MATHEMATICS

Years 1 to 10 Syllabus

This syllabus should be read in conjunction with Queensland Studies Authority Years 1 to 10 support materials.

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Contents

Rationale

Nature of the key learning area

Mathematics is a unique and powerful way of viewing the world to investigate patterns, order, generality and uncertainty. Mathematics assists individuals to make meaning of their world. The use of mathematics empowers individuals to distil the essence of life experiences into universally true abstractions and, at the same time, to apply these abstract ideas to interpret new situations in the real world.

Mathematical concepts and the processes of mathematical analysis and justification provide a unique and coherent framework for explaining a myriad of physical and social phenomena.

The concise language of mathematics, verbal and symbolic, enables communication of shared mathematical understandings within and among communities. An understanding of mathematical knowledge, procedures and strategies empowers individuals to be effective participants in an interdependent world.

Mathematics has evolved within and across cultures, developing in response to cultural needs and ways of viewing and interpreting a range of life situations and providing a sense of order in the world. The diversity of thinking, reasoning and working mathematically in response to life situations has characterised, and will continue to characterise, the evolution of mathematics.

Thinking, reasoning and working mathematically

Thinking, reasoning and working mathematically are essential elements of learning for, about and through mathematics. Positive dispositions towards mathematics learning and active engagement with mathematical tasks are integral to thinking, reasoning and working mathematically. Such dispositions are developed through student engagement in mathematical investigations relevant to a range and balance of situations from life-related to purely mathematical. When making sense of life experiences or seeking solutions to problems, individuals:

- see the mathematics in situations encountered
- plan, investigate, conjecture, justify, think critically, generalise, communicate and reflect on mathematical understandings and procedures
- select and use relevant mathematical knowledge, procedures, strategies and technologies to analyse and interpret information.

Mathematical knowledge

Mathematical knowledge is dynamic because it is socially, culturally and historically constructed, responding to changing needs and expectations while also creating conditions for change. The elements of mathematical knowledge can be categorised as number, patterns and algebra, measurement, chance and data, and space.

Mathematical knowledge includes *knowing about* mathematics, *knowing how to do* mathematics, and *knowing when and where to use* mathematics.

Knowing about mathematics involves:

- knowing that mathematics is an invented, sophisticated and abstract symbol system
- developing an appreciation of mathematics as diverse and complex with interwoven and interconnected concepts.

Knowing how to do mathematics involves:

- applying relevant mathematical knowledge, procedures and strategies in a range and balance of situations from life-related to purely mathematical.

Knowing when and where to use mathematics involves:

- being familiar with the mathematics inherent in many life contexts
- knowing why particular mathematical concepts are applicable in different situations
- critical thinking, inventiveness and persistence with investigations of relevance to an individual or group.

Contribution of the key learning area to lifelong learning

The Queensland school curriculum is designed to help students become lifelong learners. The overall learning outcomes of the curriculum contain elements common to all key learning areas and collectively describe the valued attributes of a lifelong learner.

A lifelong learner is:

- a knowledgeable person with deep understanding
- a complex thinker
- a responsive creator
- an active investigator
- an effective communicator
- a participant in an interdependent world
- a reflective and self-directed learner.

The Years 1 to 10 Mathematics key learning area provides many opportunities for students to develop these attributes.

Knowledgeable person with deep understanding

Learners understand mathematics by *knowing about* number, patterns and algebra, measurement, chance and data, and space. They learn *how to do* mathematics and *when and where* to apply mathematical knowledge to familiar

and unfamiliar, simple and complex mathematical investigations relevant to a range and balance of situations from life-related to purely mathematical. The selection and effective application of mathematical knowledge, procedures and strategies is evidence of deep understanding. Learners' understandings are enhanced through active engagement in mathematical investigations and in communicating their thinking and reasoning in ways that make sense to themselves and to others.

Complex thinker

Learners use a range of reasoning strategies to make conjectures and inferences, to analyse and synthesise information and to solve problems and make decisions. They demonstrate inductive, deductive and intuitive thinking and reasoning when engaging in mathematical investigations relevant to a range and balance of situations from life-related to purely mathematical. Learners judge the adequacy and accuracy of mathematical solutions and justify conclusions based on evidence. By reflecting on their thinking, reasoning and generalisations about mathematics, learners build on prior knowledge and incorporate new information into existing conceptual structures.

Responsive creator

Learners are creative as they think, reason and work mathematically. They see and respond to opportunities to use a variety of mathematical knowledge, procedures and strategies. They generate innovative and divergent alternatives when solving problems. They use a range of representations to communicate mathematical understandings and to transfer knowledge from one situation to another.

Active investigator

Learners value a spirit of inquiry and a questioning habit of mind that challenge perceptions and promote reasoning and thinking about possible ways of resolving mathematical problems related to a range and balance of situations from life-related to purely mathematical. Through engagement in mathematical investigations, students use knowledge, procedures, strategies and technologies to answer questions posed by themselves and others. They manipulate concrete materials and make a variety of representations and displays, including mathematical models and data displays (electronic and manual), to assist their mathematical thinking and reasoning. They develop understandings about mathematical relationships and transfer thinking and reasoning to new situations. Learners operate as active investigators when they contribute to, and share ideas about, mathematical knowledge, understandings, procedures and strategies.

Effective communicator

Learners interpret and integrate various sources and forms of information and distinguish relevant from irrelevant information when engaging in investigations. They understand and use the concise language of mathematics, both verbal and symbolic. They select appropriate mathematical language to convey, logically and clearly, their mathematical understandings, thinking and reasoning. Learners explain, clarify, persuade, debate, negotiate and pose problems for themselves and others to consider and investigate. They challenge

mathematical ideas and critically evaluate representations of mathematical information by considering the purposes and different points of view. They represent their mathematical ideas and reasoning in different ways to reflect their conceptual understandings and to meet the needs of various audiences.

Participant in an interdependent world

Learners cooperate, collaborate and negotiate in groups to plan, think, reason and resolve mathematical investigations related to a range and balance of situations from life-related to purely mathematical. They appreciate, evaluate and either challenge or incorporate different perspectives of thinking and reasoning about mathematical investigations. They take increasing responsibility for their mathematical actions and decisions based on understandings, interpretations, generalisations and evaluations.

Reflective and self-directed learner

Learners reflect on their learning as they become metacognitively aware and self-regulating. They understand how they learn mathematics and draw on what they know and can do to investigate new ideas. As self-directed, independent learners engaging in mathematical investigations, they collaborate, plan, organise, evaluate and manage their thinking and reasoning and apply appropriate knowledge, procedures and strategies to different situations. They look for opportunities to transfer concepts, ideas, procedures and strategies. They monitor:

- their mathematical understandings and applications of generalised ideas
- the efficiency of the procedures
- the appropriateness of the strategies.

Cross-curricular priorities

The Mathematics key learning area incorporates the cross-curricular priorities of literacy, numeracy, lifeskills and a futures perspective.

Literacy

Literacy refers to particular social practices that use language for thinking and making meaning in cultures. It includes speaking and listening, reading and viewing, writing and shaping, often in combination, in multimodal texts within a range of contexts. Critical thinking is also involved in these practices. Students seek and critically appraise information, make choices and use their literacy skills to become independent learners. They develop critical literacy by questioning the cultural, social and political practices embedded in spoken, written, visual, auditory, kinaesthetic and multimodal texts. Students learn the relationship between the contexts and the audiences of those texts. They begin to understand that literacy influences how people view themselves, their identities and their environments as well as providing ways to represent these views.

Students initially describe mathematical concepts through the use of everyday language. They develop a lexicon for mathematics as they differentiate between the everyday meanings of many words and the meanings that those words have when used in mathematical contexts. They link their understandings of the lexicon with mathematical symbols and communicate their thinking and reasoning effectively and efficiently. As they extend and deepen conceptual understandings, they incorporate new mathematical language into their conceptual structures.

In the Mathematics key learning area, students engage with the literacy of mathematics as code breakers, text participants, text users and text analysts when they:

- read, view, analyse and interpret the mathematics represented by text, pictures, symbols, tables, graphs and technological displays
- comprehend and analyse conversations and media presentations that convey different mathematical points of view
- organise information, ideas and arguments, using a variety of media
- communicate in various ways — for example, orally, visually, electronically, symbolically and graphically
- compose and respond to questions and problems that challenge their own and others' mathematical thinking and reasoning.

Numeracy

Numeracy is the demonstration of practices and dispositions that accurately, efficiently and appropriately meet the demands of typical everyday situations that involve number, patterns and algebra, measurement, chance and data, and space. Students develop and enhance their numeracy skills to become effective, competent members of communities and to make informed decisions in a range and balance of situations from life-related to purely mathematical.

Students live in a technologically advancing society and in the future will draw on mathematical knowledge, procedures, strategies and dispositions for effective use of technologies. Access to, and efficient use of, technologies will continue to require an understanding of number, patterns and algebra, measurement, chance and data, and space. Central to these understandings is knowing how, when and why to engage in a range of practices that include estimating, predicting, justifying and visualising. In the future, there will be an increased focus in numeracy on the use of various ways of solving a range and balance of situations from life-related to purely mathematical and the use of a range of technological tools to complete calculations, investigations and simulations.

In the Mathematics key learning area, students use and enhance numeracy skills as they think, reason and work mathematically. Students engage in numeracy practices when they:

- identify the mathematics in a range and balance of situations from life-related to purely mathematical
- identify opportunities to apply mathematical knowledge, procedures and strategies
- predict possible outcomes of investigations
- use mental computation strategies
- resolve problems with imagination and inventiveness

- use mathematical knowledge, procedures and strategies to estimate, measure or calculate
- interpret and use a range of mathematical representations
- visualise mathematical ideas
- construct physical models to represent mathematical ideas, thinking and reasoning
- interpret and follow mathematical instructions and directions
- make logical generalisations from numerical data
- represent mathematical information in different ways
- pose and test conjectures and hypotheses
- check the reasonableness of conclusions and answers.

Lifeskills

'Lifeskills' is a term used to describe the mix of knowledge, processes, skills and attitudes that are considered necessary for people to function in their contemporary and changing life roles and situations. Demonstration of lifeskills takes place in two overlapping dimensions: practical performance of, and critical reflection on, those skills.

It is possible to identify at least four sets of lifeskills that enable students to participate in the four life roles. The lifeskills and related life roles are:

- personal development skills — growing and developing as an individual
- social skills — living with and relating to other people
- self-management skills — managing resources
- citizenship skills — receiving from, and contributing to, local, state, national and global communities.

The Mathematics key learning area helps prepare students for a variety of life roles by providing opportunities for them to develop and demonstrate:

- personal development skills
  - identifying and developing mathematical interests
  - recognising individual strengths and weaknesses
  - reflecting on and articulating personal viewpoints, attitudes, insights and beliefs
  - developing knowledge, procedures and strategies
  - developing confidence and self-esteem
  - developing attitudes of perseverance, flexibility and adaptability
- social skills
  - using different modes of communication for particular purposes and audiences
  - working cooperatively and collaboratively towards shared goals
  - communicating mathematical ideas, thinking and reasoning
  - sharing resources
  - assisting others to think and reason from different perspectives

- self-management skills
  - using technologies for self-management
  - researching data sources to support, extend or challenge thinking and reasoning
  - setting personal goals and devising strategies to attain them
  - identifying and maintaining priorities
  - developing introspection
  - developing divergent and creative thinking
  - posing problems and applying problem-solving strategies
  - accessing and using appropriate resources
  - operating effectively within groups
- citizenship skills
  - respecting private and public property including equipment and intellectual property
  - acknowledging the cultural practices of a diverse range of communities
  - devising and experimenting with various strategies when problem solving within the community.

Futures perspective

A futures perspective involves knowledge, practices and dispositions that enable students to identify possible, probable and preferred individual and shared futures. A futures perspective leads to insights and understandings about thinking ahead and the roles of individuals and groups in envisioning and enacting preferred futures.

Students with a futures perspective have a disposition to take responsibility for their actions and decisions. They are empowered to participate optimistically in processes of social innovation, recovery and renewal.

Insights and knowledge about the past and present lead students to consider the consequences of past and future personal and collective actions. Futures concepts provide a basis for students to think about, and take responsibility for, decisions and actions. In the Mathematics key learning area, students:

- explore and communicate perceptions about futures based on intuitive, inductive and deductive thinking and reasoning
- understand that mathematics influences, and is influenced by, cultures and communities
- develop and utilise lateral and creative thinking, decision making, problem solving, generalising and reflecting
- develop insights into uncertainties
- envision their contribution to future mathematical thinking and reasoning, and cultural advancements
- challenge assumptions and generalisations and critique current visions of futures based on mathematically innovative thinking and reasoning
- use technologies to envision possible, probable and preferred futures.

Other curricular considerations

The Years 1 to 10 Mathematics key learning area also incorporates work education.

Work education

Work involves both the paid employment that people undertake and the unpaid work that they perform within the groups, communities and societies to which they belong. Work education is about preparing students for work in a dynamic, changing and challenging society. It involves three interrelated components — learning for work, learning about work and understanding the nature of work.

Students develop understandings about the nature of work as they consider the influence mathematics has on work and workers, and the ways in which mathematics shapes and is shaped by society. Through the Mathematics key learning area, students become capable people, creating innovative solutions for community needs, valuing enterprising and entrepreneurial behaviour and critically responding to changes in the workplace and wider community.

Work education in the Mathematics key learning area includes:

- developing the mathematical knowledge, procedures, strategies and dispositions that enable students to be competent and confident participants in a work environment
- working independently and collaboratively, valuing the contributions of a diverse community, contributing to joint efforts, assisting others and providing feedback on the work of others
- organising, communicating and sharing mathematical ideas and information with a variety of audiences
- planning and organising procedures and strategies in a range and balance of situations from life-related to purely mathematical
- using a range of technologies to enhance efficiency
- developing the characteristics of valued workers — persistence, initiative, creativity and self-reflection
- interpreting given information and applying known concepts and skills or using a range of problem-solving strategies to search for a solution.

Understandings about learners and learning

The following assumptions about learners and learning underpin the Years 1 to 10 Mathematics key learning area.

Learners

- Learners are unique individuals with divergent views about the world.
- Learners have a broad range of knowledge, attitudes, values and experiences shaped by their gender, sexual identity, socioeconomic circumstances, cultural and linguistic backgrounds and geographical locations, and by other aspects of their background, all of which form part of their learning environment.

- Learners' prior knowledge and experiences influence the ways in which they approach learning and make meaning of any new learning experience.
- Learners grow, develop and learn in different ways, in different settings and at different rates.

