fruit, vegetables, coins, books, materials or tools
- demonstrating an understanding of one by selecting, giving or taking one object
- responding to questions about group composition (for example 'Which group has more?' 'Which group has none?') verbally or by indicating through augmentative and alternative communication, actions or eye gaze

Make comparison between items using appropriate language such as 'same' or 'different' (ACMNA289b)



- comparing two collections using one to one correspondence within the context of everyday situations
- responding to questions about group comparison for example 'Are they the same?' 'Or different?' verbally or by indicating through augmentative and alternative communication, actions or eye gaze

Participate in everyday situations involving 'adding' and 'taking away' (ACMNA004b)



- combining two groups of objects to make 'more' within the context of familiar everyday situations
- participating in everyday situations that involve moving objects to make 'less' or 'more', for example dragging an object to or from a group, using a switch to initiate the action or augmentative and alternative communication to communicate the action required

Patterns and algebra

Elaborations

Participate in the comparing of objects, using language such as 'same' and 'different' (ACMNA005b)

- recognising patterns through the concept of 'same' and 'different' objects within the context of everyday situations
- repeating rhythm patterns (with movement or sound)
- making simple patterns by stacking and lining up objects
- sorting everyday familiar objects during shared experiences, for example, when cooking, playing sport or playing with toys such as blocks

Measurement and Geometry

Using units of measurement

Elaborations

Compare objects using direct comparison (ACMMG006b)

- exploring objects in structured situations based on length
- matching objects that are from a small field and identical in length
- showing recognition or preference for an object based on its mass, capacity or length within a range of situations

Recognise and participate in familiar events that happen on a daily basis (ACMMG007b)

- recognising the sequence of familiar events, for example 'first and then', with the support of picture-based schedules
- understanding and using environmental cues such as equipment, staff and location to predict and identify activities
- assisting in the construction of visual timetable for the class
- responding to the signal from a timer to indicate the end of an activity

Participate in regular daily events
(ACMMG008b)

- developing an awareness of regular events and routines, with the support of daily and weekly visual schedules
- recognising and following the routines at the start and end of the day

Shape

Elaborations

Identify when two shapes or objects are the same sort or not (ACMMG009b)

- using 'posting' of items into different containers or holes to manipulate and sort shapes and objects
- recognising three dimensional objects when identified in the environment using everyday situations
- matching everyday objects that are 'the same'
- exploring shapes by using 'play dough' and other malleable materials to make shapes
- developing an awareness of the language used to describe shapes

Location and transformation

Elaborations

Respond to a simple statement about location or direction (ACMMG010b)

- following directional communication used in daily routine, for example, 'put in' to finish an activity, 'sit down', 'stand up' during an activity or program
- following everyday language of location and direction through modelled daily routines, for example: looking upwards for 'up'; using rhymes and chants that relate to movement; following a warm-up sequence for work or sport; unpacking their bag; washing their hands and setting up for lunch
- exploring the concept of 'inside' and 'outside' during activities by putting objects 'in' and 'out' of a container and following routines and instructions that involve moving inside and outside locations

Statistics and Probability

Data representation and interpretation

Elaborations

Participate in data collection
(ACMSP011b)

- following the construction of data display, for example picture representations of student choices, presented as class display of hair colour, favourite colour, song, movie, character
- assisting to identify pictures that represent daily routines and events in a data display
- choosing pictures or objects to put in a data display

Level B achievement standard

Number and Algebra

Students participate in everyday activities that involve numbers and counting, comparing groups of objects, and pattern activities. Students can rote count to three. Students identify 'one' and 'lots' of objects and show an understanding of 'more' in familiar situations. They manipulate objects and build a tall tower by using 'more' blocks and take blocks away from a tower to make the tower 'less' tall.

Measurement and Geometry

Students participate in everyday activities that explore measurement and use measurement attributes in practical situations. Students demonstrate beginning understanding of basic measurement concepts such as 'long or short', 'heavy or light',

They explore routine events and show an awareness of time and daily routines by responding to a routine signal from the teacher, such as, 'It's time to go outside and play', 'pack up', or 'unpack bag'

They demonstrate an awareness of object permanence by searching for objects that have been hidden and participate in class activities that explore three-dimensional objects. They can match identical familiar three-dimensional shapes that are 'the same'. Students respond to specific instructions relating to manipulating the movement and location of self and objects.

Statistics and Probability

They participate in class activities that explore object, events and displaying information. They develop an awareness of chance by playing with materials or objects that involve cause and effect (actions that will happen) and playing games where the outcome is unpredictable, for example, peekaboo. Students respond to a simple pictorial representation of their activities related to a short time-frame.

Students with disabilities (Level C)

The proficiency strands *Understanding*, *Fluency*, *Problem Solving* and *Reasoning* are an integral part of the mathematics content across the three content strands: *Number and Algebra*, *Measurement and Geometry*, *Statistics and Probability*. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this level:





Understanding includes connecting names and quantities (of objects, events and numbers to five)

Fluency includes counting numbers in sequence, matching objects to replicate a pattern and predicting day and night events

Problem Solving includes matching groups and objects

Reasoning includes manipulating and playing with objects to develop links between their immediate environment, everyday language, mathematical activity and concepts.

Number and Algebra

Number and place value	Elaborations
Use number names in sequence to count in everyday situations, initially from one to five (ACMNA001c)  	<ul style="list-style-type: none"> developing fluency in forward counting to five using words, sign or augmentative and alternative communication (AAC) in meaningful contexts, including everyday experiences and stories knowing that the forward sequence of counting words occurs in the same order, for example always communicating numbers in the same sequence, indicating when another person uses number names in the wrong sequence developing one-to-one correspondence by recognising that each object is counted, by indicating an object during counting situations, for example, indicating by pointing, activating a switch or eye gaze
Know and match number name, numerals and quantities to three (ACMNA002c)  	<ul style="list-style-type: none"> developing one-to-one matching of number word or its representation through sign or alternative and augmentative communication (AAC) to objects initially up to three recognising that numerals look different from non-numeral shapes using structured situations to count and match groups of objects to a numeral, initially up to 3
Identify groups as being 'one', 'more' or 'less' (ACMNA003c)	<ul style="list-style-type: none"> indicating the larger of two groups when presented with groups of significantly different number sets, for example group of paints, lollies, tools, dots, blocks, counters

Compare and order two collections according to their quantity (ACMNA289c)



- comparing and ordering items using appropriate language of 'more', 'less', 'same'
- using everyday situations of one-to-one correspondence to compare two collections of significantly different amounts
- using practical situations to indicate 'more', 'less' or 'same'

Demonstrate in practical situations, 'adding one more to' and 'taking one away from' in everyday situations (ACMNA004c)



- using shared experiences with concrete materials to add one more to or take away one from a group of objects, and count to find a total
 - experiencing addition and subtraction in games
- communicating using language such as 'more' or 'less' to describe a change in a group using classroom resources and in practical situations

Patterns and algebra

Elaborations

Pair identical objects from a small collection. Recognise simple repeated patterns (ACMNA005c)

- copying a simple repeated pattern using one-to-one correspondence with objects
- copying a pattern associated with a familiar activity, for example repeating movement pattern
- using a single given attribute (for example, size, colour, texture, shape) to group objects
- matching, sorting and organising objects in practical situations

Measurement and Geometry

Using units of measurement

Elaborations

Compare two objects based on measurement attributes of length (ACMMG006c)

- comparing and matching objects based on their having the 'same' or 'different' length, for example pencils, shoes or food items that are the same length
- recognising length in shared experiences by comparing objects directly and indicating differences between objects
- using measurement language such as long or short to communicate significant differences between objects

Identify familiar events that occur at different stages of a day (morning, afternoon, evening, night) (ACMMG007c)

- sorting images or symbols according to whether they occur during the day or the night
- using visual schedules to complete activities within an event and events within the day, and manage time throughout the day
- interpreting language, images and communication associated with day such as morning, afternoon, and night
- indicating an event as long or short
- recognising and responding to daily routines by selecting an image from a schedule to indicate an activity has finished or is about to begin

Identify the familiar events within the day using a visual schedule (ACMMG008c)

- identifying daily events through materials, visuals and objects provided
- identifying daily events with the assistance of visual or tactile schedules and timetables
- identifying events that may or may not happen today

Shape

Elaborations

Match familiar two dimensional shapes and three dimensional objects (ACMMG009c)

- matching simple three dimensional shapes with similar attributes, for example, different-sized spheres
 - matching simple two dimensional shapes with similar attributes, for example, different-sized spheres
- recognising the relationship between familiar shapes using insert puzzles

Location and transformation

Elaborations

Locate familiar three-dimensional objects in the classroom when they are named (ACMMG010c)

- interpreting everyday language of location by following simple directions and communication, for example, move or track an object, feel or follow a path
- locating familiar environments and objects, for example, classroom, hall, desk

Statistics and Probability

Data representation and interpretation

Elaborations

Identify data relevant to a given context (ACMSP011c)

- assisting to collect information to answer a question, for example, what colours are the counters in the box
 - following simple instructions to sort objects for a data display
-

Level C achievement standard

Number and Algebra

Students connect number names and numerals with sets of up to five elements. They match individual objects with counting sequences up to and back from five. Students use concrete materials to solve problems that involve comparing, combining and separating sets, for example “How might I make this group more than the other group?” Students make ‘groups’, ‘lots’ and groups of ‘one’ and can indicate which collection has ‘more’ than the other. They can distribute objects to each person in a group until there are no objects left. Students order the first three elements of a set. Students can match one attribute of familiar objects, for example, colour, size or shape.

Measurement and Geometry

Students explore measurement attributes in practical situations and use words to describe the characteristics of familiar objects such as full, empty, long, short, light and heavy. Students solve simple mathematical problems associated with longer and shorter lengths, for example, 'How can I make this stick shorter?' They explore events and identify day and night events. They can identify events that may or may not happen today. Students respond to a simple pictorial representation of activities related to their whole day. They match objects that are the same and sort familiar objects, and an understanding of the concept of 'inside and outside' by following instructions. They demonstrate an understanding of location and spatial awareness by following simple instructions related to simple spatial concepts, such as 'under', 'on', 'beside'.

Statistics and Probability

Students participate in and contribute to the development of picture schedules, timetables and pictorial lists associated with familiar activities, such as listing the ingredients needed for a cooking session. They demonstrate an understanding of the concept of chance by participating in games of chance, and identifying events that may or may not happen today.

Students with disabilities (Level D)

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At this level:







Understanding includes connecting names, numerals and quantities of objects, events and numbers to 10)

Fluency includes counting number in sequence, continuing patterns, comparing objects, recognising events in the day

Problem Solving includes manipulating, comparing and sorting objects, such as which group (out of three) has more or less

Reasoning includes manipulating and playing with objects to develop links between their immediate environment, everyday language and mathematical activity.

Number and Algebra

Number and place value	Elaborations
Use a number names in sequence to count in everyday situations, initially from one to ten (ACMNA001d)  	<ul style="list-style-type: none"> developing fluency with forward counting by communicating number names while counting, initially to 10 and in meaningful contexts such as cooking, collecting equipment, stories and games understanding one-to-one correspondence by knowing that each object is counted only once, by tracking an object while counting in shared and structured counting experiences, for example moving objects once counted, counting objects left to right
Recognise number name, numerals and quantities, initially up to five and beyond (ACMNA002d)  	<ul style="list-style-type: none"> responding to key vocabulary and questions about 'how many' using one-to-one matching of number words, sign or augmentative and alternative communication (AAC) representation for objects to five matching numerals to the correct number of items initially to five using number games, software, cards and everyday situations
Subitise regular arrangements of objects and arrays up to five (ACMNA003d)	<ul style="list-style-type: none"> understanding that some numbers are represented by a set pattern or array
Compare, order and make comparisons between two collections, according to their quantity, using numbers initially to five (ACMNA289d)  	<ul style="list-style-type: none"> comparing and ordering collections using the appropriate language and number name comparing and communicating about characteristics of groups, for example sequencing objects in a group from smallest to largest; indicating the larger/smaller group through gesture, verbally or augmentative and alternative communication (AAC)

Model practical situations involving ‘adding to’ or ‘taking away’ with collections of up to five objects (ACMNA004d)



- using shared experiences with concrete materials to combine two groups of objects, and count to find a total
- counting on or back from a group using concrete materials, for example adding/ subtracting balls in a basket, pens in a container, tools in a tool box
- using a calculator or digital device to undertake simple addition and subtraction
- exploring the concept of adding one and taking away one

Patterns and algebra

Elaborations

Sort like objects based on a given classification. Identify and continue a simple repeated pattern with its next element (ACMNA005d)