Learning

- Learning is a lifelong process.
- Learning occurs within and across cultural and social contexts and is influenced by them.
- Learning is most effective when the learning environment is safe, supportive, enjoyable, collaborative, challenging and empowering.
- Learning is most effective when it involves active partnerships with students, parents/carers, peers, teachers, and school and community members.
- Learning contexts should acknowledge equity principles by being inclusive and supportive and by acknowledging and valuing diversity.
- Learning becomes meaningful when teaching approaches are culturally sensitive.
- Learning is enhanced when the context is relevant and motivates learners.
- Learner-centred and investigative strategies are most effective in enabling learners to think and reason, investigate and evaluate their own and others' mathematical ideas and generalisations, and to make informed choices about life situations.
- Learning requires active construction of meaning; it accommodates, acknowledges and builds on prior knowledge.
- Learning is enhanced by the use of a range of technologies.
- Learning is enhanced when learners have opportunities to represent their mathematical thinking in different ways.
- Learning is intensified when learners are encouraged to investigate, evaluate and reflect on their personal ways of thinking, reasoning and working mathematically.
- Learning becomes meaningful when community and school members value mathematics learning and its importance in society.

Learning in the Mathematics key learning area

Learning in the Mathematics key learning area involves cognitive, social and emotional and physical learning.

Cognitive learning

Cognitive learning in mathematics develops thinking and reasoning skills, some of which are used in all dimensions of learning and some of which are specific to mathematics. Students develop problem-solving and problem-posing strategies and abilities. These strategies and abilities include:

- perceiving the mathematics in situations
- analysing situations from different perspectives
- generating solutions from investigations
- using solutions to pose additional questions

- beginning with solutions and generating a range of related problems
- developing logical sequences to process and work with mathematical ideas
- making judgments
- representing ideas in a variety of ways
- generalising, evaluating and reflecting on learning.

Students become familiar with and learn to use the symbolic and verbal language that is central to mathematics.

Social and emotional learning
As students participate in mathematical activities, they develop understandings of the dynamics of various cultural, social, historical and economic contexts and shared meanings that are produced and valued within and across groups. Students develop interactive skills, social confidence, understandings of group dynamics and an ability to negotiate within groups as they work towards shared goals. They begin to understand their feelings and emotional responses to different ideas and opinions as they engage in, and reflect on, mathematical experiences. Learning situations should allow students to share their excitement and manage challenges as they resolve mathematical investigations in different ways.

Physical learning
The physical component of the Mathematics key learning area develops fine and gross motor skills, coordination and spatial awareness. Fine motor coordination and visuomotor skills are developed and refined when students manipulate a range of equipment, including electronic technologies and mathematical instruments, as they construct shapes, conduct mathematical investigations, measure, and create mathematical representations. This involves acquiring and developing procedural knowledge — knowing how to apply conceptual understandings. Gross motor coordination and spatial awareness are developed and refined when students negotiate pathways and locate objects and positions in space and when they use actions or body parts for measuring. Physical learning may also involve repetition and practice of skills to refine control that will allow the learner to focus on the mathematics of situations.

Learner-centred approach

A learner-centred approach to learning and teaching views learning as the active construction of meaning, and teaching as the act of guiding, scaffolding and facilitating learning by providing optimally challenging experiences. This approach considers knowledge as evolving and built on prior experience.

In the Mathematics key learning area, students' mathematical knowledge is developed through meaningful open-ended investigations. Students identify the mathematics that they can bring to an investigation (prior knowledge), identify the mathematics they need to learn, and plan logical sequences towards solutions. They discover common features in investigations and begin to transfer acquired knowledge, procedures and strategies to new situations and to check their understandings. Each student develops mathematical knowledge, procedures and strategies in their own way, at their own rate and in different contexts. The mathematical knowledge developed is richly interconnected within this key learning area and across other key learning areas.

Equity in the curriculum

A curriculum based on equity principles challenges inequities by:

- acknowledging and minimising unequal outcomes of schooling for different groups of students
- identifying and minimising barriers to access, participation, active engagement, construction of knowledge and demonstration of learning outcomes
- respecting and using the knowledge, skills and experiences of all students as a basis for their learning and for enhancing the learning of others in the community
- developing understanding of, and respect for, diversity within and among groups
- making explicit the fact that knowledge is historically, socially and culturally constructed
- making explicit the relationship between valued knowledge and power relations
- identifying and promoting the capacity of the Mathematics key learning area to develop knowledge, procedures, strategies and dispositions that empower students to challenge injustices and inequities.

An equitable curriculum caters for the needs of individuals and groups so that all students have opportunities for learning and for demonstrating learning outcomes. For this to occur, students must have access to the curriculum and be given opportunities to participate in learning experiences and assessment tasks.

Student access and participation

Learning experiences and assessment opportunities that support student access and participation must take account of:

- the cumulative and interrelated impacts that students' culture, language, location, ability, gender, sexual identity and socioeconomic circumstance have on their perspectives and experiences
- the life experiences of students and the diverse range of knowledge, practices and dispositions they bring to the classroom.

The Mathematics syllabus provides opportunities for all students to access learning in and through auditory, visual and kinaesthetic ways of constructing knowledge.

The educational needs of students with disabilities and students with learning difficulties are catered for as teachers identify and minimise barriers in mathematics activities. Some students may require individualised learning and assessment activities or modifications to resources or the physical environment as ways of promoting access to the mathematics curriculum.

Gender stereotypes and constructions of masculinities and femininities in various cultural and social groups may influence student choices, attitudes, perspectives and participation in mathematics. The selection of concepts, contexts, content and learning experiences should accommodate the learning styles, interests and experiences of all students and maximise their access to, and participation in, mathematics.

Learning about equity in and through Mathematics

An equitable curriculum provides opportunities for students to learn about equity. In the context of the Mathematics key learning area, students express, explore and critique personal, group and societal values. They challenge misrepresentations and stereotypes to become active participants in interdependent societies.

Mathematics investigations provide opportunities for students to understand and appreciate diverse needs, experiences, histories and perspectives and to value and respect people, cultures and their initiatives.

Students learn about the dynamic interrelationships between mathematics knowledge and the historical, social, cultural, spiritual, political and economic contexts in which it was constructed. This learning promotes understanding of the heterogeneity of knowledge, procedures and strategies within and across cultural, social, geographic and economic groups.

Outcomes

Framework

This syllabus provides a framework for planning learning experiences and assessment opportunities through which students demonstrate what they know and can do with what they know in the Years 1 to 10 Mathematics key learning area.

Key learning area outcomes

The key learning area outcomes highlight the uniqueness of the Mathematics key learning area and its particular contribution to lifelong learning. These outcomes are the intended results of extended engagement with the Years 1 to 10 Mathematics key learning area. When thinking, reasoning and working mathematically, students engage in, and reflect on, mathematical experiences to develop the knowledge, procedures, strategies and dispositions necessary to:

- understand the nature of mathematics as a dynamic human endeavour, its relationship with other human endeavours and its contribution to society
- interpret and apply underlying properties and relationships that characterise and connect aspects of mathematics
- identify and analyse information, think and reason inductively, deductively and intuitively to solve problems and make and justify decisions
- create mathematical models, reason inventively, analyse options and consider the consequences and implications of decisions
- pose and solve mathematical problems using a variety of information gathering, processing and management techniques and technologies
- use the concise language of mathematics, verbal and symbolic, when communicating observations and ideas, and engaging in substantive conversations about mathematics
- collaborate and cooperate, challenge the reasoning and perspectives of others as appropriate, and contribute mathematical learning to investigations involving a range and balance of situations from life-related to purely mathematical.
- reflect on, evaluate and apply their mathematical learning to their personal and working lives, and make informed decisions about the future.

Strands of the key learning area

The Mathematics key learning area is arranged in five strands for organisational convenience. Each strand includes interconnecting topics.

In the strands and topics of the Mathematics key learning area, a strong emphasis is placed on thinking, reasoning and working mathematically. Each strand develops topics as follows:

Number

- **Number concepts** — this topic develops numeration and number sense, including the subsets of numbers within the set of rational numbers, the base ten system and the uses and purposes of money in our society.
- **Addition and subtraction** — this topic promotes the connections between these concepts, understandings of number that support mental computation strategies and other computation methods.
- **Multiplication and division** — this topic promotes the connections between these concepts, understandings of number that support mental computation strategies, fractional and proportional thinking and other computation methods.

Patterns and Algebra

- **Patterns and functions** — this topic develops understandings of consistent change and relationships.
- **Equivalence and equations** — this topic develops understandings of balance and the methods associated with solving equations.

Measurement

- **Length, mass, area and volume** — this topic promotes understandings of estimation and measurement of these attributes, units of measure and the relationships between them.
- **Time** — this topic develops understandings of units and conventions associated with measuring and recording the passage and duration of time.

Chance and Data

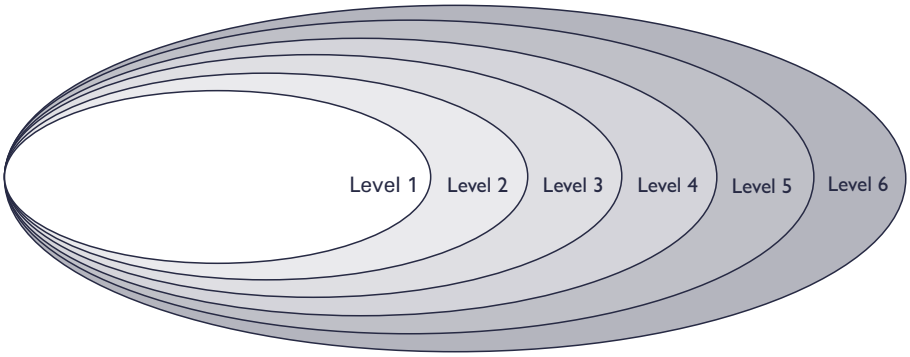
- **Chance** — this topic develops understandings of likelihood and the use of experimental and theoretical approaches to estimate or determine numerical probability to make judgments and decisions.
- **Data** — this topic develops understandings related to collecting and handling data, exploring and displaying data, and identifying and interpreting variation.

Space

- **Shape and line** — this topic promotes understandings of the geometric terms and properties used to identify 3D shapes and objects and 2D shapes, and to visualise and create representations.
- **Location, direction and movement** — this topic promotes understandings of the construction and interpretation of maps, plans and grids, and the identification and description of locations, directions and movements through familiar and other environments.

Levels

The levels outlined on the following pages indicate progressions of increasing sophistication and complexity in learning outcomes. The sequencing of the learning outcomes, based on each topic, is such that each level is nested within the following level. Learning outcomes for successive levels are conceptually related to each other, forming a continuum rather than existing simply as a number of discrete entities. This continuum is illustrated in the following diagram.



Progression of conceptual development of outcomes

In addition to these six levels, there are two other levels — Foundation Level and Beyond Level 6.

A level statement is included for each level of each strand of the syllabus. The level statement summarises learning outcomes at each level and provides the conceptual framework for developing the learning outcomes. It also includes information related to core content and contexts that contribute to the interpretation and intent of the learning outcomes.

The level statements at Foundation Level have been developed for students with disabilities demonstrating a level of understanding before that of Level 1. These level statements provide a framework for schools to develop learning outcomes that meet the individual needs of specific students with disabilities. Example learning outcomes have been provided. Learning outcomes selected or developed at Foundation Level should relate to students' individualised curriculum programs.

Core, discretionary and Foundation Level learning outcomes

Core learning outcomes

Core learning outcomes describe those learnings considered essential for all students. They describe what students know, and can do with what they know, as a result of planned learning experiences.

The core learning outcomes are presented in order of increasing complexity from Levels 1 to 6. Students progress by demonstrating core learning outcomes at one level to demonstrating the related core learning outcomes at the next level. Core learning outcomes are demonstrated in a range of contexts over time.

Core learning outcomes need to be read in conjunction with the level statement and the level-specific core content. The knowledge, procedures and strategies that students need to demonstrate the core learning outcomes at each level are described in the tables of core content.

For the purposes of planning learning and assessment, outcome levels typically relate to year levels as follows:

- students demonstrating Level 2 outcomes are at the end of Year 3
- students demonstrating Level 3 outcomes are at the end of Year 5
- students demonstrating Level 4 outcomes are at the end of Year 7
- students demonstrating Level 6 outcomes are at the end of Year 10.

Some students will demonstrate core learning outcomes beyond the typical levels described above. Some students will require more time to demonstrate the core learning outcomes.

The following indicative time allocations have been used to guide the design and development of this syllabus. These are based on an estimate of the minimum time needed to provide students with opportunities to demonstrate the core learning outcomes in the Mathematics key learning area and are as follows:

- Years 1 to 3: 600 hours across the three years
- Years 4 to 7: 640 hours across the four years
- Years 8 to 10: 240 hours across the three years.

Additional time may need to be allocated to provide students with opportunities to demonstrate both core and discretionary learning outcomes.

Discretionary learning outcomes

Discretionary learning outcomes describe what students know, and can do with what they know, beyond what is considered essential. They are intended to broaden students' understandings and provide opportunities for students to pursue interests and challenges beyond the requirements of the core learning outcomes.

Schools and teachers could use the level statements to develop discretionary learning outcomes for any levels that are specific to the local school community context and the needs and interests of individual students or groups of students.

All learning outcomes at Beyond Level 6 are discretionary. Some discretionary learning outcomes at Beyond Level 6 are considered as preparation for further specialised study in mathematics in the multiple pathways available to students.

Foundation Level

Learning outcomes at Foundation Level may be developed to meet the needs of students with disabilities and should relate to students' individualised curriculum programs. The learning outcomes presented at Foundation Level of each strand are examples of the kinds of outcomes that students at this level might demonstrate. There are no core learning outcomes at this level.

The examples of Foundation Level learning outcomes are much more specific than core learning outcomes or discretionary learning outcomes. They are tailored to meet the needs of individual students with disabilities. Additional information about these outcomes is provided in the associated curriculum materials.

Coding for outcomes

The core, discretionary and Foundation Level learning outcomes for the strands of the Mathematics key learning area syllabus are presented on the following pages. An alphabetical code has been used to identify outcomes in each of the strands:

N — Number
PA — Patterns and Algebra
M — Measurement
CD — Chance and Data
S — Space

An additional D following these codes indicates that the learning outcome is discretionary.

The numbers following the alphabetical code indicate the level of the outcome and the topic to which it relates. The following are examples of the coding:

CD 3.2 identifies Chance and Data strand, core learning outcome Level 3, topic 2 — Data

CD DB6.1 identifies Chance and Data strand, discretionary learning outcome Beyond Level 6, topic 1 — Chance

N DB6.3 identifies Number strand, discretionary learning outcome Beyond Level 6, topic 3 — Multiplication and division.

*L*earning outcomes

Strand — Number

Foundation Level

Level statement

Students are developing a notion of counting and an awareness of number and money. Number names are becoming more meaningful.

The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such outcomes should relate to the individualised curriculum programs of those students.

Example learning outcomes

Topic — Number concepts

Students rote count to a specified number (e.g. 3, 5).

Students recognise numerals in their lives and environments.

Students recognise money in various forms.

Topic — Addition and subtraction

Students show an awareness of 'more', 'less' and 'same' in life situations.

Topic — Multiplication and division

Students share a quantity of everyday objects with their peers.

Level 1

Level statement

Students are developing a sense of number by knowing number names and counting in sequence. They recognise, compare, order and represent small whole numbers and use concrete materials to explore the concept of parts of a whole. They are developing an awareness of the cost of goods and recognise and represent notes and coins.

Students identify and distinguish between situations that require them to add or subtract, to share equally or to create equal groups.

Core learning outcomes

Topic — Number concepts

N 1.1 Students identify, compare and order small whole numbers, make and match representations of these numbers and identify coins, notes and their uses.

Topic — Addition and subtraction

N 1.2 Students identify and solve addition and subtraction problems involving small whole numbers.

Topic — Multiplication and division

N 1.3 Students identify and describe equal groups and equal sharing within everyday situations.

*L*earning outcomes

Strand — Number

Level 2

Level statement

Students demonstrate their developing number sense by comparing, ordering and representing whole numbers to 999 and understanding that the value of a digit in a number determines its place. They understand that a whole can be made up of equal parts and use concrete materials to represent halves and quarters. When using money to purchase goods, they tender different combinations of notes and coins.

Students are beginning to recall or work out some addition, subtraction and multiplication number facts. They use a range of computation methods, including mental, written and calculator, to solve problems.

Core learning outcomes

Topic — Number concepts

N 2.1 Students compare and order whole numbers to 999, make and match different representations and combinations of whole numbers and of equivalent amounts of money, and identify simple fractions of objects and collections.

Topic — Addition and subtraction

N 2.2 Students identify and solve addition and subtraction problems involving whole numbers, selecting from a range of computation methods, strategies and known number facts.

Topic — Multiplication and division

N 2.3 Students identify and solve multiplication and division problems involving whole numbers, selecting from a range of computation methods, strategies and known number facts.

Level 3

Level statement

Students compare, order and represent whole numbers to 9 999, common and decimal fractions and recognise the value of each digit. They tender appropriate amounts of money for cash transactions and identify other methods of paying for goods and services.

Students recall or work out all addition, subtraction and multiplication number facts and some division facts. They use a range of computation methods, including mental, written and calculator, to solve problems that involve whole numbers and decimal fractions in context.

Core learning outcomes

Topic — Number concepts

N 3.1 Students compare, order and represent whole numbers to 9 999 and common and decimal fractions, calculate cash transactions and describe other methods of payment.

Topic — Addition and subtraction

N 3.2 Students identify and solve addition and subtraction problems involving whole numbers and decimal fractions in context, selecting from a range of computation methods, strategies and known number facts.

Topic — Multiplication and division

N 3.3 Students identify and solve multiplication and division problems involving whole numbers and decimal fractions in context, selecting from a range of computation methods, strategies and known number facts.

*L*earning outcomes

Strand — Number

Level 4	Level 5
Level statement *Students compare and order whole numbers and common and decimal fractions. They identify fractions expressed in different ways and make connections between common fractions, decimal fractions and percentages. They identify a range of factors such as advertising, discounts and methods of payment that may influence financial decisions.* *Students recall all addition, subtraction, multiplication and division number facts. They use a range of computation methods to solve problems that involve whole numbers, common and decimal fractions, percentages and rates.*	**Level statement** *Students compare and order positive and negative integers and explain and record index notation. They interpret and use conventions for expressing rates and ratios. They identify methods of saving and investigate the factors affecting debit and credit transactions. They understand that the purchase of goods and services may attract fees or charges.* *Students use a range of computation methods to solve problems that involve positive rational numbers, rates, ratios and direct proportions.*
Core learning outcomes	**Core learning outcomes**
Topic — Number concepts	*Topic — Number concepts*
N 4.1 Students compare and order whole numbers and common and decimal fractions of any size, make connections between key percentages and fractions, and describe how a range of factors influence financial decisions.	N 5.1 Students compare and order integers, use and interpret index notation, rates and ratios, and analyse options to make informed financial decisions about saving, credit and debit.
Topic — Addition and subtraction	*Topic — Addition and subtraction*
N 4.2 Students identify and solve addition and subtraction problems involving whole numbers and common and decimal fractions, selecting from a range of computation methods, strategies and known number facts.	N 5.2 Students identify and solve addition and subtraction problems involving positive rational numbers, using a range of computation methods and strategies.
Topic — Multiplication and division	*Topic — Multiplication and division*
N 4.3 Students identify and solve multiplication and division problems involving whole numbers, decimal fractions, common fractions, percentages and rates, selecting from a range of computation methods, strategies and known number facts.	N 5.3 Students identify and solve multiplication and division problems involving positive rational numbers, rates, ratios and direct proportions, using a range of computation methods and strategies.

*L*earning outcomes

Strand — Number

Level 6

Level statement

Students compare and order rational numbers and use scientific notation as a short-hand method of representing very large or very small numbers. They develop personal plans, consider financial options and monitor financial situations using available information.

Students use a range of computation methods and strategies to solve problems that involve rational numbers, rates, ratios and direct and inverse proportions.

Core learning outcomes

Topic — Number concepts

N 6.1 Students compare and order rational numbers, interpret and use scientific notation and analyse options to make informed personal budgeting and other financial decisions.

Topic — Addition and subtraction

N 6.2 Students identify and solve addition and subtraction problems involving rational numbers using a range of computation methods and strategies.

Topic — Multiplication and division

N 6.3 Students identify and solve multiplication and division problems involving rational numbers, rates, ratios and direct and inverse proportions using a range of computation methods and strategies.

Beyond Level 6

Level statement

Students compare, order and classify real numbers, integers and unit fractional powers. They consider the costs associated with saving and spending by referring to schedules of business and government charges and their available income.

Students solve problems that involve calculations with real numbers by selecting from a range of methods and determine rates of change using their own or others' graphs.

Discretionary learning outcomes

Topic — Number concepts

N DB6.1a Students interpret and use the various sets of real numbers and integer and unit fractional powers.

N DB6.1b Students make informed decisions regarding earning, spending and saving money, with reference to schedules of government and business charges.

Topic — Addition and subtraction

N DB6.2 Students identify and solve addition and subtraction problems involving real numbers using a range of computation methods and strategies.

Topic — Multiplication and division

N DB6.3a Students multiply and divide rational numbers and calculate rates of change from graphs.

N DB6.3b Students identify and solve multiplication problems involving real numbers using a range of computation methods and strategies.

*L*earning outcomes

Strand — Patterns and Algebra

Foundation Level

Level statement

Students investigate patterns in their environments and are developing an awareness of 'same' when matching.

The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such outcomes should relate to the individualised curriculum programs of those students.

Example learning outcomes

Topic — Patterns and functions

Students copy a given pattern by choosing items from a limited selection.

Students backtrack actions in familiar routines.

Topic — Equivalence and equations

Students show an awareness of 'same' in relation to people, objects, places or small collections.

Level 1

Level statement

Students identify and describe patterns in their environments. They create or continue patterns and know that some can continue indefinitely, and some radiate in a number of directions. They represent the same pattern in different ways. They describe patterns or change in terms of a simple rule and can undo a pattern or change by reversing the rule.

Students describe the number value of a group of objects as 'equal to', 'different from' or 'the same as'. They know that the number value of a group of objects stays the same when rearranged or represented in different combinations.

Core learning outcomes

Topic — Patterns and functions

PA 1.1 Students identify, describe and create patterns and change based on simple rules.

Topic — Equivalence and equations

PA 1.2 Students compare and describe arrangements of objects and combinations of numbers to 10 using the language of equivalence.

*L*earning outcomes

Strand — Patterns and Algebra

Level 2

Level statement

Students use rules to create and describe number patterns based on addition and subtraction. They identify number sequences that are not patterns. They complete missing parts of, or continue, a number pattern when given the rule. They know the inverse relationship between addition and subtraction and use this to apply and then reverse simple rules. They display the inputs and outputs of the application of rules in table form.

Students represent addition and subtraction situations using equations. They recognise and describe the equivalence or non-equivalence of two sides of an addition or subtraction equation (number sentence) and determine an unknown using a variety of self-generated and learned strategies.

Core learning outcomes

Topic — Patterns and functions

PA 2.1 Students create and explain patterns, identify and describe relationships using rules and use backtracking to reverse the effects of rules involving addition and subtraction.

Topic — Equivalence and equations

PA 2.2 Students represent and describe equivalence in equations that involve addition and subtraction.

Level 3

Level statement

Students describe relationships between sets of numbers in terms of functions or rules. They draw tables and graphs to display these relationships. They know the inverse relationship between multiplication and division and use this to reverse the effect of a rule or change.

Students represent and describe equivalence in everyday situations. They determine the missing part of an equation (number sentence) that requires either multiplication and division or addition and subtraction using a systematic guess and check strategy.

Core learning outcomes

Topic — Patterns and functions

PA 3.1 Students create and continue number patterns, identify, describe and represent relationships between two quantities and use backtracking to reverse any one of the four operations.

Topic — Equivalence and equations

PA 3.2 Students represent and describe equivalence in equations that involve combinations of multiplication and division or addition and subtraction.

*L*earning outcomes

Strand — Patterns and Algebra

Level 4	Level 5
Level statement *Students identify and create representations of patterns and functions and use their knowledge of functions and inverses to determine unknowns within equations or any position in a pattern. They apply combinations of the four operations, observing the order of operations and the presence of brackets.* *Students manipulate and solve simple equations using strategies that maintain balance. They identify relationships between sets of data and distinguish between discrete and continuous data represented in graphs and tables.*	**Level statement** *Students identify when relationships exist between two sets of everyday data and use functions expressed in words or symbols, or represented in tables and graphs, to describe these relationships. They identify relationships that are linear and express these using equations.* *Students use algebraic reasoning and conventions, including graphical representations, to solve problems and justify their solutions.*
Core learning outcomes *Topic — Patterns and functions* PA 4.1 Students identify and create representations of patterns and functions and apply backtracking to solve simple equations that involve combinations of the four operations.	**Core learning outcomes** *Topic — Patterns and functions* PA 5.1 Students interpret and compare different representations of linear and simple non-linear functions and solve the related problems.
Topic — Equivalence and equations PA 4.2 Students create and interpret equations, explain the effect of order of operations, and justify solutions to equations.	*Topic — Equivalence and equations* PA 5.2 Students interpret and solve linear equations related to realistic problems using algebraic and graphical methods.

*L*earning outcomes

Strand — Patterns and Algebra

Level 6	Beyond Level 6
Level statement *Students analyse problems from realistic situations and model them with equations using algebraic symbols, graphs and tables. They select and present representations that best display the relationships. They provide solutions or make predictions based on these models.*	**Level statement** *Students use the properties of functions to identify the form and shape of particular families of functions such as linear, quadratic, reciprocal, and exponential. They explain the effects of changing the parameters in these families of functions. They interpret or use the set of possible values of the independent variable to identify the domain of a function and represent that using inequality symbols.* *Students solve simultaneous equations and quadratic equations and manipulate expressions involving rational powers.*
Core learning outcomes *Topic — Patterns and functions* PA 6.1 Students create mathematical models of realistic situations and use interpretations of the models to draw conclusions or make decisions. *Topic — Equivalence and equations* PA 6.2 Students interpret and solve mathematical models of realistic situations by using algebraic, graphical and electronic methods.	**Discretionary learning outcomes** *Topic — Patterns and functions* PA DB6.1a Students interpret and model trends in data and solve problems by using graphs, formulae and equations. PA DB6.1b Students identify and interpret the properties of various families of functions. PA DB6.1c Students specify the domain of a function using inequality symbols. *Topic — Equivalence and equations* PA DB6.2 Students manipulate expressions and solve equations including simultaneous equations and quadratic equations.

*L*earning outcomes

Strand — Measurement

Foundation Level

Level statement

Students are responding to and developing some everyday language associated with time, length, mass, area and volume.

The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such outcomes should relate to the individualised curriculum programs of those students.

Example learning outcomes

Topic — Length, mass, area and volume

Students show an awareness of everyday language related to measurement of length, mass, area and volume.

Topic — Time

Students associate everyday language related to time, familiar events, and times of the day or week.

Level 1

Level statement

Students identify and distinguish between the attributes of length, mass, area and volume. They select an attribute to make comparisons between objects. They describe these comparisons using appropriate language. They use non-standard units when they estimate and measure length, mass, area and volume.

Students are developing an awareness of time and its relevance to their everyday lives. They sequence familiar events and relate specific events to days of the week and months of the year. They use comparative language to describe the duration of events or activities.

Core learning outcomes

Topic — Length, mass, area and volume

M 1.1 Students select the appropriate attribute to compare and order the size of objects and measure with non-standard units.

Topic — Time

M 1.2 Students sequence familiar events related to days and weeks, and directly compare the duration of events.

*L*earning outcomes

Strand — Measurement

Level 2	Level 3
Level statement *Students use non-standard and some standard units to estimate, measure and order length, mass, area and volume. They understand that the larger the unit, the fewer required to measure an object, and that standard units provide consistency when measuring.* *Students measure and compare durations of events and link these to familiar activities. They read hour and half-hour displays on analogue clocks and any time on digital displays. They use calendars to locate and sequence events that are of significance to them over a year.*	**Level statement** *Students use equivalent forms of standard units to compare, order and measure. They select appropriate standard units to estimate and measure length, mass, area and volume. They further develop their estimation skills by identifying and using a set of personal measurement referents.* *Students interpret and use calendars, simple timetables and diaries to plan and record events in their daily lives. They know and use conventions related to reading and recording time. They calculate the duration of events.*
Core learning outcomes *Topic — Length, mass, area and volume* M 2.1 Students use non-standard and standard units to estimate, measure and order the size of objects. *Topic — Time* M 2.2 Students use a calendar to locate and sequence events, read and interpret key times on 12-hour displays, and measure and compare durations of time.	**Core learning outcomes** *Topic — Length, mass, area and volume* M 3.1 Students identify and use equivalent forms of standard units when measuring, comparing and ordering, and estimate using a range of personal referents. *Topic — Time* M 3.2 Students read, record and calculate with 12-hour time, and interpret calendars and simple timetables related to daily activities.

*L*earning outcomes

Strand — Measurement

Level 4	Level 5
Level statement *Students investigate ways to determine areas, volumes and lengths of boundaries and describe the relationships between the dimensions in general terms. They select and use appropriate standard units when estimating and measuring.* *Students use personal timetables, diaries, timelines and calendars to plan and organise events or activities of significance to them. They use 24-hour and 12-hour time.*	**Level statement** *Students identify and describe links between their own generalised methods and formulae used to calculate areas, volumes and lengths of boundaries.* *Students solve realistic time-management problems and plan and manage use of time. They understand and consider the impact of different time zones within Australia.*
Core learning outcomes *Topic — Length, mass, area and volume* M 4.1 Students choose appropriate units when estimating and measuring and explain relationships between dimensions when investigating areas, volumes of prisms and lengths of boundaries of rectangles. *Topic — Time* M 4.2 Students read, record and calculate with 24-hour time and develop timetables and calendars to plan and organise events or activities.	**Core learning outcomes** *Topic — Length, mass, area and volume* M 5.1 Students develop formulae to calculate areas, volumes and lengths of boundaries where the relationships between dimensions are known, and investigate a range of other shapes to explain the relationships between dimensions. *Topic — Time* M 5.2 Students interpret and solve realistic problems related to time management and time zones within Australia.