- continuing a simple repeated two-part pattern with given objects, movements or sounds, for example, red, blue, red (set the table with drinking cups), paper, glue (set up equipment), knife and fork (set a table using two implements)
- making patterns and collections based on objects being the same, different and alike
- examining and continuing a simple repeated pattern with given objects, movements or sounds, for example, continue a two-beaded pattern (red, blue, red, blue)
- sorting and grouping objects and communicating attributes such as texture, colour, size, category; for example, sort papers into two colours, sort cutlery into two groups
- recognising patterns in familiar environments

Measurement and Geometry

Using units of measurement

Elaborations

Respond to contexts involving ‘heavier/lighter’ than and ‘holds more/less’ than (ACMMG006d)

- using measurement language such as longer and shorter, or heavier and lighter, to communicate differences between objects
- using direct comparison to compare objects based on their length, mass or volume

Identify and sequence regular events that occur during the school day and comment on their duration (short/long) (ACMMG007d)

- creating and following a visual schedule based on the school day’s events
- ordering events based on duration, for example, ‘I can do more at lunch time than recess’
- comparing and labelling events as long, short, quick
- understanding the purpose of a clock and some of its features
- using timers and a clock to explore and compare time and duration of events

Identify the days of the week in sequence
(ACMMG008d)

- using picture schedules to identify key events of a day and a week
- using everyday language 'sometimes', 'always' and never to indicate the likelihood of an event on a day or week
- using 'morning routine' to identify the days and what will occur during the day
- communicating the days of the week

Shape

Elaborations

Use direct comparison to sort three dimensional objects and two dimensional shapes (ACMMG009d)

- sorting shapes that are the 'same' or 'different'
- identifying, matching and sorting simple familiar two and three dimensional objects according to a single attribute
- identifying familiar shapes hidden in a picture
- investigating the inside and outside shape of an object
- understanding the relationship between shape and template, for example, insert puzzle, inserting a shape in a matching shaped hole

Location and transformation

Elaborations

Follow simple directional words, to locate or move an object 'on', 'in' or 'under' (ACMMG010d)

- following multiple positional directions during everyday situations, for example, chants, songs or rhymes with repeated actions, completing an art, cooking or drawing activity, locating a tool or completing a job
- developing consistency and fluency in communicating and interpreting directional and positional words
- using everyday location language to explain where an object is

Statistics and Probability

Data representation and interpretation

Elaborations

Answer simple yes/no questions about data that has been gathered in a given context (ACMSP011d)

- following and constructing a data display such as routine schedule or daily timetable
- collecting and displaying data in a personally meaningful way

Level D achievement standard

Number and Algebra

Students connect number names and numerals with sets of up to 10 elements. They match individual objects with counting sequences up to and back from 10. They recognise and point to numerals in and around the classroom, for example, numbers on a clock face. Students use concrete materials to solve problems that involve comparing, combining and separating sets. They can indicate when groups of less than 10 objects are the same or different in number and that two collections have the 'same' quantity by matching items one to one. They can find the first and last object in a sequence and place objects into sets to make 'more' and take objects from a group to make 'less'. Students order the first five elements of a set. They sort objects and shapes based on a given attribute and create simple repeating patterns of two elements or more by copying a pattern.

Measurement and Geometry

Students explore measurement attributes in practical situations and identify and describe the basic characteristics of a range of objects, for example, heights of students, cup measures in cooking. They can identify regular events within the school week. They can follow a class pictorial schedule and mark off each passing day on a calendar. Students demonstrate an understanding of two- and three-dimensional shapes by matching basic geometric objects to pictures of that object, identifying basic three-dimensional shapes in the classroom and sorting shapes into like groups. Students show an understanding of 'location' and spatial concepts by responding to instructions to position items.

Statistics and Probability

They explore events and follow a simple picture schedule, and use these to answer simple 'yes' or 'no' questions. They play a variety of chance games such as bingo or snakes and ladders and demonstrate an understanding that they will not always win.

Foundation Level

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At this level:





Understanding includes connecting names, numerals and quantities

Fluency includes readily counting numbers in sequences, continuing patterns, and comparing the lengths of objects

Problem Solving includes using materials to model authentic problems, sorting objects, using familiar counting sequences to solve unfamiliar problems, and discussing the reasonableness of the answer

Reasoning includes explaining comparisons of quantities, creating patterns, and explaining processes for indirect comparison of length

Number and Algebra

Number and place value	Elaborations
Establish understanding of the language and processes of counting by naming numbers in sequences, initially to and from 20, moving from any starting point (ACMNA001)  	<ul style="list-style-type: none"> reading stories from other cultures featuring counting in sequence to assist students to recognise ways of counting in local languages and across cultures identifying the number words in sequence, backwards and forwards, and reasoning with the number sequences, establishing the language on which subsequent counting experiences can be built developing fluency with forwards and backwards counting in meaningful contexts, including stories and rhymes understanding that numbers are said in a particular order and there are patterns in the way we say them
Connect number names, numerals and quantities, including zero, initially up to 10 and then beyond (ACMNA002)  	<ul style="list-style-type: none"> understanding that each object must be counted only once, that the arrangement of objects does not affect how many there are, and that the last number counted answers the 'how many' question using scenarios to help students recognise that other cultures count in a variety of ways, such as by placing one pebble in a bag to represent one object (for example to count the number of cattle).
Subitise small collections of objects (ACMNA003)	<ul style="list-style-type: none"> using subitising as the basis for ordering and comparing collections of numbers

Compare, order and make correspondences between collections, initially to 20, and explain reasoning (ACMNA289)



- comparing and ordering items of like and unlike characteristics using the words 'more', 'less', 'same as' and 'not the same as' and giving reasons for these answers
- understanding and using terms such as 'first' and 'second' to indicate ordinal position in a sequence.
- using objects which are personally and culturally relevant to students

Represent practical situations to model addition and sharing (ACMNA004)



- using a range of practical strategies for adding small groups of numbers, such as visual displays or concrete materials
- using Aboriginal and Torres Strait Islander methods of adding, including spatial patterns and reasoning

Patterns and algebra

Elaborations

Sort and classify familiar objects and explain the basis for these classifications. Copy, continue and create patterns with objects and drawings (ACMNA005)

- observing natural patterns in the world around us
- creating and describing patterns using materials, sounds, movements or drawings

Measurement and Geometry

Using units of measurement

Elaborations

Use direct and indirect comparisons to decide which is longer, heavier or holds more, and explain reasoning in everyday language (ACMMG006)

- comparing objects directly, by placing one object against another to determine which is longer or by pouring from one container into the other to see which one holds more
- using suitable language associated with measurement attributes, such as 'tall' and 'taller', 'heavy' and 'heavier', 'holds more' and 'holds less'

Compare and order the duration of events using the everyday language of time (ACMMG007)

- knowing and identifying the days of the week and linking specific days to familiar events
- sequencing familiar events in time order

Connect days of the week to familiar events and actions (ACMMG008)

- choosing events and actions that make connections with students' everyday family routines

Shape

Elaborations

Sort, describe and name familiar two-dimensional shapes and three-dimensional objects in the environment (ACMMG009)

- sorting and describing squares, circles, triangles, rectangles, spheres and cubes

Location and transformation

Elaborations

Describe position and movement (ACMMG010)

- interpreting the everyday language of location and direction, such as 'between', 'near', 'next to', 'forwards', 'towards'
- following and giving simple directions to guide a friend around an obstacle path and vice versa

Statistics and Probability

Data representation and interpretation

Elaborations

Answer yes/no questions to collect information (ACMSP011)

- posing questions about themselves and familiar objects and events
- representing responses to questions using simple displays, including grouping students according to their answers
- using data displays to answer simple questions such as 'how many students answered "yes" to having brown hair?'

Foundation Level achievement standard

Number and Algebra

Students connect number names and numerals with sets of up to 20 elements, estimate the size of these sets, and use counting strategies to solve problems that involve comparing, combining and separating these sets. They match individual objects with counting sequences up to and back from 20. Students order the first 10 elements of a set.

Measurement and Geometry

Students identify measurement attributes in practical situations and compare lengths, masses and capacities of familiar objects. They order events, explain their duration, and match days of the week to familiar events. Students identify simple shapes in their environment and sort shapes by their common and distinctive features. They use simple statements and gestures to describe location.

Statistics and Probability

Students sort familiar categorical data into sets and use these to answer yes/no questions and make simple true/false statements about the data.

Level 1

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At this level: Understanding includes connecting names, numerals and quantities, and partitioning numbers in various ways

Fluency includes counting number in sequences readily forward and backwards, locating numbers on a line, and naming the days of the week

Problem Solving includes using materials to model authentic problems, giving and receiving directions to unfamiliar places, and using familiar counting sequences to solve unfamiliar problems and discussing the reasonableness of the answer

Reasoning includes explaining direct and indirect comparisons of length using uniform informal units, justifying representations of data, and explaining patterns that have been created

Number and Algebra

Number and place value	Elaborations
Develop confidence with number sequences to and from 100 by ones from any starting point. Skip count by twos, fives and tens starting from zero (ACMNA012) 	<ul style="list-style-type: none"> using the popular Korean counting game (sam-yuk-gu) for skip counting developing fluency with forwards and backwards counting in meaningful contexts such as circle games
Recognise, model, read, write and order numbers to at least 100. Locate these numbers on a number line (ACMNA013)	<ul style="list-style-type: none"> modelling numbers with a range of material and images identifying numbers that are represented on a number line and placing numbers on a prepared number line
Count collections to 100 by partitioning numbers using place value (ACMNA014)	<ul style="list-style-type: none"> understanding partitioning of numbers and the importance of grouping in tens understanding two-digit numbers as comprised of tens and ones/units
Represent and solve simple addition and subtraction problems using a range of strategies including counting on, partitioning and rearranging parts (ACMNA015)	<ul style="list-style-type: none"> developing a range of mental strategies for addition and subtraction problems
Fractions and decimals	Elaborations

Recognise and describe one-half as one of two equal parts of a whole. (ACMNA016)

- sharing a collection of readily available materials into two equal portions
- splitting an object into two equal pieces and describing how the pieces are equal

Money and financial mathematics

Elaborations

Recognise, describe and order Australian coins according to their value (ACMNA017)



- showing that coins are different in other countries by comparing Asian coins to Australian coins
- understanding that the value of Australian coins is not related to size
- describing the features of coins that make it possible to identify them

Patterns and algebra

Elaborations

Investigate and describe number patterns formed by skip counting and patterns with objects (ACMNA018)

- using place-value patterns beyond the teens to generalise the number sequence and predict the next number
- investigating patterns in the number system, such as the occurrence of a particular digit in the numbers to 100

Measurement and Geometry

Using units of measurement

Elaborations

Measure and compare the lengths and capacities of pairs of objects using uniform informal units (ACMMG019)

- understanding that in order to compare objects, the unit of measurement must be the same size

Tell time to the half-hour (ACMMG020)

- reading time on analogue and digital clocks and observing the characteristics of half-hour times

Describe duration using months, weeks, days and hours (ACMMG021)

- describing the duration of familiar situations such as 'how long is it until we next come to school?'

Shape

Elaborations

Recognise and classify familiar two-dimensional shapes and three-dimensional objects using obvious features (ACMMG022)

- focusing on geometric features and describing shapes and objects using everyday words such as 'corners', 'edges' and 'faces'

Location and transformation

Elaborations

- Give and follow directions to familiar locations (ACMMG023)
- understanding that people need to give and follow directions to and from a place, and that this involves turns, direction and distance
 - understanding the meaning and importance of words such as 'clockwise', 'anticlockwise', 'forward' and 'under' when giving and following directions
 - interpreting and following directions around familiar locations

Statistics and Probability

Chance

Elaborations

Identify outcomes of familiar events involving chance and describe them using everyday language such as 'will happen', 'won't happen' or 'might happen' (ACMSP024)

- justifying that some events are certain or impossible

Data representation and interpretation

Elaborations

Choose simple questions and gather responses (ACMSP262)

- determining which questions will gather appropriate responses for a simple investigation

Represent data with objects and drawings where one object or drawing represents one data value. Describe the displays (ACMSP263)

- understanding one-to-one correspondence
 - describing displays by identifying categories with the greatest or least number of objects
-

Level 1 achievement standard

Number and Algebra

Students count to and from 100 and locate these numbers on a number line. They partition numbers using place value and carry out simple additions and subtractions, using counting strategies. Students recognise Australian coins according to their value. They identify representations of one half. Students describe number sequences resulting from skip counting by 2s, 5s and 10s. They continue simple patterns involving numbers and objects with and without the use of digital technology.

Measurement and Geometry

Students use informal units of measurement to order objects based on length and capacity. They tell time to the half-hour and explain time durations. Students describe two-dimensional shapes and three-dimensional objects. They use the language of distance and direction to move from place to place.

Statistics and Probability

Students describe data displays. They ask questions to collect data and draw simple data displays. Students classify outcomes of simple familiar events.