*L*earning outcomes

Strand — Measurement

Level 6	Beyond Level 6
Level statement *Students explore and explain relationships within triangles. They select and use formulae to solve problems related to area, volume and length.* *Students use a variety of timetables to plan, monitor, manage and record the use of time. They justify their decisions by identifying implications and consequences. They understand and consider the impact of different time zones within the world.*	**Level statement** *Students identify and apply known formulae to assist in solving multistep problems. They apply trigonometric ratios to determine the side lengths and angles of triangles.*
Core learning outcomes *Topic — Length, mass, area and volume* M 6.1 Students interpret, analyse and solve measurement problems and justify selections and applications of formulae. *Topic — Time* M 6.2 Students analyse and use a variety of timetables to justify time management decisions, and interpret and solve realistic problems involving international time zones.	**Discretionary learning outcomes** *Topic — Length, mass, area and volume* M DB 6.1a Students use combinations of procedures and formulae to solve multistep problems. M DB 6.1b Students apply trigonometric ratios to particular situations involving triangles. *Topic — Time* No outcome at this level.

*L*earning outcomes

Strand — Chance and Data

Foundation Level

Level statement

Students are developing an awareness of the occurrence of routines and events and participate in the collection of data to support class decisions.

The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such outcomes should relate to the individualised curriculum programs of those students.

Example learning outcomes

Topic — Chance

Students demonstrate an awareness of the occurrence of familiar events.

Topic — Data

Students gather or provide a small amount of information to support decisions about a class event or activity.

Level 1

Level statement

Students engage in a variety of practical activities involving chance and make subjective statements about likelihood based on their personal opinions and observations.

Students collect and classify data in response to particular situations. They interpret simple conventional displays and present information using student-generated displays.

Core learning outcomes

Topic — Chance

CD 1.1 Students use everyday language when commenting on aspects of chance in practical activities and familiar events.

Topic — Data

CD 1.2 Students collect and classify data to investigate particular situations and create and interpret simple displays.

*L*earning outcomes

Strand — Chance and Data

Level 2

Level statement

Students make comparisons and predictions about the likelihood of familiar events. They classify them as likely, unlikely or impossible, though their opinions are often swayed by sentiment. They understand that the outcome of a future event does not depend on the outcome of a previous event.

Students collect and organise data, create and interpret a range of data displays and identify significant elements of the displays. They suggest and distinguish between some sources of variation in data and explain the effects of these variations.

Core learning outcomes

Topic — Chance

CD 2.1 Students identify and classify familiar events according to the likelihood of occurrence.

Topic — Data

CD 2.2 Students collect and organise data, create and interpret a variety of displays to investigate their own and others' questions, and identify elements of the displays.

Level 3

Level statement

Students describe all possible outcomes from a single situation and order these from most likely to least likely to occur. They identify situations where every outcome has an equal chance of occurring. They estimate the probability of an event occurring by conducting experiments and analysing the results. They distinguish between situations where each outcome may or may not depend on the previous outcome.

Students identify issues and topics of particular interest and create, trial and refine questions that allow for appropriate details to be gathered through surveys, interviews and existing sources. They organise data and experiment with a variety of manual or electronic displays, selecting those that represent the data clearly. They make statements regarding the results of their surveys using quantitative and comparative language.

Core learning outcomes

Topic — Chance

CD 3.1 Students identify all possible outcomes of familiar situations or actions and, for these sample spaces, order the likelihood of occurrence of the identified outcomes using experimental data.

Topic — Data

CD 3.2 Students design and trial a variety of data collection methods and use existing sources of data to investigate their own and others' questions, organise data and create suitable displays, identifying and interpreting elements of the displays.

*L*earning outcomes

Strand — Chance and Data

Level 4

Level statement

Students conduct a range of practical activities and experiments and draw frequency tables to assist with the analysis of the data. They compare the numerical results of their experiments with the predicted results and decide whether further trials are needed. They judge the likelihood of particular events using probability values based more on observation than intuition.

Students plan for the collection of data, and design and use data record templates to gather and organise observations or responses. They select data displays that best represent the collected data type and use appropriate measures of location when commenting on data displays.

Core learning outcomes

Topic — Chance

CD 4.1 Students analyse experimental data and compare numerical results with predicted results to inform judgments about the likelihood of particular outcomes.

Topic — Data

CD 4.2 Students plan and carry out data collections using their own data record templates, choose and construct appropriate displays and make comparisons about the data based on the displays and measures of location.

Level 5

Level statement

Students make quantitative judgments, basing their predictions on experimental or theoretical probability. They use the data generated through their own experiments or collected from other research to estimate probabilities. They determine theoretical probabilities where outcomes can be shown to be equally likely.

Students design and carry out observational, experimental and survey studies involving discrete and continuous data. They explain how histograms and stem and leaf plots provide pictorial information on features of data such as location, spread and range.

Core learning outcomes

Topic — Chance

CD 5.1 Students model and determine probabilities for single events to justify statements and decisions.

Topic — Data

CD 5.2 Students plan investigations involving discrete and continuous data, produce and compare data displays involving grouping, and compare measures of location.

*L*earning outcomes

Strand — Chance and Data

Level 6	Beyond Level 6
Level statement *Students determine the theoretical probabilities of multi-outcome and compound events and design and conduct experiments to investigate and model the probabilities.* *Students decide on data collection processes appropriate for various purposes to provide representative samples. They identify the nature of variations and relationships within data sets. They analyse data displays and identify strengths and limitations of particular displays.*	**Level statement** *Students design simulations to determine probabilities of situations where direct experimentation is not practical and use addition and multiplication properties.* *Students analyse data displayed in graphs and plots and assess any unusual observations in terms of the particular circumstances under which the data was collected. They interpret and convert time and date scales and use this knowledge to experiment with different plots over different timeframes. They identify and interpret variation using histograms and stem and leaf plots.*
Core learning outcomes *Topic — Chance* CD 6.1 Students model and determine probabilities for multi-outcome and compound events and justify decisions. Topic — Data CD 6.2 Students use and interpret cross-sectional data and data collected over time to identify the nature of variations and relationships.	**Discretionary learning outcomes** *Topic — Chance* CD DB6.1 Students design simulations and use addition and multiplication properties to assist in finding probabilities. Topic — Data CD DB6.2 Students interpret box and whisker plots and use them to compare sets of data.

*L*earning outcomes

Strand — Space

Foundation Level

Level statement

Students are developing notions of shape, location, direction and movement.

The following are **examples** of learning outcomes for students with disabilities demonstrating a level of understanding before that of Level 1. Learning outcomes that meet the individual needs of specific students with disabilities can be developed from the level statement. Such outcomes should relate to the individualised curriculum programs of those students.

Example learning outcomes

Topic — Shape and line

Students recognise familiar objects from different viewpoints.

Students recognise common objects in a range of settings.

Students identify common signs in familiar contexts.

Topic — Location, direction and movement

Students position or locate objects in response to directions.

Students use an awareness of locations to follow the directions for daily routines.

Students recognise familiar places when approaching from different directions.

Level 1

Level statement

Students identify some obvious properties that distinguish 3D shapes and objects and 2D shapes, and understand that these properties are constant. They describe properties using simple geometric terms and construct representations of shapes, paying attention to the number of sides or corners and the shapes of faces.

Students identify and describe locations and the positions of objects relative to known landmarks within familiar environments. They give directions that guide others through those environments, follow directions to move between one location and another and identify alternative pathways between locations.

Core learning outcomes

Topic — Shape and line

S 1.1 Students identify everyday shapes and objects using geometric names and make and describe simple representations of them.

Topic — Location, direction and movement

S 1.2 Students follow and give simple directions to move through familiar environments and locate and place objects in those environments.

*L*earning outcomes

Strand — Space

Level 2

Level statement

Students sort 3D shapes and objects by identifying common properties, including those that distinguish them from 2D shapes. They identify and match drawings, pictures and other representations of 3D shapes and objects from different viewpoints and orientations. They investigate nets of some shapes by unfolding and refolding packages.

Students recognise that maps and plans are representations of environments and use these to follow or give directions related to pathways and the location of objects. They interpret and use alphanumeric grids to describe locations. They create simple sketches that represent parts of familiar environments and recognise the relative size and proximity of objects and locations.

Core learning outcomes

Topic — Shape and line

S 2.1 Students describe and sort 3D shapes and objects and 2D shapes according to geometric properties and identify shapes and objects from different viewpoints or orientations.

Topic — Location, direction and movement

S 2.2 Students interpret and create simple maps, plans and grids to follow and give directions, and to locate or arrange places or objects.

Level 3

Level statement

Students identify and visualise the geometric properties that define and distinguish families of prisms, cylinders, spheres, cones and pyramids. They recognise and describe the properties that distinguish trapeziums and rhombuses from other quadrilaterals, as well as the properties that distinguish different groups of triangles. They describe the properties of shapes using terms such as parallel, congruent, symmetrical and other terms related to angles. They draw shapes using various conventions to indicate particular geometric properties.

Students describe locations and directions with reference to the four compass points and grid references displayed on simple, authentic maps and plans. They interpret the symbols used on maps by referring to the keys and legends and know that most maps are orientated to the north.

Core learning outcomes

Topic — Shape and line

S 3.1 Students describe the defining geometric properties of families of 3D shapes, model 3D shapes using nets and other representations, and identify and describe the properties of specific families and subgroups of 2D shapes.

Topic — Location, direction and movement

S 3.2 Students interpret and create maps and plans using a range of conventions, describe locations and give directions using major compass points, angles and grids.

*L*earning outcomes

Strand — Space

Level 4	Level 5
Level statement *Students analyse the geometric properties that define and distinguish families of polygons and their subgroups. They analyse and describe groups of 3D shapes, such as the Platonic solids. They use the properties of prisms and pyramids to identify other shapes belonging to those groups. They analyse and classify shapes according to criteria including rotational symmetry and perpendicular lines or faces, and measure angles in degrees using protractors.* *Students interpret maps of the world, describing the location of the equator and other key lines of reference. They describe how the lines of latitude and longitude relate to the equator and the poles. They refer to the eight compass points or angle of turn when giving directions. They use simple linear scales to estimate distance on maps and plans.*	**Level statement** *Students investigate the properties of shapes, including congruence and similarity, and identify shapes embedded within irregular shapes to assist with the calculation of areas. They interpret and draw plans and elevations with attention to suitable scales, depth and perspective, and use geometric tools to assist with the construction of shapes and angles.* *Students use the conventions of mapping, including latitude and longitude, to interpret and describe movements and locations on maps of the world. They calculate distance on maps and dimensions on plans by referring to scales expressed as simple ratios. They give or follow directions expressed as compass bearings and distance to move around a local environment.*
Core learning outcomes *Topic — Shape and line* S 4.1 Students analyse the geometric properties of a range of 3D and 2D shapes to classify shapes into families and their subgroups and justify reasoning. *Topic — Location, direction and movement* S 4.2 Students interpret maps and plans with reference to conventions including latitude and longitude for maps, and describe movements using compass points and distance.	**Core learning outcomes** *Topic — Shape and line* S 5.1 Students analyse the relationships between the properties of shapes, lines and angles to explain similarity and congruence and to create representations of geometric objects that satisfy design specifications. *Topic — Location, direction and movement* S 5.2 Students interpret maps and globes referring to latitude and longitude, interpret and describe plans that use scale and describe movements using compass bearings and distance.

*L*earning outcomes

Strand — Space

Level 6

Level statement

Students make generalisations about shapes, lines and angles and develop chains of reasoning connecting related properties that can be used to solve geometric problems. They communicate their solutions by using geometric terms and symbols supported by appropriate representations.

Students analyse a range of authentic maps, globes and plans, identifying the information that guides interpretation. They understand why time varies across the world, and refer to international time zones, rotation of the Earth, and position on the Earth's surface to explain or calculate dates and times in specific places.

Core learning outcomes

Topic — Shape and line

S 6.1 Students use deductive reasoning to generalise about the properties of shapes, lines and angles referring to relationships between these properties to justify arguments.

Topic — Location, direction and movement

S 6.2 Students interpret maps and plans using standard conventions, provide directions based on bearings and distance, and use longitude to explain time differences between major locations.

Beyond Level 6

Level statement

Students solve problems related to shapes, lines and angles by referring to known properties. They deduce geometric properties using chains of reasoning and can follow and appreciate the validity and elegance of others' reasoning of similar problems.

Students interpret, draw and analyse simple network diagrams and determine the number of routes, the shortest route and critical paths.

Discretionary learning outcomes

Topic — Shape and line

S DB6.1 Students use deductive reasoning to establish theorems associated with circles and quadrilaterals.

Topic — Location, direction and movement

S DB6.2 Students analyse simple network diagrams to determine optimal pathways in a system.

Using learning outcomes to plan for learning and assessing

Learning outcomes provide a framework for planning for learning, teaching and assessing by describing what it is that students should know and be able to do with what they know. Planning for learning, teaching, and assessing are concurrent processes that exist in a dynamically interdependent relationship.

Using learning outcomes for planning involves:

- adopting a learner-centred approach to learning and teaching
- planning learning experiences and assessment opportunities at the same time
- assisting students to work towards demonstrating learning outcomes
- establishing clear expectations of student demonstrations as a basis for monitoring the progress of student learning.

The core learning outcomes are sequenced conceptually in six progressive levels. This continuum of conceptual development is represented in the level statements for each strand. Learning outcomes at each level are qualitatively different from the corresponding learning outcomes at the levels before and after. This sequencing across levels assists teachers in planning learning experiences to cater for the range of developmental characteristics of students.

Planning should make provision for students to demonstrate learning outcomes in more than one context and on more than one occasion. Activities incorporating a variety of content and contexts should be organised to provide these opportunities. Many learning activities can be opportunities for teachers to gather evidence about students' demonstrations of learning outcomes or aspects of outcomes. Assessment opportunities may relate to more than one outcome.

Planning at Foundation Level may involve learning outcomes developed from the level statements to meet the specific needs of individual students or groups of students with disabilities.

When planning for students who have already demonstrated the core learning outcomes for Level 6, teachers may use the level statements and discretionary learning outcomes provided for Beyond Level 6.

Planning includes determining opportunities for developing knowledge, procedures and strategies and for ongoing monitoring and assessing of students' demonstrations of learning outcomes. Feedback from assessment of these demonstrations leads to both short-term adjustments to, and long-term revision of, curriculum plans for Mathematics.

Planning in Mathematics includes *long-term planning, mid-term planning* and *short-term planning*.

Long-term planning outlines a program for all students in a school across several years of schooling. Whole-school programs promote balanced and sequential learning experiences for students and ensure continuity of learning from year to year. Long-term plans should be sufficiently flexible to allow for any modifications that may be necessary to cater for the learning needs and changing interests of students and to satisfy changing community interests or priorities.