Level 2

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At this level:

Understanding includes connecting number calculations with counting sequences, partitioning and combining numbers flexibly, identifying and describing the relationship between addition and subtraction and between multiplication and division

Fluency includes counting numbers in sequences readily, using informal units iteratively to compare measurements, using the language of chance to describe outcomes of familiar chance events and describing and comparing time durations

Problem Solving includes formulating problems from authentic situations, making models and using number sentences that represent problem situations, and matching transformations with their original shape

Reasoning includes using known facts to derive strategies for unfamiliar calculations, comparing and contrasting related models of operations, and creating and interpreting simple representations of data

Number and Algebra

Number and place value	Elaborations
Investigate number sequences, initially those increasing and decreasing by twos, threes, fives and ten from any starting point, then moving to other sequences. (ACMNA026)	<ul style="list-style-type: none"> developing fluency and confidence with numbers and calculations by saying number sequences recognising patterns in number sequences, such as adding 10 always results in the same final digit
Recognise, model, represent and order numbers to at least 1000 (ACMNA027)	<ul style="list-style-type: none"> recognising there are different ways of representing numbers and identifying patterns going beyond 100 developing fluency with writing numbers in meaningful contexts
Group, partition and rearrange collections up to 1000 in hundreds, tens and ones to facilitate more efficient counting (ACMNA028)	<ul style="list-style-type: none"> using an abacus to model and represent numbers understanding three-digit numbers as comprised of hundreds, tens and ones/units demonstrating and using models such as linking blocks, sticks in bundles, place-value blocks and Aboriginal bead strings and explaining reasoning



Explore the connection between addition and subtraction (ACMNA029)

- becoming fluent with partitioning numbers to understand the connection between addition and subtraction
- using counting on to identify the missing element in an additive problem

Solve simple addition and subtraction problems using a range of efficient mental and written strategies (ACMNA030)

- becoming fluent with a range of mental strategies for addition and subtraction problems, such as commutativity for addition, building to 10, doubles, 10 facts and adding 10
- modelling and representing simple additive situations using materials such as 10 frames, 20 frames and empty number lines

Recognise and represent multiplication as repeated addition, groups and arrays (ACMNA031)

- representing array problems with available materials and explaining reasoning
- visualising a group of objects as a unit and using this to calculate the number of objects in several identical groups

Recognise and represent division as grouping into equal sets and solve simple problems using these representations (ACMNA032)

- dividing the class or a collection of objects into equal-sized groups
- identifying the difference between dividing a set of objects into three equal groups and dividing the same set of objects into groups of three

Fractions and decimals

Elaborations

Recognise and interpret common uses of halves, quarters and eighths of shapes and collections (ACMNA033)

- recognising that sets of objects can be partitioned in different ways to demonstrate fractions
- relating the number of parts to the size of a fraction

Money and financial mathematics

Elaborations

Count and order small collections of Australian coins and notes according to their value (ACMNA034)

- identifying equivalent values in collections of coins or notes, such as two five-cent coins having the same value as one 10-cent coin
- counting collections of coins or notes to make up a particular value, such as that shown on a price tag

Patterns and algebra

Elaborations




Describe patterns with numbers and identify missing elements (ACMNA035)

- describing a pattern created by skip counting and representing the pattern on a number line
- investigating features of number patterns resulting from adding twos, fives or 10s

Solve problems by using number sentences for addition or subtraction (ACMNA036)

- representing a word problem as a number sentence
- writing a word problem to represent a number sentence

Measurement and Geometry

Using units of measurement	Elaborations
Compare and order several shapes and objects based on length, area, volume and capacity using appropriate uniform informal units (ACMMG037)	<ul style="list-style-type: none"> comparing lengths using finger length, hand span or a piece of string comparing areas using the palm of the hand or a stone comparing capacities using a range of containers
Compare masses of objects using balance scales (ACMMG038)	<ul style="list-style-type: none"> using balance scales to determine whether the mass of different objects is more, less or about the same, or to find out how many marbles are needed to balance a tub of margarine or a carton of milk
Tell time to the quarter-hour, using the language of 'past' and 'to' (ACMMG039)	<ul style="list-style-type: none"> describing the characteristics of quarter-past times on an analogue clock, and identifying that the small hand is pointing just past the number and the big hand is pointing to the three
Name and order months and seasons (ACMMG040) 	<ul style="list-style-type: none"> investigating the seasons used by Aboriginal people, comparing them to those used in Western society and recognising the connection to weather patterns.
Use a calendar to identify the date and determine the number of days in each month (ACMMG041)  	<ul style="list-style-type: none"> using calendars to locate specific information, such as finding a given date on a calendar and saying what day it is, and identifying personally or culturally specific days
Shape	Elaborations
Describe and draw two-dimensional shapes, with and without digital technologies (ACMMG042)	<ul style="list-style-type: none"> identifying key features of squares, rectangles, triangles, kites, rhombuses and circles, such as straight lines or curved lines, and counting the edges and corners
Describe the features of three-dimensional objects (ACMMG043)	<ul style="list-style-type: none"> identifying geometric features such as the number of faces, corners or edges
Location and transformation	Elaborations
Interpret simple maps of familiar locations and identify the relative positions of key features (ACMMG044)	<ul style="list-style-type: none"> understanding that we use representations of objects and their positions, such as on maps, to allow us to receive and give directions and to describe place constructing arrangements of objects from a set of directions
Investigate the effect of one-step slides and flips with and without digital technologies (ACMMG045)	<ul style="list-style-type: none"> understanding that objects can be moved but changing position does not alter an object's size or features

- Identify and describe half and quarter turns (ACMMG046)
- predicting and reproducing a pattern based around half and quarter turns of a shape and sketching the next element in the pattern

Statistics and Probability

Chance

Elaborations

Identify practical activities and everyday events that involve chance. Describe outcomes as 'likely' or 'unlikely' and identify some events as 'certain' or 'impossible' (ACMSP047)

- classifying a list of everyday events according to how likely they are to happen, using the language of chance, and explaining reasoning

Data representation and interpretation

Elaborations

Identify a question of interest based on one categorical variable. Gather data relevant to the question (ACMSP048)

- determining the variety of birdlife in the playground and using a prepared table to record observations



Collect, check and classify data (ACMSP049)

- recognising the usefulness of tally marks
- identifying categories of data and using them to sort data

Create displays of data using lists, table and picture graphs and interpret them (ACMSP050)

- creating picture graphs to represent data using one-to-one correspondence
 - comparing the usefulness of different data displays
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Level 2 achievement standard

Number and Algebra

Students count to and from, and order numbers up to 1000. They perform simple addition and subtraction calculations, using a range of strategies. They find the total value of simple collections of Australian notes and coins. Students represent multiplication and division by grouping into sets and divide collections and shapes into halves, quarters and eighths. They recognise increasing and decreasing number sequences involving 2s, 3s, 5s and 10s, identify the missing element in a number sequence, and use digital technology to produce sequences by constant addition.

Measurement and Geometry

Students order shapes and objects, using informal units for a range of measures. They tell time to the quarter hour and use a calendar to identify the date, days, weeks and months included in seasons and other events. Students draw two-dimensional shapes, specify their features and explain the effects of one-step transformations. They recognise the features of three-dimensional objects. They interpret simple maps of familiar locations.

Statistics and Probability

Students collect data from relevant questions to create lists, tables and picture graphs with and without the use of digital technology. They interpret data in context. Students describe outcomes of familiar events using everyday language.

Level 3

The proficiency strands **Understanding, Fluency, Problem Solving and Reasoning** are an integral part of mathematics content across the three content strands: **Number and Algebra, Measurement and Geometry, and Statistics and Probability**. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this level:

Understanding includes connecting number representations with number sequences, partitioning and combining numbers flexibly, representing unit fractions, using appropriate language to communicate times, and identifying environmental symmetry

Fluency includes recalling multiplication facts, using familiar metric units to order and compare objects, identifying and describing outcomes of chance experiments, interpreting maps and communicating positions

Problem Solving includes formulating and modelling authentic situations involving planning methods of data collection and representation, making models of three-dimensional objects and using number properties to continue number patterns

Reasoning includes using generalising from number properties and results of calculations, comparing angles, creating and interpreting variations in the results of data collections and data displays

Number and Algebra

Number and place value	Elaborations
Investigate the conditions required for a number to be odd or even and identify odd and even numbers (ACMNA051)	<ul style="list-style-type: none"> identifying even numbers using skip counting by twos or by grouping even collections of objects in twos explaining why all numbers that end in the digits 0, 2, 4, 6 and 8 are even and that numbers ending in 1, 3, 5, 7 and 9 are odd
Recognise, model, represent and order numbers to at least 10 000 (ACMNA052)	<ul style="list-style-type: none"> placing four-digit numbers on a number line using an appropriate scale reproducing numbers in words using their numerical representations and vice versa
Apply place value to partition, rearrange and regroup numbers to at least 10 000 to assist calculations and solve problems (ACMNA053)	<ul style="list-style-type: none"> recognising that 10 000 equals 10 thousands, 100 hundreds, 1000 tens and 10 000 ones justifying choices about partitioning and regrouping numbers in terms of their usefulness for particular calculations
Recognise and explain the connection between addition and subtraction (ACMNA054)	<ul style="list-style-type: none"> demonstrating the connection between addition and subtraction using partitioning or by writing equivalent number sentences

Recall addition facts for single-digit numbers and related subtraction facts to develop increasingly efficient mental strategies for computation (ACMNA055)

- recognising that certain single-digit number combinations always result in the same answer for addition and subtraction, and using this knowledge for addition and subtraction of larger numbers
- combining knowledge of addition and subtraction facts and partitioning to aid computation (for example $57 + 19 = 57 + 20 - 1$)

Recall multiplication facts of two, three, five and ten and related division facts (ACMNA056)

- establishing multiplication facts using number sequences

Represent and solve problems involving multiplication using efficient mental and written strategies and appropriate digital technologies (ACMNA057)

- writing simple word problems in numerical form and vice versa
- using a calculator to check the solution and reasonableness of the answer

Fractions and decimals

Elaborations

Model and represent unit fractions including $1/2$, $1/4$, $1/3$, $1/5$ and their multiples to a complete whole (ACMNA058)



- partitioning areas, lengths and collections to create halves, thirds, quarters and fifths, such as folding the same sized sheets of paper to illustrate different unit fractions and comparing the number of parts with their sizes
- locating unit fractions on a number line
- recognising that in English the term 'one third' is used (order: numerator, denominator) but that in other languages this concept may be expressed as 'three parts, one of them' (order: denominator, numerator) for example Japanese

Money and financial mathematics

Elaborations

Represent money values in multiple ways and count the change required for simple transactions to the nearest five cents (ACMNA059)



- recognising the relationship between dollars and cents, and that not all countries use these denominations and divisions (for example Japanese Yen)

Patterns and algebra

Elaborations

Describe, continue, and create number patterns resulting from performing addition or subtraction (ACMNA060)

- identifying and writing the rules for number patterns
- describing a rule for a number pattern, then creating the pattern

Measurement and Geometry

Using units of measurement

Elaborations

Measure, order and compare objects using familiar metric units of length, mass and capacity (ACMMG061)



- recognising the importance of using common units of measurement
- recognising and using centimetres and metres, grams and kilograms, and millilitres and litres

Tell time to the minute and investigate the relationship between units of time (ACMMG062)

- recognising there are 60 minutes in an hour and 60 seconds in a minute

Shape

Elaborations

Make models of three-dimensional objects and describe key features (ACMMG063)

- exploring the creation of three-dimensional objects using origami, including prisms and pyramids



Location and transformation

Elaborations

Create and interpret simple grid maps to show position and pathways (ACMMG065)

- creating a map of the classroom or playground

Identify symmetry in the environment (ACMMG066)

- identifying symmetry in Aboriginal rock carvings or art
- identifying symmetry in the natural and built environment



Geometric reasoning

Elaborations

Identify angles as measures of turn and compare angle sizes in everyday situations (ACMMG064)

- opening doors partially and fully and comparing the size of the angles created
- recognising that analogue clocks use the turning of arms to indicate time, and comparing the size of angles between the arms for familiar times

Statistics and Probability

Chance

Elaborations

Conduct chance experiments, identify and describe possible outcomes and recognise variation in results (ACMSP067)

- conducting repeated trials of chance experiments such as tossing a coin or drawing a ball from a bag and identifying the variations between trials

Data representation and interpretation

Elaborations

Identify questions or issues for categorical variables. Identify data sources and plan methods of data collection and recording (ACMSP068)

- refining questions and planning investigations that involve collecting data, and carrying out the investigation (for example narrowing the focus of a question such as 'which is the most popular breakfast cereal?' to 'which is the most popular breakfast cereal among Level 3 students in our class?')