Mid-term planning outlines the sequence of units or worthwhile activities planned for a specific cohort of students across a year. Mid-term planning, such as a yearly overview, is a way of providing systematic and coherent opportunities

for students to demonstrate learning outcomes or aspects of outcomes. Mid-term plans should be relevant to the school, local and wider community and developed in relation to long-term planning.

Short-term planning outlines a program for a class or group of students for a specific or relatively short period and includes units of work.

Mathematics units of work are organised and focused sequences of learning activities that provide opportunities for students to demonstrate selected learning outcomes or aspects of outcomes. Units are intended to meet the learning needs of a class, including small groups and individuals, through the selection and sequencing of learning outcomes or aspects of outcomes. Units of work should be developed and sequenced around investigations or central organising ideas that facilitate and enhance learning related to the identified outcomes and core content.

Planning with outcomes

When planning units of work, teachers could combine learning outcomes from:

- within a strand of a key learning area
- across strands within a key learning area
- across levels within a key learning area
- across key learning areas.

Planning is a complex process typically involving a dynamic, rather than a linear, progression. The following essential features of effective planning for learning and assessing are applicable to long-term, mid-term and short-term planning. Teachers:

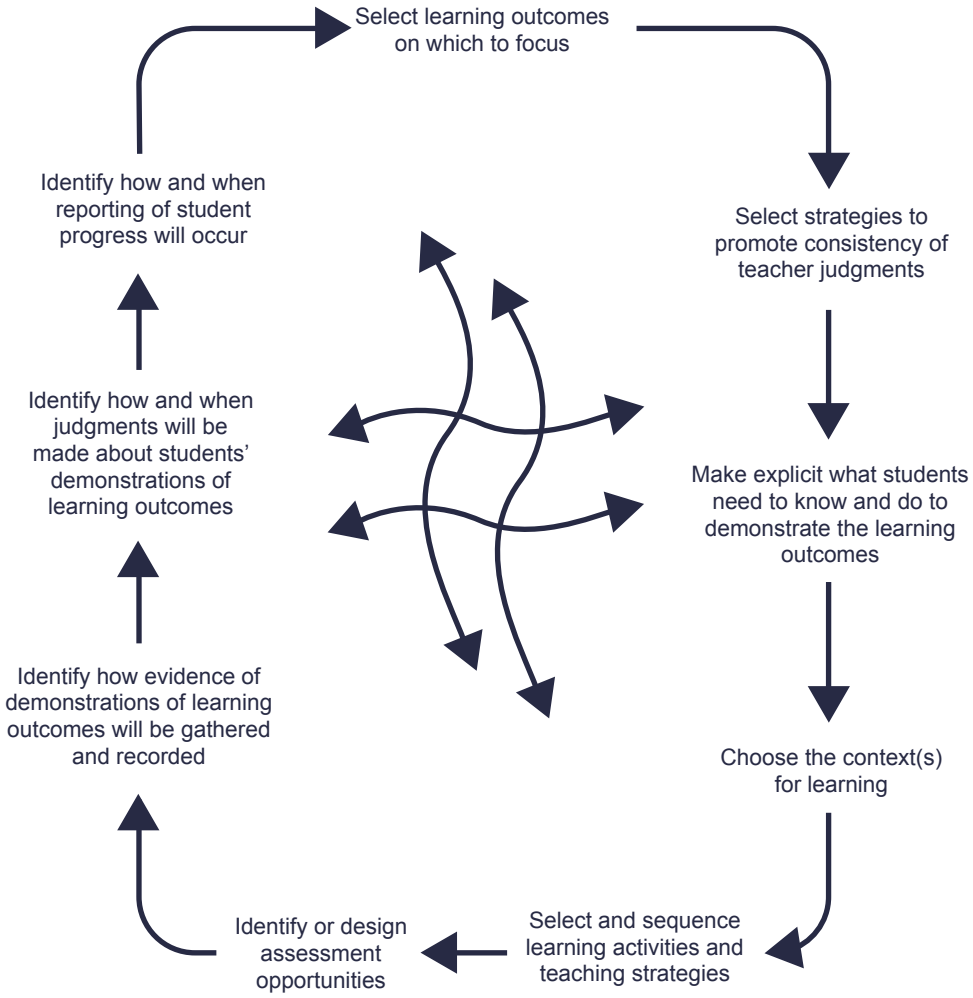
- select learning outcomes on which to focus by:
  - taking into account system and/or school programs and policies related to learning, teaching and assessing in Mathematics
  - considering the core learning outcomes at the levels most likely to be typical of how to progress what students know and can do
  - considering the prior learning and demonstrations of Mathematics learning outcomes or aspects of outcomes
  - taking into consideration the needs and interests of students
  - considering the strands and topics and the relationships among them
  - looking at the outcomes at the levels before and after the selected outcomes to be aware of the developmental sequence
- select strategies that promote consistency of teacher judgments — for example, collaborative planning, common assessment tasks, statements of anticipated evidence or criteria sheets, samples of typical responses, moderation processes
- make explicit what students are expected to know and do with what they know to demonstrate the learning outcomes by:
  - analysing the selected learning outcomes and identifying the particular aspects of the outcomes the students are expected to demonstrate
  - using elements from the syllabus (including the core content) and support materials (including elaborations) to support understanding of the learning outcomes and assist with the analysis

- choose the contexts for learning by:
  - considering the specific needs, interests and abilities of students in the class for which the units or investigations are planned (learning styles, special needs, target groups, previous experiences and prior learnings)
  - identifying real-life situations that support the development of mathematical knowledge, procedures and strategies
  - taking into account available and relevant human and material resources
- select and sequence learning activities and teaching strategies by:
  - using the analyses of the learning outcomes, the level-specific core content and the elaborations to guide the selection or design of learning activities that meet the needs, interests and abilities of students
  - identifying core content that is relevant to the context to develop activities
  - designing learning activities or using support materials or other resources to identify activities that provide opportunities through which students develop the knowledge, procedures and strategies required by the learning outcomes
  - choosing teaching strategies that meet the needs of the students, scaffold their learning and provide explicit teaching
  - sequencing learning activities according to a preferred teaching approach — for example, investigations, inquiry approach
- identify or design assessment opportunities by:
  - identifying learning activities that could provide assessment opportunities for students to demonstrate what they know and can do with what they know in terms of the selected learning outcomes
  - designing specific assessment tasks if required
  - making explicit the basis for judgments about students' demonstrations of learning outcomes (anticipated evidence)
- identify how evidence of demonstrations of learning outcomes will be gathered and recorded by:
  - selecting the assessment techniques that will be used to gather evidence
  - deciding on the most appropriate way to record evidence so that it is manageable, easily maintained and accessible
- identify how and when judgments will be made about students' demonstrations of learning outcomes by:
  - deciding how and when the recorded evidence will be used
- identify how and when reporting of student progress will occur by:
  - deciding how and when regular feedback will be provided to students about their learning and their progress in relation to the learning outcomes or aspects of the outcomes
  - identifying whether (and, if so, how and when) other audiences will be provided with information about students' demonstrations of learning.

As part of the planning process, teachers evaluate and reflect on student learning in relation to selected learning outcomes or aspects of outcomes and identify implications for future planning for students' demonstrations of learning outcomes.

The following diagram illustrates the planning approach described previously. It highlights the dynamic and cyclic nature of the planning process and the integrated nature of planning, teaching, assessing and reporting.

A model for planning units of work



Planning for learning, teaching, assessing and reporting

Integration and complementary learning

Knowledge, procedures and strategies developed in each of the strands of the Mathematics key learning area may be transferred to other learning contexts, thereby broadening and deepening understandings. Associating learning outcomes from different strands of the Mathematics key learning area or from different key learning areas in various life-related contexts may further enrich such understandings.

Links between the strands of the syllabus may be made when combinations of knowledge, procedures and strategies from more than one strand are co-developed. Information from other key learning areas can provide a stimulus or context for learning. Daily classroom activities, routines and transitions may also provide opportunities for integration.

The focus for planning when using outcomes from within and across key learning areas can be framed in terms of:

- a problem to be solved
- a question to be answered
- a significant task to be completed
- an issue to be explored.

Framing investigations in these ways provides a focus and defines the parameters within which a unit is developed. Procedures and strategies developed through mathematics may be useful for learning in other areas of the curriculum. At the same time, mathematical investigations often draw on practices, dispositions and ways of thinking that have been developed in other contexts. To maintain the integrity of learning in the Mathematics key learning area, integration should involve individual learners in working to demonstrate specific Mathematics learning outcomes.

Core content

The primary tools for planning learning experiences and assessment opportunities are the core learning outcomes together with the core content identified at each level. Students will engage with core content as they are provided with opportunities to demonstrate core learning outcomes in the syllabus.

Although the core content is listed in strands for each level for organisational convenience, there will be some natural overlap as opportunities for learning are planned. The organisation of content within a level should not be considered hierarchical and the content should be embedded in a range of contexts.

The level-specific core content is related to the developmental sequence of the core learning outcomes. This core content is organised using subsets of the topics. These subsets are applied consistently across all levels to illustrate the developmental sequence. Subset headings appear in a lighter shade where there is no specific core content.

The core content for each strand is identified on the following pages.

Core content

Number — Number concepts

Level 1	Level 2	Level 3
Numeration • whole numbers 0 to 10 • number names 0 to 100 • parts of a whole – whole, part, slice, bit, piece	**Numeration** • whole numbers to 99, then to 999 • place value to hundreds • equals (=), does not equal (≠) • fractions in context – equal parts of a whole ◦ half (1 part out of 2 equal parts) ◦ quarter (1 part out of 4 equal parts)	**Numeration** • whole numbers to 9 999 • decimal fractions in context – tenths, hundredths • place value from thousands to hundredths • greater than (>), equal to (=), less than (<) • fractions in context – equal parts of a whole – common fraction format – decimal fraction format
Number sense • conservation of number 0 to 10 • position and order of numbers 0 to 10 • different representations of numbers (concrete, verbal, pictorial, symbolic)	**Number sense** • conservation of number (whole numbers) • position and order of numbers – relationships between numbers • different representations of numbers • subsets of whole numbers – odd and even	**Number sense** • conservation of number (whole numbers, decimal and common fractions) • position and order of numbers – relationships between numbers – sensible adjustments of numbers • different representations of numbers • subsets of whole numbers – multiples – factors
Money • goods and services have a purchase price • terms – saving, spending, cost • attributes of coins and notes	**Money** • goods and services have a purchase price – tendering cash for purchases • equivalent values • conventions – reading and recording dollars and cents	**Money** • cash transactions • cashless transactions (e.g. EFTPOS, prepaid cards, accounts) • equivalent values • conventions – reading – recording – rounding totals for cash purchases • change

Core content

Number — Number concepts

Level 4	Level 5	Level 6
Numeration • whole numbers • decimal fractions • key percentages (100%, 50%, 25%, 20%, 10%, 1%) • fractions – common fraction format – terms (vinculum, numerator, denominator) – decimal fraction format – percentage format – equivalence • square and cubic notation	**Numeration** • integers • index notation (whole number indices only) • square root • percentage – whole percentages (e.g. 65%, 110%) – fractional (e.g. 6.5%, 12½%) – greater than 100%	**Numeration** • rational numbers • index notation (integer indices) • scientific notation (positive and negative powers of 10)
Number sense • position and order of numbers – relationships between numbers – sensible adjustments of numbers • connections between key percentages, unit fractions and decimal fractions • everyday representations of numbers (e.g. 20K/20 000, $1.5m/$1.5 million, $3b/$3 billion) • subsets of numbers – prime and composite – square – triangular	**Number sense** • position and order of numbers including integers – relationships between numbers – sensible adjustments of numbers • connections between squares and square roots • connections between percentages and fractions	**Number sense** • position and order within the set of rational numbers – sensible adjustments of numbers • connections between scientific notation and other representations of numbers
Money • financial decisions – purchases (best buys, discounts) – advertising (for purchases) – methods of payment – budgets for specific events • key percentages – simple interest – discounts • cashless transactions (e.g. cheques, money orders, EFTPOS, store cards)	**Money** • financial decisions – credit and debit transactions – charges/fees (including GST) – advertising (of financial services) – short-term benefits and/or long-term consequences – methods of saving • cashless transactions (e.g. direct debit, BPAY) • percentages – interest – discounts	**Money** • financial decisions and budgeting – income (gross, net) – expenditure – saving for a purpose – borrowing – savings plan – planning for an event – consequences of over-commitment • percentages – compound growth • cashless transactions (e.g. internet and phone banking) • comparisons of rates, fees and charges

Core content

Number — Addition and subtraction

Level 1	Level 2	Level 3
Addition • totals to 10 • joining model • language of joining • two or more addends	**Addition** • totals to 999 • two or more addends • recall or work out addition facts to 9 + 9	**Addition** • totals to 9 999 • decimals to 2 places in context with the same number of places • recall addition facts to 9 + 9
Subtraction • whole numbers to 10 • take away model • language of take away	**Subtraction** • whole numbers to 999 • models and language – take away – missing addend – comparison (difference) • recall or work out subtraction facts	**Subtraction** • whole numbers to 9 999 • mental computations with money (change) • recall subtraction facts
Connections • inverse – addition undoes subtraction – subtraction undoes addition	**Connections** • missing addend • inverse (backtracking) – related addition and subtraction facts	**Connections** • inverse (backtracking) – related addition and subtraction facts
Mental computation strategies • count on (in 1s, 2s) • count back (in 1s, 2s)	**Mental computation strategies** • to work out basic facts – count on – count back – doubles – near doubles – make to 10 – turnarounds (commutativity) • generalisations about addition and subtraction – extension of strategies to larger numbers • student-generated	**Mental computation strategies** • for larger numbers and decimal fractions in context – making numbers manageable – count on and back – doubles – changing operations – turnarounds (commutativity) • generalisations about addition and subtraction • student-generated
Computation methods • mental computations • written recordings – words for addition (add) – words for subtraction (cover up, take away, left) • calculators, computers • symbols – addition (+) – subtraction (–)	**Computation methods** • mental computations • written recordings – student-generated – traditional methods • calculators, computers	**Computation methods** • mental computations – exact – approximate • written recordings – student-generated – traditional methods • calculators, computers

Core content

Number — Addition and subtraction

Level 4	Level 5	Level 6
Addition and subtraction • whole numbers • common fractions (same denominators) • decimal fractions including different numbers of decimal places	**Addition and subtraction** • positive rational numbers – whole numbers – decimal fractions – common fractions ◦ related denominators	**Addition and subtraction** • rational numbers
Connections • inverse (backtracking)	**Connections** • inverse (backtracking)	**Connections** • inverse (backtracking)
Mental computation strategies • for whole numbers and decimal fractions – making numbers manageable – count on and back – doubling – changing operations • for common fractions • generalisations about addition and subtraction	**Mental computation strategies** • relevant to whole numbers, common fractions and decimal fractions • generalisations about addition and subtraction	**Mental computation strategies** • relevant to integers and whole numbers, common fractions and decimal fractions • generalisations about addition and subtraction
Computation methods • mental computations – exact – approximate • written recordings – student-generated – traditional methods • calculators, computers	**Computation methods** • mental computations – exact – approximate • written recordings – student-generated – traditional methods • calculators, computers	**Computation methods** • mental computations – exact – approximate • written recordings – student-generated – traditional methods • calculators, computers