Collect data, organise into categories and create displays using lists, tables, picture graphs and simple column graphs, with and without the use of digital technologies (ACMSP069)

- exploring meaningful and increasingly efficient ways to record data, and representing and reporting the results of investigations
- collecting data to investigate features in the natural environment



Interpret and compare data displays
(ACMSP070)

- comparing various student-generated data representations and describing their similarities and differences
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Level 3 achievement standard

Number and Algebra

Students count and order numbers to and from 10 000. They recognise the connection between addition and subtraction, and solve problems using efficient strategies for multiplication with and without the use of digital technology. Students recall addition and multiplication facts for single-digit numbers. They represent money values in various ways and correctly count out change from financial transactions. Students model and represent unit fractions for halves, thirds, quarters, fifths and eighths, and multiples of these up to one. They classify numbers as either odd or even, continue number patterns involving addition or subtraction, and explore simple number sequences based on multiples.

Measurement and Geometry

Students use metric units for length, mass and capacity. They tell time to the nearest minute. Students identify symmetry in natural and constructed environments. They use angle size as a measure of turn in real situations and make models of three-dimensional objects. Students match positions on maps with given information and create simple maps.

Statistics and Probability

Students carry out simple data investigations for categorical variables. They interpret and compare data displays. Students conduct chance experiments, list possible outcomes and recognise variations in results.

Level 4

The proficiency strands **Understanding, Fluency, Problem Solving and Reasoning** are an integral part of mathematics content across the three content strands: **Number and Algebra, Measurement and Geometry, and Statistics and Probability**. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this level:

Understanding includes making connections between representations of numbers, partitioning and combining numbers flexibly, extending place value to decimals, using appropriate language to communicate times, and describing properties of symmetrical shapes

Fluency includes recalling multiplication tables, communicating sequences of simple fractions, using instruments to measure accurately, creating patterns with shapes and their transformations, and collecting and recording data

Problem Solving includes formulating, modelling and recording authentic situations involving operations, comparing large numbers with each other, comparing time durations, and using properties of numbers to continue patterns

Reasoning includes using generalising from number properties and results of calculations, deriving strategies for unfamiliar multiplication and division tasks, comparing angles, communicating information using graphical displays and evaluating the appropriateness of different displays

Number and Algebra

Number and place value	Elaborations
Investigate and use the properties of odd and even numbers (ACMNA071)	<ul style="list-style-type: none"> using the four operations with pairs of odd or even numbers or one odd and one even number, then using the relationships established to check the accuracy of calculations
Recognise, represent and order numbers to at least tens of thousands (ACMNA072)	<ul style="list-style-type: none"> reproducing five-digit numbers in words using their numerical representations, and vice versa
Apply place value to partition, rearrange and regroup numbers to at least tens of thousands to assist calculations and solve problems (ACMNA073)	<ul style="list-style-type: none"> recognising and demonstrating that the place-value pattern is built on the operations of multiplication or division of tens
Investigate number sequences involving multiples of 3, 4, 6, 7, 8, and 9 (ACMNA074)	<ul style="list-style-type: none"> recognising that number sequences can be extended indefinitely, and determining any patterns in the sequences
Recall multiplication facts up to 10×10 and related division facts (ACMNA075)	<ul style="list-style-type: none"> using known multiplication facts to calculate related division facts

Develop efficient mental and written strategies and use appropriate digital technologies for multiplication and for division where there is no remainder (ACMNA076)

- using known facts and strategies, such as commutativity, doubling and halving for multiplication, and connecting division to multiplication when there is no remainder

Fractions and decimals

Elaborations

Investigate equivalent fractions used in contexts (ACMNA077)

- exploring the relationship between families of fractions (halves, quarters and eighths or thirds and sixths) by folding a series of paper strips to construct a fraction wall

Count by quarters halves and thirds, including with mixed numerals. Locate and represent these fractions on a number line (ACMNA078)



- converting mixed numbers to improper fractions and vice versa
- investigating the use of fractions and sharing as a way of managing Country: for example taking no more than half the eggs from a nest to protect future bird populations

Recognise that the place value system can be extended to tenths and hundredths. Make connections between fractions and decimal notation (ACMNA079)

- using division by 10 to extend the place-value system
- using knowledge of fractions to establish equivalences between fractions and decimal notation

Money and financial mathematics

Elaborations

Solve problems involving purchases and the calculation of change to the nearest five cents with and without digital technologies (ACMNA080)



- recognising that not all countries use dollars and cents, eg India uses rupees.
- Carrying out calculations in another currency as well as in dollars and cents, and identifying both as decimal systems

Patterns and algebra

Elaborations

Explore and describe number patterns resulting from performing multiplication (ACMNA081)

- identifying examples of number patterns in everyday life

Solve word problems by using number sentences involving multiplication or division where there is no remainder (ACMNA082)

- representing a word problem as a number sentence
- writing a word problem using a given number sentence

Use equivalent number sentences involving addition and subtraction to find unknown quantities (ACMNA083)

- writing number sentences to represent and answer questions such as: 'When a number is added to 23 the answer is the same as 57 minus 19. What is the number?'
- using partitioning to find unknown quantities in number sentences

Measurement and Geometry

Using units of measurement

Elaborations

Use scaled instruments to measure and compare lengths, masses, capacities and temperatures (ACMMG084)

- reading and interpreting the graduated scales on a range of measuring instruments to the nearest graduation

Compare objects using familiar metric units of area and volume (ACMMG290)



- comparing areas using grid paper
- comparing volume using centicubes
- recognising that metric units are not the only units used throughout the world, for example measuring the area of floor space using tatami mats (Japan), using squares for room and house area (Australia)

Convert between units of time (ACMMG085)

- identifying and using the correct operation for converting units of time

Use am and pm notation and solve simple time problems (ACMMG086)

- calculating the time spent at school during a normal school day
- calculating the time required to travel between two locations
- determining arrival time given departure time

Shape

Elaborations

Compare the areas of regular and irregular shapes by informal means (ACMMG087)

- comparing areas using metric units, such as counting the number of square centimetres required to cover two areas by overlaying the areas with a grid of centimetre squares

Compare and describe two dimensional shapes that result from combining and splitting common shapes, with and without the use of digital technologies (ACMMG088)

- identifying common two-dimensional shapes that are part of a composite shape by re-creating it from these shapes
- creating a two-dimensional shapes from verbal or written instructions

Location and transformation

Elaborations

Use simple scales, legends and directions to interpret information contained in basic maps (ACMMG090)



- identifying the scale used on maps of cities and rural areas in Australia and a city in Indonesia and describing the difference
- using directions to find features on a map

Create symmetrical patterns, pictures and shapes with and without digital technologies (ACMMG091)



- using stimulus materials such as the motifs in Central Asian textiles, Tibetan artefacts, Indian lotus designs and symmetry in Yolngu or Central and Western Desert art

Geometric reasoning

Elaborations

Compare angles and classify them as equal to, greater than or less than a right angle (ACMMG089)

- creating angles and comparing them to a right angle using digital technologies

Statistics and Probability

Chance	Elaborations
Describe possible everyday events and order their chances of occurring (ACMSP092)	<ul style="list-style-type: none"> using lists of events familiar to students and ordering them from 'least likely' to 'most likely' to occur
Identify everyday events where one cannot happen if the other happens (ACMSP093)	<ul style="list-style-type: none"> using examples such as weather, which cannot be dry and wet at the same time
Identify events where the chance of one will not be affected by the occurrence of the other (ACMSP094)	<ul style="list-style-type: none"> explaining why the probability of a new baby being either a boy or a girl does not depend on the sex of the previous baby
Data representation and interpretation	Elaborations
Select and trial methods for data collection, including survey questions and recording sheets (ACMSP095)	<ul style="list-style-type: none"> comparing the effectiveness of different methods of collecting data choosing the most effective way to collect data for a given investigation
Construct suitable data displays, with and without the use of digital technologies, from given or collected data. Include tables, column graphs and picture graphs where one picture can represent many data values (ACMSP096)	<ul style="list-style-type: none"> exploring ways of presenting data and showing the results of investigations investigating data displays using many-to-one correspondence
Evaluate the effectiveness of different displays in illustrating data features including variability (ACMSP097)	<ul style="list-style-type: none"> interpreting data representations in the media and other forums in which symbols represent more than one data value suggesting questions that can be answered by a given data display and using the display to answer questions

Level 4 achievement standard

Number and Algebra

Students recall multiplication facts to 10 x 10 and related division facts. They choose appropriate strategies for calculations involving multiplication and division, with and without the use of digital technology, and estimate answers accurately enough for the context. Students solve simple purchasing problems with and without the use of digital technology. They locate familiar fractions on a number line, recognise common equivalent fractions in familiar contexts and make connections between fractions and decimal notations up to two decimal places. Students identify unknown quantities in number sentences. They use the properties of odd and even numbers and describe number patterns resulting from multiplication. Students continue number sequences involving multiples of single-digit numbers and unit fractions, and locate them on a number line.

Measurement and Geometry

Students compare areas of regular and irregular shapes, using informal units. They solve problems involving time duration. Students use scaled instruments to measure length, angle, area, mass, capacity and temperature of shapes and objects. They convert between units of time. Students create symmetrical simple and composite shapes and patterns, with and without the use of digital technology. They classify angles in relation to a right angle. Students interpret information contained in maps.

Statistics and Probability

Students describe different methods for data collection and representation, and evaluate their effectiveness. They construct data displays from given or collected data, with and without the use of digital technology. Students list the probabilities of everyday events. They identify dependent and independent events.

Level 5

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At this level:

Understanding includes making connections between representations of numbers, using fractions to represent probabilities, comparing and ordering fractions and decimals and representing them in various ways, describing transformations and identifying line and rotational symmetry

Fluency includes choosing appropriate units of measurement for calculation of perimeter and area, using estimation to check the reasonableness of answers to calculations and using instruments to measure angles

Problem Solving includes formulating and solving authentic problems using whole numbers and measurements and creating financial plans

Reasoning includes investigating strategies to perform calculations efficiently, continuing patterns involving fractions and decimals, interpreting results of chance experiments, posing appropriate questions for data investigations and interpreting data sets

Number and Algebra

Number and place value	Elaborations
Identify and describe factors and multiples of whole numbers and use them to solve problems (ACMNA098)	<ul style="list-style-type: none"> exploring factors and multiples using number sequences using simple divisibility tests
Use estimation and rounding to check the reasonableness of answers to calculations (ACMNA099)	<ul style="list-style-type: none"> recognising the usefulness of estimation to check calculations applying mental strategies to estimate the result of calculations, such as estimating the cost of a supermarket trolley load
Solve problems involving multiplication of large numbers by one- or two-digit numbers using efficient mental, written strategies and appropriate digital technologies (ACMNA100)	<ul style="list-style-type: none"> exploring techniques for multiplication such as the area model, the Italian lattice method or the partitioning of numbers applying the distributive law and using arrays to model multiplication and explain calculation strategies

Solve problems involving division by a one digit number, including those that result in a remainder (ACMNA101)

- using the fact that equivalent division calculations result if both numbers are divided by the same factor
- interpreting and representing the remainder in division calculations sensibly for the context

Use efficient mental and written strategies and apply appropriate digital technologies to solve problems (ACMNA291)

- using calculators to check the reasonableness of answers

Fractions and decimals

Elaborations

Compare and order common unit fractions and locate and represent them on a number line (ACMNA102)

- recognising the connection between the order of unit fractions and their denominators

Investigate strategies to solve problems involving addition and subtraction of fractions with the same denominator (ACMNA103)

- modelling and solving addition and subtraction problems involving fractions by using jumps on a number line, or making diagrams of fractions as parts of shapes

Recognise that the place value system can be extended beyond hundredths (ACMNA104)

- using knowledge of place value and division by 10 to extend the number system to thousandths and beyond
- recognising the equivalence of one thousandths and 0.001

Compare, order and represent decimals (ACMNA105)

- locating decimals on a number line

Money and financial mathematics

Elaborations

Create simple financial plans (ACMNA106)

- creating a simple budget for a class fundraising event
- identifying the GST component of invoices and receipts

Patterns and algebra

Elaborations

Describe, continue and create patterns with fractions, decimals and whole numbers resulting from addition and subtraction (ACMNA107)

- using the number line or diagrams to create patterns involving fractions or decimals

Use equivalent number sentences involving multiplication and division to find unknown quantities (ACMNA121)

- using relevant problems to develop number sentences

Measurement and Geometry

Using units of measurement

Elaborations

Choose appropriate units of measurement for length, area, volume, capacity and mass (ACMMG108)



- investigating alternative measures of scale to demonstrate that these vary between countries and change over time, for example temperature measurement in Australia, Indonesia, Japan and USA
- recognising that some units of measurement are better suited for some tasks than others, for example kilometres rather than metres to measure the distance between two towns

Calculate the perimeter and area of rectangles using familiar metric units (ACMMG109)

- exploring efficient ways of calculating the perimeters of rectangles such as adding the length and width together and doubling the result
- exploring efficient ways of finding the areas of rectangles