Core content

Number — Multiplication and division

Level 1	Level 2	Level 3
Multiplication • models and language – set (equal groups)	**Multiplication** • models and language – set (equal groups) – area (arrays) – linear (number lines) • multiplication facts – recall 2s, 4s, 5s and 1s to x 9	**Multiplication** • models and language • combinations of whole numbers and decimal fractions in context • multiplication facts – recall 2s, 4s, 5s and 1s to x 9 – work out remaining facts
Division • models and language – partition (sharing equally)	**Division** • models and language – partition (sharing equally) – quotition (equal groups)	**Division** • models and language – partition (sharing equally) – quotition (equal groups) • involving single-digit whole number divisors • division facts – recall 2s, 4s, 5s and 1s – work out remaining facts
Connections	**Connections** • inverse (backtracking) – division undoes multiplication – multiplication undoes division	**Connections** • inverse (backtracking) – related multiplication and division facts – missing factor
Fractions and proportion	Fractions and proportion	**Fractions and proportion** • reducing numbers by ½ • enlarging numbers by multiples of ½ (e.g. 1½)
Mental computation strategies *Multiplication*	**Mental computation strategies** ***Multiplication*** • to work out basic facts – skip counting – doubles – double doubles – turnarounds (commutativity) • student-generated • generalisations about multiplication	**Mental computation strategies** ***Multiplication*** • to work out basic facts – double, double doubles (x 8) – build up, build down to known facts – turnarounds (commutativity) • extend basic facts strategies to larger numbers • student-generated • generalisations about multiplication
Division	*Division*	***Division*** • related multiplication facts • extend basic facts to other numbers • student-generated • generalisations about division
Computation methods	**Computation methods** • mental computations – exact • written recordings – language for multiplication (groups of, rows of, jumps of) – language for division (share between, share) • calculators • symbols for multiplication (×) and division (÷)	**Computation methods** • mental computations – exact – approximate • written recordings – student-generated – traditional methods (single-digit whole number multipliers and divisors) • calculators/computers – link × and ÷ with*and / symbols

Core content

Number — Multiplication and division

Level 4	Level 5	Level 6
Multiplication • whole numbers • common fractions • decimal fractions to hundredths • recall multiplication facts to 9 x 9	**Multiplication** • positive rational numbers – whole numbers – common fractions – decimal fractions – numbers with indices	**Multiplication** • rational numbers – negative numbers (with calculator)
Division • whole numbers • decimal fractions to hundredths • recall division facts	**Division** • positive rational numbers – whole numbers – common fractions – decimal fractions	**Division**
Connections • relationship between division and common fractions • inverse (backtracking)	**Connections** • inverse (backtracking)	**Connections** • inverse (backtracking)
Fractions and proportion ***Fractions*** • unit fractions as operators (e.g. $^1/_8$ of 120) • vinculum for division (horizontal line separating the numerator from the denominator) • links between key percentages, unit fractions and decimal fractions	**Fractions and proportion** ***Fractions*** • percentages, common fractions, decimal fractions	**Fractions and proportion** ***Fractions*** • fractional percentages of numbers
Rates • simple everyday rates such as kilometres per hour	***Rates*** • calculations involving everyday rates (e.g. mobile phone charges) ***Ratio*** • simple everyday ratios (e.g. 1 part juice concentrate to 4 parts water) • symbol for ratio (:) ***Direct proportion*** • calculations with direct proportion (including graphical representations)	***Rates*** • comparisons of rates expressed in various forms ***Ratio and proportion*** • as direct proportion • as inverse proportion

continued

Core content

Number — Multiplication and division *(continued)*

Level 4	Level 5	Level 6
Mental computation strategies • for beyond basic facts – extensions of all multiplication and division facts – doubling – halving – student-generated – place value – adjusting numbers – build up, build down • generalisations about multiplication and division	**Mental computation strategies** • relevant to whole numbers, common and decimal fractions, percentages – links – student-preferred • generalisations about multiplication and division	**Mental computation strategies** • relevant to rational numbers • generalisations about multiplication and division
Computation methods • mental computations – exact – approximate • written recordings – student-generated – traditional methods (one- and two-digit multipliers; single-digit whole number divisors) • formats for recording division – 13/4, $13 \div 4$, $4\overline{)13}$, $\frac{13}{4}$ • calculators, computers	**Computation methods** • mental computations – exact – approximate • written recordings – student-generated – traditional methods • calculators, computers	**Computation methods** • mental computations – exact – approximate • written recordings – student-generated – traditional methods • calculators, computers

Core content

Patterns and Algebra — Patterns and functions

Level 1	Level 2	Level 3
Patterns • repeating • non-patterns • spatial • translating patterns into different representations • growing • skip counting with calculators (addition and subtraction)	**Patterns** • missing terms • non-patterns or patterns with errors • spatial • translating patterns into number patterns • number patterns – rules based on previous term – skip counting with calculators (constant function key)	**Patterns** • number (including patterns with decimals) – rules based on previous term – calculators (whole and decimal numbers involving any operations) – missing term – non-patterns or patterns with errors – rules based on the position of terms (one operation only)
Functions • rules describing consistent change of one attribute both forwards and backwards (backtracking)	**Functions** • input → output (function machines) • backtracking (inverse) – addition or subtraction – reversing a change • relationship rules – given – student-generated – identified • represent input → output data in table form • rules relating two sets of data	**Functions** • input → output (function machines) • backtracking (inverse) – multiplication or division – reversing a change • representations of relationships – rules, tables, graphs

Core content

Patterns and Algebra — Patterns and functions

Level 4	Level 5	Level 6
Patterns • rules based on the position of terms (combinations of operations) • calculator number patterns • ordered pairs and graphs (with discrete data only)	**Patterns**	**Patterns**
Functions • input → output (with combinations of operations) • rules relating two sets of data • backtracking (inverse) – with combination of operations • representations of relationships – ordered pairs – tables, line graphs, equations (number sentences) – trends – discrete data – continuous data – electronic, manual	**Functions** • ordered pairs (four quadrants) • representations of variables – words – symbols • linear models – representations (tables, line graphs, linear equations, proportion equations) – dependent and independent variables – discrete and continuous data – trends • non-linear models – dependent and independent variables – discrete and continuous data – representations (tables, line graphs) – trends • representations of relationships – electronic, manual	**Functions** • linear models – equations – representations (tables, graphs) – trends • non-linear models – representations (tables, graphs) – trends • representations of relationships – electronic, manual

Core content

Patterns and Algebra — Equivalence and equations

Level 1	Level 2	Level 3
Equivalence • conservation • language – equal to, same as – different from	**Equivalence** • conservation • balance • transitive relation • language – equal to, same as – not equal to, different from • unknowns – missing addend – guess and check	**Equivalence** • conservation • balance • language – same and different – more and less – equal, not equal – greater than, less than • unknowns – guess and check
Representations • objects • pictures	**Representations** • objects • equations (number sentences) • symbols – equals (=) – does not equal (≠) – for unknowns (shapes, boxes, question marks, spaces, lines)	**Representations** • equations (number sentences) • symbols – equals (=) – does not equal (≠) – greater than (>) – less than (<) – for unknowns (shapes, boxes, question marks, spaces, lines)

Core content

Patterns and Algebra — Equivalence and equations

Level 4	Level 5	Level 6
Equivalence • order of operations • methods for solving equations – balance – guess and check	**Equivalence** • methods for solving equations – substitution – balance – backtracking – guess and check – graphical displays – tabular data	**Equivalence** • methods for solving equations – graphical methods – substitution – balance – backtracking – guess and check • simplifying • collecting like terms • expanding
Representations • symbols – equals (=) – does not equal (≠) – brackets – for unknowns (shapes, boxes, question marks, spaces, lines) • arrow diagrams	**Representations** • variables – words – letter symbols • algebraic conventions – implied multiplication (3t) – implied division ($\frac{a}{3}$) – computer format (*, /) • arrow diagrams • linear • proportion equations	**Representations** • linear, proportion equations • life-related non-linear models • algebraic conventions – logical setting out • models

Core content

Measurement — Length, mass, area and volume

Level 1	Level 2	Level 3
Measurement terms and attributes • attributes – length – mass – covering (area) – fill and pack (volume) • direct and indirect comparisons • descriptive and comparative terms associated with length, mass, area and volume	**Measurement terms and attributes** • associated with the attributes of: – length (height, width, depth, distance …) – mass (weighing) – area (covering) – volume (pouring, packing, layers)	**Measurement terms and attributes** • boundaries • square units • metric prefixes – milli-, centi-, kilo-
Units of measure • non-standard units • measuring instruments – balance scales	**Units of measure** • metres (m) • centimetres (cm) • kilograms (kg) and parts of kilograms (half, quarter) • litres (L) and parts of litres (half, quarter) • non-standard units for volume (e.g. layers of blocks) • measuring instruments – rulers, tape measures – scales – area grids – litre jugs • personal referents • related historical units of measure	**Units of measure** • metres (m) and centimetres (cm) • grams (g) and kilograms (kg) • square centimetres (cm^2) • square metres (m^2) • millilitres (mL) and litres (L) • non-standard units for volume (e.g. layers of blocks) • measuring instruments – square centimetre grids • equivalent forms of standard units (e.g. 1.5 kg/1500 g; 600 mL/0.6 L) • personal referents • related historical units of measure
Relationships	**Relationships** • the larger the unit the fewer required to measure and vice versa – non-standard and standard units	**Relationships** • the larger the unit the fewer required to measure and vice versa – millilitres and litres – grams and kilograms – centimetres and metres

Core content

Measurement — Length, mass, area and volume

Level 4	Level 5	Level 6
Measurement terms and attributes • perimeter • circumference • square and cubic units	**Measurement terms and attributes** • perimeter • circumference • diameter • radius • pi (π)	**Measurement terms and attributes** • tangent • opposite and adjacent sides • hypotenuse
Units of measure • millimetres (mm), centimetres (cm), metres (m) and kilometres (km) • tonnes (t) and kilograms (kg) • square metres (m^2) • square centimetres (cm^2) • cubic metres (m^3) • cubic centimetres (cm^3) • measuring instruments • related historical units of measure	**Units of measure** • square metres (m^2) • hectares (ha) and square kilometres (km^2) • measuring instruments • historical units of measure	**Units of measure**
Relationships • the larger the unit the fewer required to measure and vice versa – metres, centimetres and millimetres – kilograms and tonnes – square centimetres and square metres • relationships between: – length, width and area of rectangle – length, width and height, and volume of a prism – length of side and perimeter	**Relationships** • the larger the unit the fewer required to measure and vice versa – millilitres and cubic centimetres – hectares and square metres • relationships between: – diameter and circumference of circle (pi) – length and width (height), and areas of triangles and parallelograms – areas of triangles and areas of rectangles – areas of rectangles and areas of parallelograms (same length, same width or height) – areas of circles and irregular shapes • formulae – area of rectangle – volume of prism – perimeter of rectangles including squares	**Relationships** • within right-angled triangles – Pythagoras' Theorem – tangent ratio • formulae – circumference of circle – area of circle – area of triangle – volume of cylinder – volumes of pyramids and cones • compound shapes • objects

Core content

Measurement — Time

Level 1	Level 2	Level 3
Units and conventions • non-standard units • units – days, weeks, months • comparative language (e.g. later, earlier, more time, less time) • class calendars	**Units and conventions** • units – seconds (s) – minutes (min) – hours (h) ◦ half hour, quarter hour – years (yr) • 12-hour displays – analogue (o'clock, half hour, 5-minute interval markings) – digital (all times) • seasons • calendars – abbreviations for days (e.g. Mon) – months in words • representations (e.g. 9:30, nine-thirty)	**Units and conventions** • units – fortnight – leap year • 12-hour displays (analogue and digital) – quarter past, quarter to – five-minute intervals • timelines • timetables (e.g. school, bus, train) • diaries (e.g. personal, school, class) • calendars – abbreviations for days (e.g. M for Monday), months (e.g. Feb for February) • conventions – dates (e.g. dd/mm/yy) – ante meridiem (a.m.) – post meridiem (p.m.)
Relationships • points in time (e.g. home time, start time) • times of day (e.g. morning) • days and a week • duration – time between start and finish	**Relationships** • days and months • weeks and a year • months and a year • analogue and digital displays • duration – estimation of seconds, minutes	**Relationships** • digital and analogue time • seconds and a minute • minutes and an hour • minutes and parts of hours (quarter, half) • hours and days • duration – personal referent (for seconds, minutes, half hour)

Core content

Measurement — Time

Level 4	Level 5	Level 6
Units and conventions • units – decade – century (e.g. 21st century is 2001–2100) • 24-hour time • personal timetables, diaries (electronic or manual) • timelines • calendars	**Units and conventions** • Australian time zones – Eastern Standard Time (EST) – Central Standard Time (CST) – Western Standard Time (WST) – daylight saving time • timetables	**Units and conventions** • international time zones – Greenwich Mean Time (GMT) or Universal Time Coordinates (UTC) – International Date Line • timetables
Relationships • days, weeks, months and years • hour and minutes (e.g. 90 minutes = 1½ hours) • decade and century • 24-hour time and 12-hour time • duration – time calculations	**Relationships** • decimal representations of time units (e.g. 2.25 hours = 2 hours 15 minutes) • duration – time calculations – timetables of more than one week duration	**Relationships** • time zones and longitude • synchronisation of events • duration – time calculations

Core content

Chance and Data — Chance

Level 1	Level 2	Level 3
Likelihood • language of chance – always, sometimes, never – will, will not or might happen – maybe – fair, not fair – lucky, unlucky	**Likelihood** • language of chance – likely, unlikely – impossible	**Likelihood** • language of chance – more likely, less likely, equally likely – most likely, least likely – certain – multiple outcomes – relate everyday language or colloquialisms to likelihood (e.g. 'no chance') – experimental probability (e.g. one in four chance) – sample space (all possible outcomes)
Judgments • subjective judgments – personal opinions – personal statements	**Judgments** • subjective judgments – comparisons and predictions – independence of an event from a previous event	**Judgments** • subjective and numerical judgments – comparisons and predictions based on experimental data – fairness of rules – independence and dependence of subsequent outcomes (randomness)