Compare 12- and 24-hour time systems and convert between them (ACMMG110)



- investigating the ways time was and is measured in different Aboriginal Country, such as using tidal change
- using units hours, minutes and seconds

Shape

Elaborations

Connect three-dimensional objects with their nets and other two-dimensional representations (ACMMG111)

- identifying the shape and relative position of each face of a solid to determine the net of the solid, including that of prisms and pyramids
- representing two-dimensional shapes such as photographs, sketches and images created by digital technologies

Location and transformation

Elaborations

Use a grid reference system to describe locations. Describe routes using landmarks and directional language (ACMMG113)



- comparing aerial views of Country, desert paintings and maps with grid references
- creating a grid reference system for the classroom and using it to locate objects and describe routes from one object to another

Describe translations, reflections and rotations of two-dimensional shapes. Identify line and rotational symmetries (ACMMG114)

- identifying and describing the line and rotational symmetry of a range of two-dimensional shapes, by manually cutting, folding and turning shapes and by using digital technologies
- identifying the effects of transformations by manually flipping, sliding and turning two-dimensional shapes and by using digital technologies

Apply the enlargement transformation to familiar two dimensional shapes and explore the properties of the resulting image compared with the original (ACMMG115)

- using digital technologies to enlarge shapes
- using a grid system to enlarge a favourite image or cartoon

Geometric reasoning

Elaborations

Estimate, measure and compare angles using degrees. Construct angles using a protractor (ACMMG112)

- measuring and constructing angles using both 180° and 360° protractors
- recognising that angles have arms and a vertex, and that size is the amount of turn required for one arm to coincide with the other

Statistics and Probability

Chance

Elaborations

List outcomes of chance experiments involving equally likely outcomes and represent probabilities of those outcomes using fractions (ACMSP116)



- commenting on the likelihood of winning simple games of chance by considering the number of possible outcomes and the consequent chance of winning in simple games of chance such as jan-ken-pon (rock-paper-scissors)

Recognise that probabilities range from 0 to 1 (ACMSP117)

- investigating the probabilities of all outcomes for a simple chance experiment and verifying that their sum equals 1

Data representation and interpretation

Elaborations

Pose questions and collect categorical or numerical data by observation or survey (ACMSP118)



- posing questions about insect diversity in the playground, collecting data by taping a one-metre-square piece of paper to the playground and observing the type and number of insects on it over time

Construct displays, including column graphs, dot plots and tables, appropriate for data type, with and without the use of digital technologies (ACMSP119)

- identifying the best methods of presenting data to illustrate the results of investigations and justifying the choice of representations

Describe and interpret different data sets in context (ACMSP120)

- using and comparing data representations for different data sets to help decision making

Level 5 achievement standard

Number and Algebra

Students solve simple problems involving the four operations using a range of strategies including digital technology. They estimate to check the reasonableness of answers and approximate answers by rounding. Students identify and describe factors and multiples. They explain plans for simple budgets. Students order decimals and unit fractions and locate them on a number line. Students add and subtract fractions with the same denominator. They find unknown quantities in number sentences and continue patterns by adding or subtracting fractions and decimals.

Measurement and Geometry

Students use appropriate units of measurement for length, area, volume, capacity and mass, and calculate perimeter and area of rectangles. They convert between 12 and 24-hour time. Students use a grid reference system to locate landmarks. They estimate angles, and use protractors and digital technology to construct and measure angles. Students connect three-dimensional objects with their two-dimensional representations. They describe transformations of two-dimensional shapes and identify line and rotational symmetry.

Statistics and Probability

Students pose questions to gather data and construct various displays appropriate for the data, with and without the use of digital technology. They compare and interpret different data sets. Students list outcomes of chance experiments with equally likely outcomes and assign probabilities as a number from 0 to 1.

Level 6

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At this level:

Understanding includes describing properties of different sets of numbers, using fractions and decimals to describe probabilities, representing fractions and decimals in various ways and describing connections between them, and making reasonable estimations

Fluency includes representing integers on a number line, calculating simple percentages, using brackets appropriately, converting between fractions and decimals, using operations with fractions, decimals and percentages, measuring using metric units, and interpreting timetables

Problem Solving includes formulating and solving authentic problems using fractions, decimals, percentages and measurements, interpreting secondary data displays, and finding the size of unknown angles

Reasoning includes explaining mental strategies for performing calculations, describing results for continuing number sequences, explaining the transformation of one shape into another, explaining why the actual results of chance experiments may differ from expected results

Number and Algebra

Number and place value	Elaborations
Identify and describe properties of prime, composite, square and triangular numbers (ACMNA122)	<ul style="list-style-type: none"> understanding that some numbers have special properties and that these properties can be used to solve problems representing composite numbers as a product of their prime factors and using this form to simplify calculations by cancelling common primes understanding that if a number is divisible by a composite number then it is also divisible by the prime factors of that number (for example 216 is divisible by 8 because the number represented by the last three digits is divisible by 8, and hence 216 is also divisible by 2 and 4)
Select and apply efficient mental and written strategies and appropriate digital technologies to solve problems involving all four operations with whole numbers (ACMNA123)	<ul style="list-style-type: none"> applying strategies already developed for solving problems involving small numbers to those involving large numbers applying a range of strategies to solve realistic problems and commenting on the efficiency of different strategies

Investigate everyday situations that use integers. Locate and represent these numbers on a number line (ACMNA124)

- understanding that integers are ...-3, -2, -1, 0, 1, 2, 3,.....
- solving everyday additive problems using a number line
- investigating everyday situations that use integers, such as temperatures
- using number lines to position and order integers around zero

Fractions and decimals

Elaborations

Compare fractions with related denominators and locate and represent them on a number line (ACMNA125)

- demonstrating equivalence between fractions using drawings and models

Solve problems involving addition and subtraction of fractions with the same or related denominators (ACMNA126)

- understanding the processes for adding and subtracting fractions with related denominators and fractions as an operator, in preparation for calculating with all fractions
- solving realistic additive (addition and subtraction) problems involving fractions to develop understanding of equivalent fractions and the use of fractions as operators
- modelling and solving additive problems involving fractions by using methods such as jumps on a number line, or by making diagrams of fractions as parts of shapes

Find a simple fraction of a quantity where the result is a whole number, with and without digital technologies (ACMNA127)

- recognising that finding one third of a quantity is the same as dividing by 3

Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers (ACMNA128)

- extending whole-number strategies to explore and develop meaningful written strategies for addition and subtraction of decimal numbers to thousandths
- exploring and practising efficient methods for solving problems requiring operations on decimals, to gain fluency with calculating with decimals and with recognising appropriate operations

Multiply decimals by whole numbers and perform divisions by non-zero whole numbers where the results are terminating decimals, with and without digital technologies (ACMNA129)

- interpreting the results of calculations to provide an answer appropriate to the context

Multiply and divide decimals by powers of 10 (ACMNA130)

- Multiplying and dividing decimals by multiples of powers of 10

Make connections between equivalent fractions, decimals and percentages (ACMNA131)

- connecting fractions, decimals and percentages as different representations of the same number, moving fluently between representations and choosing the appropriate one for the problem being solved

Money and financial mathematics

Elaborations

Investigate and calculate percentage discounts of 10%, 25% and 50% on sale items, with and without digital technologies (ACMNA132)

- using authentic information to calculate prices on sale goods

Patterns and algebra

Elaborations

Continue and create sequences involving whole numbers, fractions and decimals. Describe the rule used to create the sequence (ACMNA133)

- identifying and generalising number patterns
- investigating additive and multiplicative patterns such as the number of tiles in a geometric pattern, or the number of dots or other shapes in successive repeats of a strip or border pattern looking for patterns in the way the numbers increase/decrease

Explore the use of brackets and order of operations to write number sentences (ACMNA134)

- appreciating the need for rules to complete multiple operations within the same number sentence

Measurement and Geometry

Using units of measurement

Elaborations

Connect decimal representations to the metric system (ACMMG135)

- recognising the equivalence of measurements such as 1.25 metres and 125 centimetres

Convert between common metric units of length, mass and capacity (ACMMG136)

- identifying and using the correct operations when converting units including millimetres, centimetres, metres, kilometres, milligrams, grams, kilograms, tonnes, millilitres, litres, kilolitres and megalitres
- recognising the significance of the prefixes in units of measurement

Solve problems involving the comparison of lengths and areas using appropriate units (ACMMG137)

- recognising and investigating familiar objects using concrete materials and digital technologies

Connect volume and capacity and their units of measurement (ACMMG138)

- recognising that 1ml is equivalent to 1cm³

Interpret and use timetables (ACMMG139)

- planning a trip involving one or more modes of public transport
- developing a timetable of daily activities

Shape

Elaborations

Construct simple prisms and pyramids (ACMMG140)



- considering the history and significance of pyramids from a range of cultural perspectives including those structures found in China, Korea and Indonesia
- constructing prisms and pyramids from nets, and skeletal models

Location and transformation

Elaborations

Investigate combinations of translations, reflections and rotations, with and without the use of digital technologies (ACMMG142)

- designing a school or brand logo using transformation of one or more shapes
- understanding that translations, rotations and reflections can change the position and orientation but not shape or size

Introduce the Cartesian coordinate system using all four quadrants (ACMMG143)

- understanding that the Cartesian plane provides a graphical or visual way of describing location

Geometric reasoning

Elaborations

Investigate, with and without digital technologies, angles on a straight line, angles at a point and vertically opposite angles. Use results to find unknown angles (ACMMG141)



- identifying the size of a right angle as 90° and defining acute, obtuse, straight and reflex angles
- measuring, estimating and comparing angles in degrees and classifying angles according to their sizes
- investigating the use of rotation and symmetry in the diagrammatic representations of kinship relationships of Central and Western Desert people
- recognising and using the two alternate conventions for naming angles

Statistics and Probability

Chance

Elaborations

Describe probabilities using fractions, decimals and percentages (ACMSP144)



- investigating games of chance popular in different cultures and evaluating the relative benefits to the organisers and participants (for example Pachinko)

Conduct chance experiments with both small and large numbers of trials using appropriate digital technologies (ACMSP145)

- conducting repeated trials of chance experiments, identifying the variation between trials and realising that the results tend to the prediction with larger numbers of trials

Compare observed frequencies across experiments with expected frequencies (ACMSP146)

- predicting likely outcomes from a run of chance events and distinguishing these from surprising results

Data representation and interpretation

Elaborations

Interpret and compare a range of data displays, including side-by-side column graphs for two categorical variables (ACMSP147)

- comparing different student-generated diagrams, tables and graphs, describing their similarities and differences and commenting on the usefulness of each representation for interpreting the data
- understanding that data can be represented in different ways, sometimes with one symbol representing more than one piece of data, and that it is important to read all information about a representation before making judgments

Interpret secondary data presented in digital media and elsewhere (ACMSP148)

- investigating data representations in the media and discussing what they illustrate and the messages the people who created them might want to convey
 - identifying potentially misleading data representations in the media, such as graphs with broken axes or non-linear scales, graphics not drawn to scale, data not related to the population about which the claims are made, and pie charts in which the whole pie does not represent the entire population about which the claims are made
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Level 6 achievement standard

Number and Algebra

Students recognise the properties of prime, composite, square and triangular numbers and determine sets of these numbers. They solve problems that involve all four operations with whole numbers and describe the use of integers in everyday contexts. Students locate fractions and integers on a number line and connect fractions, decimals and percentages as different representations of the same number. They solve problems involving the addition and subtraction of related fractions. Students calculate a simple fraction of a quantity and calculate common percentage discounts on sale items, with and without the use of digital technology. They make connections between the powers of 10 and the multiplication and division of decimals. Students add, subtract and multiply decimals and divide decimals where the result is rational. Students write number sentences using brackets and order of operations, and specify rules used to generate sequences involving whole numbers, fractions and decimals. They use ordered pairs of integers to represent coordinates of points and locate a point in any one of the four quadrants on the Cartesian plane.

Measurement and Geometry

Students relate decimals to the metric system and choose appropriate units of measurement to perform a calculation. They solve problems involving length and area, and make connections between capacity and volume. Students interpret a variety of everyday timetables. They solve problems using the properties of angles and investigate simple combinations of transformations in the plane, with and without the use of digital technology. Students construct simple prisms and pyramids.

Statistics and Probability

Students interpret and compare a variety of data displays, including displays for two categorical variables. They analyse and evaluate data from secondary sources. Students compare observed and expected frequencies of events, including those where outcomes of trials are generated with the use of digital technology. They specify, list and communicate probabilities of events using simple ratios, fractions, decimals and percentages.

Level 7

The proficiency strands **Understanding, Fluency, Problem Solving and Reasoning** are an integral part of mathematics content across the three content strands: **Number and Algebra, Measurement and Geometry, and Statistics and Probability**. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this level:

Understanding includes describing patterns in uses of indices with whole numbers, recognising equivalences between fractions, decimals, percentages and ratios, plotting points on the Cartesian plane, identifying angles formed by a transversal crossing a pair of lines, and connecting the laws and properties of numbers to algebraic terms and expressions

Fluency includes calculating accurately with integers, representing fractions and decimals in various ways, investigating best buys, finding measures of central tendency and calculating areas of shapes and volumes of prisms

Problem Solving includes formulating and solving authentic problems using numbers and measurements, working with transformations and identifying symmetry, calculating angles and interpreting sets of data collected through chance experiments

Reasoning includes applying the number laws to calculations, applying known geometric facts to draw conclusions about shapes, applying an understanding of ratio and interpreting data displays

Number and Algebra


Number and place value	Elaborations
Investigate index notation and represent whole numbers as products of powers of prime numbers (ACMNA149)	<ul style="list-style-type: none"> defining and comparing prime and composite numbers and explaining the difference between them applying knowledge of factors to strategies for expressing whole numbers as products of powers of prime factors, such as repeated division by prime factors or creating factor trees solving problems involving lowest common multiples and greatest common divisors (highest common factors) for pairs of whole numbers by comparing their prime factorisation
Investigate and use square roots of perfect square numbers (ACMNA150)	<ul style="list-style-type: none"> investigating square numbers such as 25 and 36 and developing square-root notation investigating between which two whole numbers a square root lies
Apply the associative, commutative and distributive laws to aid mental and written computation (ACMNA151)	<ul style="list-style-type: none"> understanding that arithmetic laws are powerful ways of describing and simplifying calculations
Compare, order, add and subtract integers (ACMNA280)	

Real numbers	Elaborations
Compare fractions using equivalence. Locate and represent positive and negative fractions and mixed numbers on a number line (ACMNA152)	<ul style="list-style-type: none"> exploring equivalence among families of fractions by using a fraction wall or a number line (for example by using a fraction wall to show that $\frac{2}{3}$ is the same as $\frac{4}{6}$ and $\frac{6}{9}$)
Solve problems involving addition and subtraction of fractions, including those with unrelated denominators (ACMNA153)	<ul style="list-style-type: none"> exploring and developing efficient strategies to solve additive problems involving fractions (for example by using fraction walls or rectangular arrays with dimensions equal to the denominators)
Multiply and divide fractions and decimals using efficient written strategies and digital technologies (ACMNA154)	<ul style="list-style-type: none"> investigating multiplication of fractions and decimals, using strategies including patterning and multiplication as repeated addition, with both concrete materials and digital technologies, and identifying the processes for division as the inverse of multiplication
Express one quantity as a fraction of another, with and without the use of digital technologies (ACMNA155)	<ul style="list-style-type: none"> using authentic examples for the quantities to be expressed and understanding the reasons for the calculations
Round decimals to a specified number of decimal places (ACMNA156)	<ul style="list-style-type: none"> using rounding to estimate the results of calculations with whole numbers and decimals, and understanding the conventions for rounding
Connect fractions, decimals and percentages and carry out simple conversions (ACMNA157)	<ul style="list-style-type: none"> justifying choices of written, mental or calculator strategies for solving specific problems including those involving large numbers understanding that quantities can be represented by different number types and calculated using various operations, and that choices need to be made about each calculating the percentage of the total local municipal area set aside for parkland, manufacturing, retail and residential dwellings to compare land use
Find percentages of quantities and express one quantity as a percentage of another, with and without digital technologies. (ACMNA158)	<ul style="list-style-type: none"> using authentic problems to express quantities as percentages of other amounts
Recognise and solve problems involving simple ratios (ACMNA173)	<ul style="list-style-type: none"> understanding that rate and ratio problems can be solved using fractions or percentages and choosing the most efficient form to solve a particular problem
Money and financial mathematics	Elaborations
Investigate and calculate 'best buys', with and without digital technologies (ACMNA174)	<ul style="list-style-type: none"> applying the unitary method to identify 'best buys' situations, such as comparing the cost per 100g
Patterns and algebra	Elaborations

Introduce the concept of variables as a way of representing numbers using letters (ACMNA175)	<ul style="list-style-type: none"> • understanding that arithmetic laws are powerful ways of describing and simplifying calculations and that using these laws leads to the generality of algebra
Create algebraic expressions and evaluate them by substituting a given value for each variable (ACMNA176)	<ul style="list-style-type: none"> • using authentic formulas to perform substitutions
Extend and apply the laws and properties of arithmetic to algebraic terms and expressions (ACMNA177)	<ul style="list-style-type: none"> • identifying order of operations in contextualised problems, preserving the order by inserting brackets in numerical expressions, then recognising how order is preserved by convention • moving fluently between algebraic and word representations as descriptions of the same situation

Linear and non-linear relationships

Elaborations

Given coordinates, plot points on the Cartesian plane, and find coordinates for a given point (ACMNA178)	<ul style="list-style-type: none"> • plotting points from a table of integer values and recognising simple patterns, such as points that lie on a straight line
Solve simple linear equations (ACMNA179)	<ul style="list-style-type: none"> • solving equations using concrete materials, such as the balance model, and explain the need to do the same thing to each side of the equation using substitution to check solutions • investigating a range of strategies to solve equations
Investigate, interpret and analyse graphs from authentic data (ACMNA180) 	<ul style="list-style-type: none"> • using travel graphs to investigate and compare the distance travelled to and from school • interpreting features of travel graphs such as the slope of lines and the meaning of horizontal lines • using graphs of evaporation rates to explore water storage

Measurement and Geometry

Using units of measurement

Elaborations

Establish the formulas for areas of rectangles, triangles and parallelograms and use these in problem solving (ACMMG159)	<ul style="list-style-type: none"> • building on the understanding of the area of rectangles to develop formulas for the area of triangles • establishing that the area of a triangle is half the area of an appropriate rectangle • using area formulas for rectangles and triangles to solve problems involving areas of surfaces
Calculate volumes of rectangular prisms (ACMMG160)	<ul style="list-style-type: none"> • investigating volumes of cubes and rectangular prisms and establishing and using the formula $V = l \times b \times h$ • understanding and using cubic units when interpreting and finding volumes of cubes and rectangular prisms

Shape

Elaborations

Draw different views of prisms and solids formed from combinations of prisms (ACMMG161)

- using aerial views of buildings and other 3-D structures to visualise the structure of the building or prism

Location and transformation

Elaborations

Describe translations, reflections in an axis, and rotations of multiples of 90° on the Cartesian plane using coordinates. Identify line and rotational symmetries (ACMMG181)

- describing patterns and investigating different ways to produce the same transformation such as using two successive reflections to provide the same result as a translation
- experimenting with, creating and re-creating patterns using combinations of reflections and rotations using digital technologies

Geometric reasoning

Elaborations

Identify corresponding, alternate and co-interior angles when two straight lines are crossed by a transversal (ACMMG163)

- defining and classifying pairs of angles as complementary, supplementary, adjacent and vertically opposite

Investigate conditions for two lines to be parallel and solve simple numerical problems using reasoning (ACMMG164)

- constructing parallel and perpendicular lines using their properties, a pair of compasses and a ruler, and dynamic geometry software
- defining and identifying the relationships between alternate, corresponding and co-interior angles for a pair of parallel lines cut by a transversal

Demonstrate that the angle sum of a triangle is 180° and use this to find the angle sum of a quadrilateral (ACMMG166)

- using concrete materials and digital technologies to investigate the angle sum of a triangle and quadrilateral

Classify triangles according to their side and angle properties and describe quadrilaterals (ACMMG165)

- identifying side and angle properties of scalene, isosceles, right-angled and obtuse-angled triangles
- describing squares, rectangles, rhombuses, parallelograms, kites and trapeziums

Statistics and Probability

Chance

Elaborations

Construct sample spaces for single-step experiments with equally likely outcomes (ACMSP167)

- discussing the meaning of probability terminology (for example probability, sample space, favourable outcomes, trial, events and experiments)
- distinguishing between equally likely outcomes and outcomes that are not equally likely

Assign probabilities to the outcomes of events and determine probabilities for events (ACMSP168)

- expressing probabilities as decimals, fractions and percentages

Data representation and interpretation

Elaborations

Identify and investigate issues involving numerical data collected from primary and secondary sources (ACMSP169)



- obtaining secondary data from newspapers, the Internet and the Australian Bureau of Statistics
- investigating secondary data relating to the distribution and use of non-renewable resources around the world

Construct and compare a range of data displays including stem-and-leaf plots and dot plots (ACMSP170)

- understanding that some data representations are more appropriate than others for particular data sets, and answering questions about those data sets
- using ordered stem-and-leaf plots to record and display numerical data collected in a class investigation, such as constructing a class plot of height in centimetres on a shared stem-and-leaf plot for which the stems 12, 13, 14, 15, 16 and 17 have been produced

Calculate mean, median, mode and range for sets of data. Interpret these statistics in the context of data (ACMSP171)



- understanding that summarising data by calculating measures of centre and spread can help make sense of the data

Describe and interpret data displays using median, mean and range (ACMSP172)

- using mean and median to compare data sets and explaining how outliers may affect the comparison
 - locating mean, median and range on graphs and connecting them to real life
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Level 7 achievement standard

Number and Algebra

Students solve problems involving the order, addition and subtraction of integers. They make the connections between whole numbers and index notation and the relationship between perfect squares and square roots. They solve problems involving all four operations with fractions, decimals, percentages and their equivalences, and express fractions in their simplest form. Students compare the cost of items to make financial decisions, with and without the use of digital technology. They make simple estimates to judge the reasonableness of results. Students use variables to represent arbitrary numbers and connect the laws and properties of number to algebra and substitute numbers into algebraic expressions. They assign ordered pairs to given points on the Cartesian plane and interpret and analyse graphs of relations from real data. Students develop simple linear models for situations, make predictions based on these models, solve related equations and check their solutions.

Measurement and Geometry

Students use formulas for the area and perimeter of rectangles. They classify triangles and quadrilaterals and represent transformations of these shapes on the Cartesian plane, with and without the use of digital technology. Students name the types of angles formed by a transversal crossing parallel lines and solve simple numerical problems involving these lines and angles. They describe different views of three-dimensional objects, and use models, sketches and digital technology to represent these views. Students calculate volumes of rectangular prisms.

Statistics and Probability

Students identify issues involving the collection of discrete and continuous data from primary and secondary sources. They construct stem-and-leaf plots and dot-plots. Students identify or calculate mean, mode, median and range for data sets, using digital technology for larger data sets. They describe the relationship between the median and mean in data displays. Students determine the sample space for simple experiments with equally likely outcomes, and assign probabilities outcomes.

Level 8

The proficiency strands **Understanding, Fluency, Problem Solving and Reasoning** are an integral part of mathematics content across the three content strands: **Number and Algebra, Measurement and Geometry, and Statistics and Probability**. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this level:

Understanding includes describing patterns involving indices and recurring decimals, identifying commonalities between operations with algebra and arithmetic, connecting rules for linear relations their graphs, explaining the purpose of statistical measures, and explaining measurements of perimeter and area

Fluency includes calculating accurately with simple decimals, indices and integers, recognising equivalence of common decimals and fractions including recurring decimals, factorising and simplifying basic algebraic expressions, and evaluating perimeters, areas of common shapes and their volumes and three dimensional objects

Problem Solving includes formulating, and modelling practical situations involving ratios, profit and loss, areas and perimeters of common shapes, and using two-way tables and Venn diagrams to calculate probabilities

Reasoning includes justifying the result of a calculation or estimation as reasonable, deriving probability from its complement, using congruence to deduce properties of triangles, finding estimates of means and proportions of populations

Number and Algebra

Number and place value	Elaborations
Use index notation with numbers to establish the index laws with positive integral indices and the zero index (ACMNA182)	<ul style="list-style-type: none"> evaluating numbers expressed as powers of positive integers
Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies (ACMNA183)	<ul style="list-style-type: none"> using patterns to assist in finding rules for the multiplication and division of integers using the number line to develop strategies for adding and subtracting rational numbers
Real numbers	Elaborations
Investigate terminating and recurring decimals (ACMNA184)	<ul style="list-style-type: none"> recognising terminating, recurring and non-terminating decimals and choosing their appropriate representations
Investigate the concept of irrational numbers, including π (ACMNA186)	<ul style="list-style-type: none"> understanding that the real number system includes irrational numbers

Solve problems involving the use of percentages, including percentage increases and decreases, with and without digital technologies (ACMNA187)

- using percentages to solve problems, including those involving mark-ups, discounts, and GST
- using percentages to calculate population increases and decreases

Solve a range of problems involving rates and ratios, with and without digital technologies (ACMNA188)



- understanding that rate and ratio problems can be solved using fractions or percentages and choosing the most efficient form to solve a particular problem
- calculating population growth rates in Australia and Asia and explaining their difference