Core content

Chance and Data — Chance

Level 4	Level 5	Level 6
Likelihood • language of chance – frequency table – relative frequency • probability values – impossible to certain, 0 to 1, key percentages between 0% and 100% – relate colloquialisms to probability values (e.g. 'fifty-fifty', 'Buckley's chance')	**Likelihood** • language of chance – theoretical probability (of a single event) • probability models – lists, tables – computer simulations – experiments	**Likelihood** • language of chance – multi-outcome events – compound events – conditional probability (replacement and non-replacement) • theoretical probability of multi-outcome and compound events • probability models – lists, tables, tree diagrams – computer simulations – experiments
Judgments • subjective and numerical judgments – comparisons and predictions based on experimental and given data – fairness of rules	**Judgments** • quantitative judgments – probability of events with equally likely outcomes – fair, unfair and biased judgments – probability to support statements and decisions (single events) – experimental and theoretical probability links – extrapolations from simplified explorations	**Judgments** • quantitative judgments – predictions and justifications – experimental and theoretical probability links – extrapolations from simplified explorations

Core content

Chance and Data — Data

Level 1	Level 2	Level 3
Collecting and handling data • collection methods – observation – questioning • classify data • check data	**Collecting and handling data** • collection methods – observation – simple surveys • classify data • record and check data	**Collecting and handling data** • collection methods – surveys – observations – experiments • classify, record and check data • existing data sources – publications
Exploring and presenting data • simple displays – lists – tables – people graphs – object graphs – picture graphs – student-generated	**Exploring and presenting data** • displays – tables – picture graphs – bar graphs • main elements of displays – titles – axes	**Exploring and presenting data** • displays – tables – picture graphs (one-to-many representations) – bar graphs • main elements of displays – titles – axes – scales
Identifying and interpreting variation • sources of variation – recording methods – observational conditions • natural variation	**Identifying and interpreting variation** • sources of variation – recording methods – observational conditions • natural variation • effects of variation	**Identifying and interpreting variation** • comparative and quantitative language • variety of displays to illustrate data features and variation

Core content

Chance and Data — Data

Level 4	Level 5	Level 6
Collecting and handling data • plans and methods for data collection – design of data record templates – data entry into spreadsheets – extraction of data from existing data sources • classify data • check data • discrete data – categorical data – count data • continuous data	**Collecting and handling data** • studies involving observations, experiments and surveys • templates for recording data • spreadsheets • consistency of units and conditions • detect errors • discrete data • continuous data • groups (bins)	**Collecting and handling data** • data over time (time a major focus) • cross-sectional data (time not a major focus) • nature of types of data sets – sample data – census data
Exploring and presenting data • displays – pie charts – bar graphs – dot-plots – line graphs – two-way tables – lists	**Exploring and presenting data** • displays – two-way tables – compound bar graphs – histograms – stem and leaf plots	**Exploring and presenting data** • displays – plots over time – scatterplots – two-way tables – histograms – stem and leaf plots
Identifying and interpreting variation • features of data – measures of location (central tendency) ◦ mean ◦ median ◦ mode (for discrete data) • limitations of measures of location	**Identifying and interpreting variation** • features of data – spread – range – measures of location (central tendency) and limitations – shape (e.g. asymmetry, unusual features) • histograms and stem and leaf plots as picture estimates	**Identifying and interpreting variation** • comparisons of features of graphs and plots – location (mean, median) – spread – shape • relationships between variables – through scatterplots for continuous data – through two-way tables for categorical data

Core content

Space — Shape and line

Level 1	Level 2	Level 3
3D shapes and objects and 2D shapes • cubes, rectangular prisms, spheres, cylinders, cones, pyramids • everyday examples of 3D shapes (e.g. ice-cream cones, balls, dice) • circles, triangles, rectangles including squares	**3D shapes and objects and 2D shapes** • common characteristics of cubes and prisms • spheres, cylinders, cones, pyramids • common characteristics of rectangles including squares	**3D shapes and objects and 2D shapes** • definition of: – prisms – spheres – cylinders – cones – pyramids • quadrilaterals (parallelograms, rectangles, trapeziums, rhombuses including diamonds) • triangles (right-angled triangles, isosceles triangles, scalene triangles, equilateral triangles)
Geometric terms and properties • open and closed figures • flat, straight, curved, round • 3D shapes (shapes of faces, function — 'will roll'…) • 2D shapes (straight and curved lines, number of sides, number of corners)	**Geometric terms and properties** • face, corner, side, edge • 3D shapes (shape and number of faces, function …) • 2D shapes (number of sides, number of angles …) • nets of 3D shapes with flat surfaces	**Geometric terms and properties** • vertex, base, apex • congruence (same shape and size) • parallel sides, faces, lines • equal sides and angles • conventions for labelling shapes and angles – letters for naming shapes (ABC …) – arrows to identify parallel lines – marks to identify equal sides of shapes – symbols for angles • surfaces of 3D shapes • nets (excluding spheres) • line symmetry of 2D shapes • symmetrical/asymmetrical shapes • transformations of 2D shapes – enlargements and reductions of shapes • tessellating properties of triangles and quadrilaterals

continued

Core content

Space — Shape and line *(continued)*

Level 1	Level 2	Level 3
Visualisations and representations • 'mind pictures' of 3D and 2D shapes • 3D objects from different viewpoints • 2D shapes in different orientations • shapes within shapes – folding, cutting – joining halves • shapes within pictures, illustrations, puzzles	**Visualisations and representations** • 'mind pictures' of 3D and 2D shapes • 3D objects from different viewpoints • 2D shapes in different orientations • partition of 2D shapes (e.g. triangles within a square) • depth in 3D shapes	**Visualisations and representations** • 'mind pictures' of a single flip, slide or turn of 2D shapes • 'mind pictures' of 3D shapes • different viewpoints and orientations • nets of shapes • shapes within shapes, angles within angles • conventions for representing 3D shapes (dotted lines, shading, connecting overlays)
Lines and angles • straight and curved lines • corners (angles)	**Lines and angles** • right angle (square corner) • angles ('greater than', 'less than', 'same as' a right angle)	**Lines and angles** • vertical, horizontal and oblique lines • parallel lines • degrees • right angle (90 degrees) • acute, obtuse, straight and reflex angles

Core content

Space — Shape and line

Level 4	Level 5	Level 6
3D shapes and objects and 2D shapes • triangular prisms and hexagonal prisms • square-based pyramids, tetrahedrons • circle, semicircle, quadrant, concentric circles • regular and irregular polygons (quadrilaterals, triangles, pentagons, hexagons, octagons, dodecagons) • non-polygons (e.g. ellipse) • Platonic solids (cube tetrahedron, octahedron, dodecahedron, icosahedron)	**3D shapes and objects and 2D shapes** • plans and elevations • compound shapes • embedded shapes	**3D shapes and objects and 2D shapes** • generalisations relating to 2D shapes • relationships between 2D and 3D shapes
Geometric terms and properties • perpendicular faces, perpendicular lines • congruence • symmetry • rotational symmetry • sum of internal angles of shapes	**Geometric terms and properties** • similarity – similar shapes (reductions and enlargements) • congruence – symbol for labelling • scale plans	**Geometric terms and properties** • general patterns of triangles, quadrilaterals, parallel and intersecting lines • scale factor
Visualisations and representations • 3D shapes from different viewpoints • 2D shapes in different orientations • shapes embedded within other shapes	**Visualisations and representations** • conventions for representing 3D shapes (perspective) • sections and cross-sections	**Visualisations and representations** • embedded shapes, lines and angles
Lines and angles • intersecting lines • diagonal lines • perpendicular lines • degrees • geometric tools – 360 degrees protractor – pair of compasses	**Lines and angles** • external angles • simple constructions using geometric tools – perpendicular line (90 degrees) – angle of 60 degrees – bisect a line	**Lines and angles** • letter conventions • angles produced when a transversal crosses parallel lines • generalisations relating angles – vertically opposite – at a point – in a triangle – in a quadrilateral

Core content

Space — Location, direction and movement

Level 1	Level 2	Level 3
Location and movement • language – position (on, between, beside, near, before, after …) – direction (over, under, up, down, left, right …) – movement (forwards, backwards, sideways …) – non-verbal ◦ signs, symbols (static) ◦ gestures (dynamic) • 'mind pictures' of familiar pathways • alternative pathways	**Location and movement** • simple maps • sketches of simple plans (e.g. rooms) • relative size of objects and locations • non-labelled grids • alphanumeric grids (e.g. B3) • movement (e.g. paces, steps, grid spaces) • different viewpoints (above, 'bird's eye view', front, behind, side) • alternative pathways	**Location and movement** • combinations of alphanumeric grids and maps (e.g. local area) • plans (e.g. school layout) • conventions – keys and legends (symbols and explanations of the symbols) – grid references (regions and/or points) – orientation to north
Direction and angle • language – turns (change in direction)	**Direction and angle** • language – full, half, quarter and three-quarter turns – left and right turns – clockwise, anticlockwise	**Direction and angle** • the four compass points (N, S, E, W) • connection between compass points and the amount of turn

Core content

Space — Location, direction and movement

Level 4	Level 5	Level 6
Location and movement • conventions – simple scale on maps (linear form or 1 cm:1 km) – coordinates ◦ grid references ◦ movement between grid reference points – latitude and longitude ◦ key lines of reference (prime meridian, equator) ◦ polar limits • maps – flat maps – globes • plans (e.g. shopping centre)	**Location and movement** • conventions – scale on maps expressed as a simple ratio (e.g. 1:10; 1:1000) – coordinates ◦ latitude and longitude expressed in whole degrees ◦ location of points and places using latitude and longitude – distance and bearing (local environment) • maps – flat maps including world, atlas, street directory and orthophoto – globes • simple floor plans with scale	**Location and movement** • conventions – scale on maps expressed as ratio (e.g. 1:25; 1:40) – coordinates ◦ fractions of degrees expressed as minutes (mentally and on scientific calculators) ◦ latitude and longitude expressed in degrees and minutes – scale on floor plans expressed in millimetres • key referents for international time zones – Greenwich Mean Time (GMT) or Universal Time Coordinates (UTC) – International Date Line • link between longitude and time • distance and bearing
Direction and angle • eight compass points (N, NE, E, SE, S, SW, W, NW) • connection between the eight compass points and the amount of turn • angle as a difference in direction • estimation and measurement of angles in degrees	**Direction and angle** • bearings in whole degrees (measured clockwise from north) • estimation of bearings in degrees • application of scales to maps to find actual distances	**Direction and angle** • maps (local environment) with a given scale • navigational instructions based on distance and bearings (using protractors)

Assessment

Assessment is the purposeful, systematic and ongoing collection of evidence for use in making judgments about students' demonstrations of learning outcomes. In this syllabus, core learning outcomes are presented in levels of increasing sophistication and complexity to form continua of learning. Assessment focuses on monitoring demonstrations of these core learning outcomes to provide evidence of student progress in the Mathematics key learning area.

Purposes of assessment

Information obtained from assessment can be used for a variety of purposes including providing feedback on student progress and informing decision making related to student learning.

Providing feedback

Assessment is used to:

- provide ongoing feedback on the progress of individual students and groups of students in relation to learning outcomes throughout the learning and teaching process
- inform students, teachers, parents/carers, others in the community and/or school authorities about students' demonstrations of learning outcomes.

Informing decision making

Assessment information helps teachers to:

- make decisions about student needs, the learning and teaching process, and resource requirements
- plan learning and teaching programs for individuals, classes and the whole school
- discuss future learning pathways with students and parents/carers
- make decisions about providing learning support to particular groups of students
- develop learning resources and curriculum materials.

Principles of assessment

For assessment to be effective, it should:

- focus on students' demonstrations of learning outcomes
- be comprehensive
- be valid and reliable
- take account of individual learners
- be an integral part of the learning and teaching process
- provide opportunities for students to take responsibility for their own learning and for monitoring their own progress
- reflect equity principles.

Demonstrations of learning outcomes

Assessment focuses on students' demonstrations of learning outcomes. Assessment is typically designed to provide opportunities for students to demonstrate multiple learning outcomes or aspects of multiple learning outcomes. When assessment is focused on learning outcomes, students are made aware of what is being assessed, how and when they will be assessed, and how judgments will be made about their demonstrations of learning outcomes. Teachers may then use information from assessment to plan further learning.

Comprehensive range of evidence

Judgments about students' demonstrations of learning outcomes should be based on a comprehensive range of evidence gathered and recorded over time. To collect such evidence, teachers need to provide multiple opportunities in a variety of contexts for students to demonstrate learning outcomes, and need to use a variety of assessment techniques and recording instruments. Because students have different learning styles, evidence should be gathered from various sources. Examples of assessment techniques, recording instruments and sources are provided in Table 1 on p. 71.

Valid and reliable evidence

Assessment should provide valid, reliable evidence that relates directly to specific learning outcomes. It is essential that assessment opportunities assess what they are intended to assess and that judgments about students' demonstrations of learning outcomes are based on a broad range of evidence gathered and recorded over time. Teacher judgments about students' demonstrations of learning outcomes should be consistent within their own classes for different students, for different assessment opportunities and at different times. They should also be consistent with the judgments of other teachers in their school and other schools.

Individual learners

At any one time in their schooling, students could demonstrate learning outcomes or aspects of learning outcomes in different ways and at different levels. When planning assessment, teachers need to take account of the fact that each student will progress at a different rate in relation to the learning outcomes and that individual students could progress at different rates in relation to different learning outcomes in different strands. They also need to take

account of factors that influence students' learning — in particular, their prior knowledge, experiences and unique circumstances, and their social, emotional, physical, cognitive and linguistic development.

Integral part of learning and teaching process

Assessment is an integral part of the learning and teaching process and should acknowledge and support students' learning. Learning, teaching and assessing are planned concurrently. As teachers plan learning experiences, they should also plan how they will assess students' learning and monitor progress. Learning activities can be used as opportunities to gather evidence of students' demonstrations of learning outcomes. Assessment opportunities should match the learning activities and teaching methods students have experienced. Assessment opportunities should be meaningful, interesting and challenging and contribute to the development of students as lifelong learners.

Responsibility for own learning; self-monitoring

Assessment should provide feedback and support to assist students to take responsibility for their own learning. This involves giving students opportunities to set their own learning goals, to monitor their progress in relation to the learning outcomes and to gather information that they and others may use to make decisions about future learning. Opportunities also need to be provided for students and teachers to develop shared understandings about how learning outcomes might be demonstrated and for students to explain how they might demonstrate the learning outcomes in their own terms.

Equity principles

Assessment based on principles of equity enables students to demonstrate learning outcomes in ways that are sensitive to, and inclusive of, their circumstances. This includes:

- providing assessment opportunities that assist students or groups of students to overcome barriers that might limit their demonstrations of learning outcomes
- negotiating assessment with students so that they maximise their opportunities to demonstrate learning outcomes.

Process of assessment

The process of assessment involves:

- providing students with opportunities to demonstrate what they know, and can do with what they know, in terms of identified learning outcomes
- gathering and recording evidence of students' demonstrations of the identified learning outcomes
- using the evidence to make overall judgments about students' demonstrations of learning outcomes.