Money and financial mathematics

Elaborations

Solve problems involving profit and loss, with and without digital technologies (ACMNA189)

- expressing profit and loss as a percentage of cost or selling price, comparing the difference
- investigating the methods used in retail stores to express discounts

Patterns and algebra

Elaborations

Extend and apply the distributive law to the expansion of algebraic expressions (ACMNA190)

- applying the distributive law to the expansion of algebraic expressions using strategies such as the area model

Factorise algebraic expressions by identifying numerical factors (ACMNA191)

- recognising the relationship between factorising and expanding
- identifying the greatest common divisor (highest common factor) of numeric and algebraic expressions and using a range of strategies to factorise algebraic expressions

Simplify algebraic expressions involving the four operations (ACMNA192)

- understanding that the laws used with numbers can also be used with algebra

Linear and non-linear relationships

Elaborations

Plot linear relationships on the Cartesian plane with and without the use of digital technologies (ACMNA193)



- completing a table of values, plotting the resulting points and determining whether the relationship is linear
- finding the rule for a linear relationship

Solve linear equations using algebraic and graphical techniques. Verify solutions by substitution (ACMNA194)

- solving real life problems by using variables to represent unknowns

Measurement and Geometry

Using units of measurement

Elaborations

Choose appropriate units of measurement for area and volume and convert from one unit to another (ACMMG195)

- choosing units for area including mm^2 , cm^2 , m^2 , hectares, km^2 , and units for volume including mm^3 , cm^3 , m^3
- recognising that the conversion factors for area units are the squares of those for the corresponding linear units
- recognising that the conversion factors for volume units are the cubes of those for the corresponding linear units

Find perimeters and areas of parallelograms, trapeziums, rhombuses and kites (ACMMG196)

- establishing and using formulas for areas such as trapeziums, rhombuses and kites

Investigate the relationship between features of circles such as circumference, area, radius and diameter. Use formulas to solve problems involving circumference and area (ACMMG197)

- investigating the circumference and area of circles with materials or by measuring, to establish an understanding of formulas
- investigating the area of circles using a square grid or by rearranging a circle divided into sectors

Develop the formulas for volumes of rectangular and triangular prisms and prisms in general. Use formulas to solve problems involving volume (ACMMG198)

- investigating the relationship between volumes of rectangular and triangular prisms

Solve problems involving duration, including using 12- and 24-hour time within a single time zone (ACMMG199)

- identifying regions in Australia and countries in Asia that are in the same time zone



Geometric reasoning

Elaborations

Define congruence of plane shapes using transformations (ACMMG200)

- understanding the properties that determine congruence of triangles and recognising which transformations create congruent figures
- establishing that two figures are congruent if one shape lies exactly on top of the other after one or more transformations (translation, reflection, rotation), and recognising that the matching sides and the matching angles are equal

Develop the conditions for congruence of triangles (ACMMG201)

- investigating the minimal conditions needed for the unique construction of triangles, leading to the establishment of the conditions for congruence (SSS, SAS, ASA and RHS)
- solving problems using the properties of congruent figures
- constructing triangles using the conditions for congruence

Establish properties of quadrilaterals using congruent triangles and angle properties, and solve related numerical problems using reasoning (ACMMG202)

- establishing the properties of squares, rectangles, parallelograms, rhombuses, trapeziums and kites
- identifying properties related to side lengths, parallel sides, angles, diagonals and symmetry

Statistics and Probability

Chance

Elaborations

Identify complementary events and use the sum of probabilities to solve problems (ACMSP204)

- identifying the complement of familiar events
- understanding that probabilities range between 0 to 1 and that calculating the probability of an event allows the probability of its complement to be found

Describe events using language of 'at least', exclusive 'or' (A or B but not both), inclusive 'or' (A or B or both) and 'and'. (ACMSP205)

- posing 'and', 'or' and 'not' probability questions about objects or people

Represent events in two-way tables and Venn diagrams and solve related problems (ACMSP292)

- using Venn diagrams and two-way tables to calculate probabilities for events, satisfying 'and', 'or' and 'not' conditions
- understanding that representing data in Venn diagrams or two-way tables facilitates the calculation of probabilities
- collecting data to answer the questions using Venn diagrams or two-way tables

Data representation and interpretation

Elaborations

Investigate techniques for collecting data, including census, sampling and observation (ACMSP284)

- identifying situations where data can be collected by census and those where a sample is appropriate

Explore the practicalities and implications of obtaining data through sampling using a variety of investigative processes (ACMSP206)

- investigating the uses of random sampling to collect data

Explore the variation of means and proportions of random samples drawn from the same population (ACMSP293)

- using sample properties to predict characteristics of the population

Investigate the effect of individual data values, including outliers, on the mean and median (ACMSP207)

- using displays of data to explore and investigate effects

Level 8 achievement standard

Number and Algebra

Students use efficient mental and written strategies to make estimates and carry out the four operations with integers, and apply the index laws to whole numbers. They identify and describe rational and irrational numbers in context. Students estimate answers and solve everyday problems involving profit and loss rates, ratios and percentages, with and without the use of digital technology. They simplify a variety of algebraic expressions and connect expansion and factorisation of linear expressions. Students solve linear equations and graph linear relationships on the Cartesian plane.

Measurement and Geometry

Students convert between units of measurement for area and for volume. They find the perimeter and area of parallelograms, rhombuses and kites. Students name the features of circles, calculate circumference and area, and solve problems relating to the volume of prisms. They make sense of time duration in real applications, including the use of 24-hour time. Students identify conditions for the congruence of triangles and deduce the properties of quadrilaterals. They use tools, including digital technology, to construct congruent shapes.

Statistics and Probability

Students explain issues related to the collection of sample data and discuss the effect of outliers on means and medians of the data. They use various approaches, including the use of digital technology, to generate simple random samples from a population. Students model situations with Venn diagrams and two-way tables and explain the use of 'not', 'and' and 'or'. Students choose appropriate language to describe events and experiments. They determine complementary events and calculate the sum of probabilities.

Level 9

The proficiency strands **Understanding, Fluency, Problem Solving and Reasoning** are an integral part of mathematics content across the three content strands: **Number and Algebra, Measurement and Geometry, and Statistics and Probability**. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this level:

Understanding includes describing the relationship between graphs and equations, simplifying a range of algebraic expressions, explaining the use of relative frequencies to estimate probabilities, and the use of the trigonometric ratios for right-angle triangles

Fluency includes applying the index laws to expressions with integer indices, expressing numbers in scientific notation, listing outcomes for experiments and developing familiarity with calculations involving the Cartesian plane and calculating areas of shapes and surface areas of prisms

Problem Solving includes formulating, and modelling practical situations involving surface areas and volumes of right prisms, applying ratio and scale factors to similar figures, solving problems involving right-angle trigonometry, and collecting data from secondary sources to investigate an issue

Reasoning includes following mathematical arguments, evaluating media reports and using statistical knowledge to clarify situations, developing strategies in investigating similarity and sketching linear graphs

Number and Algebra

Real numbers	Elaborations
Solve problems involving direct proportion. Explore the relationship between graphs and equations corresponding to simple rate problems (ACMNA208)	<ul style="list-style-type: none"> identifying direct proportion in real-life contexts
Apply index laws to numerical expressions with integer indices (ACMNA209)	<ul style="list-style-type: none"> simplifying and evaluating numerical expressions, using involving both positive and negative integer indices
Express numbers in scientific notation (ACMNA210)	<ul style="list-style-type: none"> representing extremely large and small numbers in scientific notation, and numbers expressed in scientific notation as whole numbers or decimals
Money and financial mathematics	Elaborations
Solve problems involving simple interest (ACMNA211)	<ul style="list-style-type: none"> understanding that financial decisions can be assisted by mathematical calculations
Patterns and algebra	Elaborations

Extend and apply the index laws to variables, using positive integer indices and the zero index (ACMNA212)

- understanding that index laws apply to variables as well as numbers

Apply the distributive law to the expansion of algebraic expressions, including binomials, and collect like terms where appropriate (ACMNA213)

- understanding that the distributive law can be applied to algebraic expressions as well as numbers
- understanding the relationship between expansion and factorisation and identifying algebraic factors in algebraic expressions

Linear and non-linear relationships

Elaborations

Find the distance between two points located on a Cartesian plane using a range of strategies, including graphing software (ACMNA214)

- investigating graphical and algebraic techniques for finding distance between two points
- using Pythagoras' theorem to calculate distance between two points

Find the midpoint and gradient of a line segment (interval) on the Cartesian plane using a range of strategies, including graphing software (ACMNA294)

- investigating graphical and algebraic techniques for finding midpoint and gradient
- recognising that the gradient of a line is the same as the gradient of any line segment on that line

Sketch linear graphs using the coordinates of two points and solve linear equations (ACMNA215)

- determining linear rules from suitable diagrams, tables of values and graphs and describing them using both words and algebra

Graph simple non-linear relations with and without the use of digital technologies and solve simple related equations (ACMNA296)

- graphing parabolas, and circles connecting x-intercepts of a graph to a related equation

Measurement and Geometry

Using units of measurement

Elaborations

Calculate the areas of composite shapes (ACMMG216)

- understanding that partitioning composite shapes into rectangles and triangles is a strategy for solving problems involving area

Calculate the surface area and volume of cylinders and solve related problems (ACMMG217)

- analysing nets of cylinders to establish formulas for surface area
- connecting the volume and capacity of a cylinder to solve authentic problems

Solve problems involving the surface area and volume of right prisms (ACMMG218)

- solving practical problems involving surface area and volume of right prisms

Investigate very small and very large time scales and intervals (ACMMG219)

- investigating the usefulness of scientific notation in representing very large and very small numbers

Geometric reasoning

Elaborations

Use the enlargement transformation to explain similarity and develop the conditions for triangles to be similar (ACMMG220)

- establishing the conditions for similarity of two triangles and comparing this to the conditions for congruence
- using the properties of similarity and ratio, and correct mathematical notation and language, to solve problems involving enlargement (for example, scale diagrams)
- using the enlargement transformation to establish similarity understanding that similarity and congruence help describe relationships between geometrical shapes and are important elements of reasoning and proof

Solve problems using ratio and scale factors in similar figures (ACMMG221)

- establishing the relationship between areas of similar figures and the ratio of corresponding sides (scale factor)

Pythagoras and trigonometry

Elaborations

Investigate Pythagoras' Theorem and its application to solving simple problems involving right angled triangles (ACMMG222)

- understanding that Pythagoras' Theorem is a useful tool in determining unknown lengths in right-angled triangles and has widespread applications
- recognising that right-angled triangle calculations may generate results that can be integers, fractions or irrational numbers

Use similarity to investigate the constancy of the sine, cosine and tangent ratios for a given angle in right-angled triangles (ACMMG223)

- developing understanding of the relationship between the corresponding sides of similar right-angled triangles

Apply trigonometry to solve right-angled triangle problems (ACMMG224)

- understanding the terms 'adjacent' and 'opposite' sides in a right-angled triangle
- selecting and accurately using the correct trigonometric ratio to find unknown sides (adjacent, opposite and hypotenuse) and angles in right-angled triangles

Statistics and Probability

Chance

Elaborations

List all outcomes for two-step chance experiments, both with and without replacement using tree diagrams or arrays. Assign probabilities to outcomes and determine probabilities for events (ACMSP225)

- conducting two-step chance experiments
- using systematic methods to list outcomes of experiments and to list outcomes favourable to an event
- comparing experiments which differ only by being undertaken with replacement or without replacement

Calculate relative frequencies from given or collected data to estimate probabilities of events involving 'and' or 'or' (ACMSP226)

- using Venn diagrams or two-way tables to calculate relative frequencies of events involving 'and', 'or' questions
- using relative frequencies to find an estimate of probabilities of 'and', 'or' events

Investigate reports of surveys in digital media and elsewhere for information on how data were obtained to estimate population means and medians (ACMSP227)



- investigating a range of data and its sources, for example the age of residents in Australia, Cambodia and Tonga; the number of subjects studied at school in a level by 14-level-old students in Australia, Japan and Timor-Leste

Data representation and interpretation

Elaborations

Identify everyday questions and issues involving at least one numerical and at least one categorical variable, and collect data directly from secondary sources (ACMSP228)



- comparing the annual rainfall in various parts of Australia, Pakistan, New Guinea and Malaysia

Construct back-to-back stem-and-leaf plots and histograms and describe data, using terms including 'skewed', 'symmetric' and 'bi modal' (ACMSP282)

- using stem-and-leaf plots to compare two like sets of data such as the heights of girls and the heights of boys in a class
- describing the shape of the distribution of data using terms such as 'positive skew', 'negative skew' and 'symmetric' and 'bi-modal'

Compare data displays using mean, median and range to describe and interpret numerical data sets in terms of location (centre) and spread (ACMSP283)

- comparing means, medians and ranges of two sets of numerical data which have been displayed using histograms, dot plots, or stem and leaf plots

Level 9 achievement standard

Number and Algebra

Students apply the index laws using integer indices to variables and numbers, express numbers in scientific notation, solve problems involving very small and very large numbers, and check the order of magnitude of calculations. They solve problems involving simple interest. Students use the distributive law to expand algebraic expressions, including binomial expressions, and simplify a range of algebraic expressions. They find the distance between two points on the Cartesian plane and the gradient and midpoint of a line segment using a range of strategies including the use of digital technology. Students sketch and draw linear and non-linear relations, solve simple related equations and explain the relationship between the graphical and symbolic forms, with and without the use of digital technology.

Measurement and Geometry

Students solve measurement problems involving perimeter and area of composite shapes, surface area and volume of rectangular prisms and cylinders, with and without the use of digital technology. They relate three-dimensional objects to two-dimensional representations. Students explain similarity of triangles, interpret ratios and scale factors in similar figures, and apply Pythagoras's theorem and trigonometry to solve problems involving angles and lengths in right-angled triangles.

Statistics and Probability

Students compare techniques for collecting data from primary and secondary sources, and identify questions and issues involving different data types. They construct histograms and back-to-back stem-and-leaf plots with and without the use of digital technology. Students identify mean and median in skewed, symmetric and bi-modal displays and use these to describe and interpret the distribution of the data. They calculate relative frequencies to estimate probabilities. Students list outcomes for two-step experiments and assign probabilities for those outcomes and related events.

Level 10

The proficiency strands **Understanding, Fluency, Problem Solving and Reasoning** are an integral part of mathematics content across the three content strands: **Number and Algebra, Measurement and Geometry, and Statistics and Probability**. The proficiencies reinforce the significance of working mathematically within the content and describe how the content is explored or developed. They provide the language to build in the developmental aspects of the learning of mathematics.

At this level:

Understanding includes applying the four operations to algebraic fractions, finding unknowns in formulas after substitution, making the connection between equations of relations and their graphs, comparing simple and compound interest in financial contexts and determining probabilities of two and three step experiments

Fluency includes factorising and expanding algebraic expressions, using a range of strategies to solve equations and using calculations to investigate the shape of data sets

Problem Solving includes calculating the surface area and volume of a diverse range of prisms to solve practical problems, finding unknown lengths and angles using applications of trigonometry, using algebraic and graphical techniques to find solutions to simultaneous equations and inequalities, and investigating independence of events

Reasoning includes formulating geometric proofs involving congruence and similarity, interpreting and evaluating media statements and interpreting and comparing data sets

Number and Algebra

Money and financial mathematics

Elaborations

Connect the compound interest formula to repeated applications of simple interest using appropriate digital technologies (ACMNA229)

- working with authentic information, data and interest rates to calculate compound interest and solve related problems

Patterns and algebra

Elaborations

Factorise algebraic expressions by taking out a common algebraic factor (ACMNA230)

- using the distributive law and the index laws to factorise algebraic expressions
- understanding the relationship between factorisation and expansion

Simplify algebraic products and quotients using index laws (ACMNA231)

- applying knowledge of index laws to algebraic terms, and simplifying algebraic expressions using both positive and negative integral indices

Apply the four operations to simple algebraic fractions with numerical denominators (ACMNA232)

- expressing the sum and difference of algebraic fractions with a common denominator
- using the index laws to simplify products and quotients of algebraic fractions

Expand binomial products and factorise monic quadratic expressions using a variety of strategies (ACMNA233)

- exploring the method of completing the square to factorise quadratic expressions and solve quadratic equations
- identifying and using common factors, including binomial expressions, to factorise algebraic expressions using the technique of grouping in pairs
- using the identities for perfect squares and the difference of squares to factorise quadratic expressions

Substitute values into formulas to determine an unknown (ACMNA234)

- solving simple equations arising from formulas

Linear and non-linear relationships

Elaborations

Solve problems involving linear equations, including those derived from formulas (ACMNA235)

- representing word problems with simple linear equations and solving them to answer questions

Solve linear inequalities and graph their solutions on a number line (ACMNA236)

- representing word problems with simple linear inequalities and solving them to answer questions

Solve linear simultaneous equations, using algebraic and graphical techniques including using digital technology (ACMNA237)

- associating the solution of simultaneous equations with the coordinates of the intersection of their corresponding graphs

Solve problems involving parallel and perpendicular lines (ACMNA238)

- solving problems using the fact that parallel lines have the same gradient and conversely that if two lines have the same gradient then they are parallel
- solving problems using the fact that the product of the gradients of perpendicular lines is -1 and conversely that if the product of the gradients of two lines is -1 then they are perpendicular

Explore the connection between algebraic and graphical representations of relations such as simple quadratics, circles and exponentials using digital technology as appropriate (ACMNA239)

- sketching graphs of parabolas, and circles
- applying translations, reflections and stretches to parabolas and circles
- sketching the graphs of exponential functions using transformations

Solve linear equations involving simple algebraic fractions (ACMNA240)

- solving a wide range of linear equations, including those involving one or two simple algebraic fractions, and checking solutions by substitution
- representing word problems, including those involving fractions, as equations and solving them to answer the question

Solve simple quadratic equations using a range of strategies (ACMNA241)

- using a variety of techniques to solve quadratic equations, including grouping, completing the square, the quadratic formula and choosing two integers with the required product and sum

Measurement and Geometry

Using units of measurement

Elaborations

Solve problems involving surface area and volume for a range of prisms, cylinders and composite solids (ACMMG242)

- Investigating and determining the volumes and surface areas of composite solids by considering the individual solids from which they are constructed

Geometric reasoning

Elaborations

Formulate proofs involving congruent triangles and angle properties (ACMMG243)

- applying an understanding of relationships to deduce properties of geometric figures (for example the base angles of an isosceles triangle are equal)

Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes (ACMMG244)

- distinguishing between a practical demonstration and a proof (for example demonstrating triangles are congruent by placing them on top of each other, as compared to using congruence tests to establish that triangles are congruent)
- performing a sequence of steps to determine an unknown angle giving a justification in moving from one step to the next.
- communicating a proof using a sequence of logically connected statements

Pythagoras and trigonometry

Elaborations

Solve right-angled triangle problems including those involving direction and angles of elevation and depression (ACMMG245)

- applying Pythagoras's Theorem and trigonometry to problems in surveying and design

Statistics and Probability

Chance

Elaborations

Describe the results of two- and three-step chance experiments, both with and without replacements, assign probabilities to outcomes and determine probabilities of events. Investigate the concept of independence (ACMSP246)

- recognising that an event can be dependent on another event and that this will affect the way its probability is calculated

Use the language of 'ifthen', 'given', 'of', 'knowing that' to investigate conditional statements and identify common mistakes in interpreting such language (ACMSP247)

- using two-way tables and Venn diagrams to understand conditional statements
- using arrays and tree diagrams to determine probabilities

Data representation and interpretation

Elaborations

Determine quartiles and interquartile range (ACMSP248)

- finding the five-number summary (minimum and maximum values, median and upper and lower quartiles) and using its graphical representation, the box plot, as tools for both numerically and visually comparing the centre and spread of data sets

Construct and interpret box plots and use them to compare data sets (ACMSP249)



- understanding that box plots are an efficient and common way of representing and summarising data and can facilitate comparisons between data sets
- using parallel box plots to compare data about the age distribution of Aboriginal and Torres Strait Islander people with that of the Australian population as a whole

Compare shapes of box plots to corresponding histograms and dot plots (ACMSP250)

- Investigating data in different ways to make comparisons and draw conclusions

Use scatter plots to investigate and comment on relationships between two numerical variables (ACMSP251)

- using authentic data to construct scatter plots, make comparisons and draw conclusions

Investigate and describe bivariate numerical data where the independent variable is time (ACMSP252)



- investigating biodiversity changes in Australia since European occupation
- constructing and interpreting data displays representing bivariate data over time

Evaluate statistical reports in the media and other places by linking claims to displays, statistics and representative data (ACMSP253)



- investigating the use of statistics in reports regarding the growth of Australia's trade with other countries of the Asia region
- evaluating statistical reports comparing the life expectancy of Aboriginal and Torres Strait Islander people with that of the Australian population as a whole

Level 10 achievement standard

Number and Algebra

Students recognise the connection between simple and compound interest. They solve problems involving linear equations and inequalities, quadratic equations and pairs of simultaneous linear equations and related graphs, with and without the use of digital technology. Students substitute into formulas, find unknown values, manipulate linear algebraic expressions, expand binomial expressions and factorise monic and simple non-monic quadratic expressions, with and without the use of digital technology. They represent linear, quadratic and exponential functions numerically, graphically and algebraically, and use them to model situations and solve practical problems.

Measurement and Geometry

Students solve and explain surface area and volume problems relating to composite solids. They use parallel and perpendicular lines, angle and triangle properties, similarity, trigonometry and congruence to solve practical problems and develop proofs involving lengths, angles and areas in plane shapes. They use digital technology to construct and manipulate geometric shapes and objects, and explore symmetry and pattern in two dimensions.

Statistics and Probability

Students compare univariate data sets by referring to summary statistics and the shape of their displays. They describe bivariate data where the independent variable is time and use scatter-plots generated by digital technology to investigate relationships between two continuous variables. Students evaluate the use of statistics in the media. They list outcomes for multi-step chance experiments involving independent and dependent events, and assign probabilities for these experiments.

Level 10A

Number and Algebra

Real numbers

Define rational and irrational numbers and perform operations with surds and fractional indices (ACMNA264)

Elaborations

- understanding that the real number system includes irrational numbers
- extending the index laws to rational number indices
- performing the four operations with surds

Use the definition of a logarithm to establish and apply the laws of logarithms (ACMNA265)

- investigating the relationship between exponential and logarithmic expressions
- simplifying expressions using the logarithm laws

Patterns and algebra

Investigate the concept of a polynomial and apply the factor and remainder theorems to solve problems (ACMNA266)

Elaborations

- investigating the relationship between algebraic long division and the factor and remainder theorems

Linear and non-linear relationships

Solve simple exponential equations (ACMNA270)

Elaborations

- investigating exponential equations derived from authentic mathematical models based on population growth

Describe, interpret and sketch parabolas, hyperbolas, circles and exponential functions and their transformations (ACMNA267)

- applying transformations, including translations, reflections in the axes and stretches to help graph parabolas, rectangular hyperbolas, circles and exponential functions

Apply understanding of polynomials to sketch a range of curves and describe the features of these curves from their equation (ACMNA268)

- investigating the features of graphs of polynomials including axes intercepts and the effect of repeated factors

Factorise monic and non-monic quadratic expressions and solve a wide range of quadratic equations derived from a variety of contexts (ACMNA269)

- writing quadratic equations that represent practical problems

Measurement and Geometry

Using units of measurement

Solve problems involving surface area and volume of right pyramids, right cones, spheres and related composite solids (ACMMG271)

Elaborations

- using formulas to solve problems
- using authentic situations to apply knowledge and understanding of surface area and volume

Geometric reasoning

Elaborations

Prove and apply angle and chord properties of circles (ACMMG272)

- performing a sequence of steps to determine an unknown angle or length in a diagram involving a circle, or circles, giving a justification in moving from one step to the next
- communicating a proof using a logical sequence of statements
- proving results involving chords of circles

Pythagoras and trigonometry

Elaborations

Establish the sine, cosine and area rules for any triangle and solve related problems (ACMMG273)

- applying knowledge of sine, cosine and area rules to authentic problems such as those involving surveying and design

Use the unit circle to define trigonometric functions, and graph them with and without the use of digital technologies (ACMMG274)

- establishing the symmetrical properties of trigonometric functions
- investigating angles of any magnitude
- understanding that trigonometric functions are periodic and that this can be used to describe motion

Solve simple trigonometric equations (ACMMG275)

- using periodicity and symmetry to solve equations

Apply Pythagoras' theorem and trigonometry to solving three-dimensional problems in right-angled triangles (ACMMG276)

- investigating the applications of Pythagoras's theorem in authentic problems

Statistics and Probability

Chance

Elaborations

Investigate reports of studies in digital media and elsewhere for information on their planning and implementation (ACMSP277)

- evaluating the appropriateness of sampling methods in reports where statements about a population are based on a sample
- evaluating whether graphs in a report could mislead, and whether graphs and numerical information support the claims

Data representation and interpretation

Elaborations

Calculate and interpret the mean and standard deviation of data and use these to compare data sets (ACMSP278)



- using the standard deviation to describe the spread of a set of data
- using the mean and standard deviation to compare numerical data sets

Use information technologies to investigate bivariate numerical data sets. Where appropriate use a straight line to describe the relationship allowing for variation (ACMSP279)

- investigating different techniques for finding a 'line of best fit'