Opportunities to demonstrate learning outcomes

Students should have multiple opportunities to demonstrate learning outcomes that have been the focus of planned activities. Assessment opportunities need

to be provided over time and in a range of contexts. Teachers can use learning activities as assessment opportunities, or design specific tasks that give students opportunities to demonstrate learning outcomes.

Gathering and recording evidence

Evidence about students' demonstrations of learning outcomes or aspects of outcomes should be gathered from several different sources across a range of contexts, and be recorded over time using a variety of assessment techniques and recording instruments. This evidence should be relevant to the learning outcomes being assessed and be collected in a focused and systematic way.

Sources of evidence
Using evidence from a variety of sources accommodates different learning styles, different types of learning outcomes, the different ways in which students may demonstrate learning outcomes, and learning that has taken place in different contexts. Sources of evidence can include learning activities as well as specifically designed assessment tasks. Examples of activities, tasks, products or processes that could be used as sources of evidence are provided in Table 1.

Assessment techniques
Assessment techniques include observation, consultation and focused analysis. Self- and peer-assessment can also be used to gather evidence about students' demonstrations of learning outcomes. Combinations of these techniques provide teachers with comprehensive evidence on which to base judgments.

Assessment techniques should be selected to best suit the context in which the learning outcomes are being demonstrated and the type of evidence required. Teachers should familiarise students with the techniques through modelling and practice. Descriptions of these techniques are provided in Table 1.

Record keeping
Record keeping must support planning and should be manageable and easily maintained. It must provide a way of documenting evidence drawn from a range of contexts about student learning related to the demonstrations of learning outcomes. It should also be accessible when making overall judgments about students' demonstrations of learning outcomes. Examples of recording instruments are listed in Table 1.

A **student folio** is a useful way of collating and storing evidence about a student's demonstrations of learning outcomes or aspects of outcomes gathered using a range of assessment techniques. Folios are developed over time and can include evidence such as work in progress, responses to assessment tasks, products from learning activities, annotated samples of student work, anecdotal records, checklists, photographic records, or video/audio tapes. Materials for the folio may be selected by negotiation between the teacher and the student. This collection of work provides an informative picture of a student's accomplishments.

Folios of student work are used to monitor progress and to provide progressive information about the patterns of a student's demonstrations of learning until the point in time when an overall judgment can be made. At that point, a selection is made of a student's work that best represents the pattern of the student's demonstrations in relation to learning outcomes. This selection is assembled specifically for purposes of making an overall judgment in relation to the learning outcomes.

Table 1: Examples of ways to gather and record evidence from a variety of sources

Sources of evidence	Assessment techniques	Recording instruments
• computer-generated presentations • concept maps • debates • discussions with students • games • journals • observations of written work in progress • plans of approach to investigations • projects/assignments • questioning led by teacher or student • reports (e.g. on investigations) • research projects • sketches and drawings • structured whole- or small-group discussions • student explanations of work in progress • student folios • working notes and jottings • written tests (e.g. Years 3, 5 and 7 test reports)	**Observation** involves teachers observing students as they participate in planned activities. Teacher observation occurs continually as a natural part of the learning and teaching process and can be used to gather a broad range of evidence about students' demonstrations of learning outcomes. Teacher observations can also be structured to gather particular kinds of evidence in relation to learning outcomes. **Consultation** involves teachers discussing student work with students, colleagues, parents/carers or other paraprofessionals. The varying perspectives of the participants in consultations can help enrich the evidence gathered about students' demonstrations of learning outcomes. Consultation can be used to verify the evidence gathered using other techniques. Some consultations may reveal a need for more detailed assessment. **Focused analysis** involves teachers examining in detail student responses to tasks or activities (e.g. computer-generated presentations, group discussions, tests, debates or research projects). This technique provides detailed evidence about students' demonstrations of learning outcomes. **Self- and peer-assessment** involves students using the above techniques to assess their own work and the work of their peers. Self- and peer-assessment allow teachers to take account of students' perceptions when gathering evidence.	• anecdotal records • annotated work samples • audio and visual (including photographic and video) recordings • checklists • feedback sheets • folios • learning logs • observation notes • reflection sheets, diaries or scrapbooks • reports of test results • self- and peer-assessment sheets • self- and peer-reflective journals • statements of anticipated evidence or criteria sheets • student/teacher journals • worksheets

Making judgments about demonstrations of learning outcomes

Teacher judgments are fundamental to the assessment process. Judgments about what students know, and can do with what they know, are an integral and ongoing part of the assessment process. Throughout the assessment process, teachers make judgments about:

- students' responses to particular assessment tasks
- what students know and can do with particular content
- whether students can demonstrate aspects of learning outcomes.

Such judgments are part of the ongoing monitoring of student progress and inform planning for future learning activities and assessment opportunities. The criteria on which judgments are to be based should be drawn from the learning outcomes and made known to students before tasks are undertaken so that the basis for judgments is clear.

From time to time, overall judgments are made about students' demonstrations of learning outcomes in relation to the continua of learning described by the learning outcomes. That is, judgments are made that there is sufficient evidence available to show that a student can demonstrate learning outcomes identified for a particular level. Key factors in determining whether there is sufficient evidence to make an overall judgment are:

- the evidence indicates that the student has demonstrated all aspects of a learning outcome, rather than some aspects of the outcome
- the evidence has been obtained over time and in a variety of contexts and represents long-term rather than short-term learning
- the evidence shows that a consistent pattern of demonstrations has been established.

Teachers, therefore, make judgments about a student's demonstrations of learning outcomes when satisfied that they have sufficient evidence. An overall judgment can be made when a consistent pattern of demonstrations has been established across a range of contexts.

When making an overall judgment about a student's demonstration of a learning outcome, teachers need to:

- analyse what it is that the student is expected to know and be able to do with what they know
- consider the learning outcomes at the levels before and after the focus learning outcomes
- consider the level statement and level-specific core content and, if necessary, the elaborations in the support materials relevant to the learning outcome
- consider the range of evidence that has been gathered and recorded
- consider the assessment opportunities that have been provided
- make a judgment about which learning outcome the student has demonstrated. In making this judgment, teachers match the student's demonstrations of learning against the learning outcomes.

Judgments about a student's demonstrations of learning outcomes are made without reference to the performance of other students.

A flow chart summarising the process of making an overall judgment about a student's demonstration of a learning outcome is provided in Figure 1.

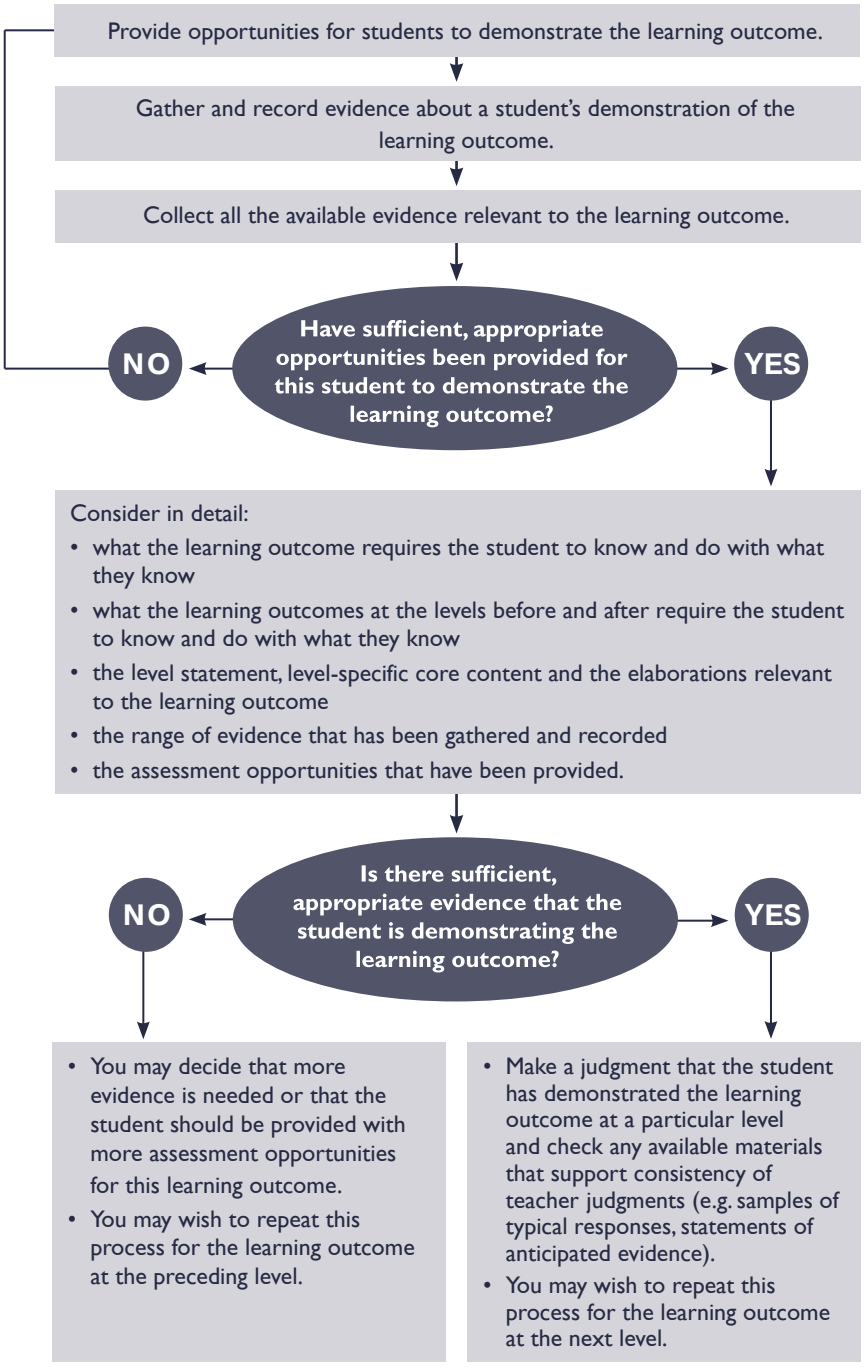


Figure 1: Making an overall judgment about a student's demonstration of a learning outcome

Consistency of teacher judgments

To be consistent, teacher judgments about students' demonstrations of learning outcomes must hold true in later situations and be comparable with the judgments of other teachers.

The judgments of teachers need to be consistent:

- within their own classes for different students
- for different assessment opportunities at different times
- with other teachers in the same school (i.e. consistency within schools)
- with teachers in other schools (i.e. consistency among schools).

Strategies for ensuring consistency of teacher judgments include:

- ***sharing of understandings about the learning outcomes***: Teachers discuss the meaning of learning outcomes and what students have to know and do to demonstrate these outcomes.
- ***collaborative planning***: Teachers work together to plan for learning and assessing and to reach shared understandings about what is required for demonstrations of learning outcomes. Collaborative planning in primary or middle schools may involve teachers of the same year level, teachers of consecutive year levels or bands of schooling, or specialist and generalist classroom teachers. It may also involve whole-school planning. Collaborative planning in middle or secondary schools may involve teachers of the same year level, teachers of consecutive year levels, or teachers with subject expertise in two or more areas. Primary and secondary teachers might also plan collaboratively, especially for the transition from Year 7 to Year 8.
- ***using common assessment tasks***: Teachers cooperatively plan and/or moderate assessment tasks focusing on identified learning outcomes. A common assessment task that provides students with opportunities to demonstrate learning outcomes at a range of levels allows teachers to develop shared understandings about the demonstrations of learning outcomes at different levels.
- ***designing statements of anticipated evidence, or criteria sheets***: Teachers identify the properties, components or dimensions by which students' demonstrations of learning outcomes will be judged. In developing a common statement of anticipated evidence or a criteria sheet, teachers collaboratively analyse the learning outcomes to identify and record the anticipated evidence or criteria that will be used as the basis for judgments. Anticipated evidence could be identified in assessment tasks, criteria sheets or verbal descriptions.
- ***conducting moderation processes (formal and informal)***: Teachers discuss and compare judgments made about students' work and associated demonstrations of learning outcomes. Formal moderation processes occur when school authorities require teachers from within or among schools to discuss the consistency of judgments about demonstrations of learning outcomes. Informal moderation occurs any time that teachers discuss and compare their judgments of students' work. In both formal and informal moderation, teachers use student folios to support teacher judgments.
- ***collecting and using samples of typical responses:*** Teachers compile and refer to samples of student work that show how learning outcomes may be demonstrated. The samples could be annotated samples of student responses to selected assessment tasks.

Reporting

Reporting is the process of communicating information and judgments about students' demonstrations of learning outcomes. Reporting information about student progress in relation to learning outcomes can occur in terms of core learning outcomes, or in terms of strands or key learning areas. Reporting to students and parents/carers should provide them with timely and accurate information that they can understand, interpret and use to support student learning.

Reporting to students and parents/carers

Teachers need to provide regular feedback to students and parents/carers about students' learning and progress in relation to learning outcomes. The information provided should be constructive and enable students to reflect on their progress and negotiate future learning and assessment. This kind of reporting is an important and ongoing part of the learning and teaching process and can occur incidentally as well as in planned ways.

Students and parents/carers also need to be provided with information about student progress at certain points in time as identified by schools in their overall plans for learning, assessing and reporting.

Reporting on student progress in relation to learning outcomes

Information reported to students and parents/carers as part of the ongoing learning and teaching process could include:

- explanations of particular assessment opportunities
- evidence about demonstrations of learning outcomes
- judgments about demonstrations of particular learning outcomes
- clarification of learning outcomes and how they could be demonstrated
- identification of future assessment opportunities and anticipated evidence.

Information reported to students and parents/carers at particular points in time could include:

- records of the learning outcomes or aspects of outcomes previously demonstrated by the student
- descriptions of learning outcomes that the student has had opportunities to demonstrate since reporting last occurred
- statements about what students were expected to know and do with what they know to demonstrate the learning outcomes

- descriptions of the contexts in which learning and assessment has occurred
- records of the learning outcomes or aspects of learning outcomes demonstrated by the student since reporting last occurred
- records of the learning outcomes or aspects of learning outcomes that the student is currently working towards
- information about the relationship between levels of learning outcomes and year levels
- information that is specific to individual students, such as the student's self-assessment or future learning plans and goals.

Language, formats and modes of reporting

The language, formats and modes used for reporting should be meaningful and relevant to the proposed audience. Possible modes for reporting include:

- written reports (print or electronic)
- student–teacher conferences
- teacher–parent interviews
- student-led three-way conferences (student, teacher and parents/carers)
- culminating presentations
- student folios (print or electronic).

For further information on assessment and reporting, refer to *Position Paper and Guidelines: An Outcomes Approach to Assessment and Reporting* by searching the publications area of the Years 1 to 10 pages of the Queensland Studies Authority website, www.qsa.qld.edu.au.

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- display digital works within their premises (e.g. on an intranet)
- make a digital copy for research or study
- for administrative purposes, make a digital copy of a work held in printed format
- make a copy of an artistic work to display on their premises if the original is lost or in danger.

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