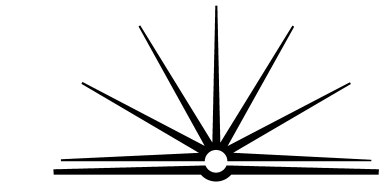

Mathematics
K–10

Draft syllabus

Consultation period
14 June – 22 August 2011

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Contents

Background information

The *Mathematics K–10 Syllabus* is being developed to deliver the Australian Curriculum to NSW schools. The syllabus is being developed within the context of the NSW Board of Studies *K–10 Curriculum Framework*, using the Board's syllabus development process.

On 8 December 2010 Australian education ministers endorsed the Australian Curriculum content descriptions for Foundation to Year 10 Mathematics. The endorsed content descriptions form the basis for the Board's development of the *Mathematics K–10 Draft Syllabus* for implementation in NSW schools.

The K–10 syllabus will challenge students to meet high, but realistic, expectations as they progress through the years of schooling. It clearly articulates standards that show what students are expected to know and be able to do at each stage from Kindergarten to Year 10. This provides the context for assessment for learning and meaningful reporting of student achievement.

The draft syllabus

The draft syllabus has been guided by the *Mathematics K–10 Directions for Syllabus Development* available on the NSW Board of Studies website. The *Directions for Syllabus Development* reflects the Australian Curriculum, Assessment and Reporting Authority (ACARA) developed curriculum, the feedback received from NSW stakeholders and the advice of the K–10 NSW Board Curriculum Committee for Mathematics.

The Board's syllabus development process

This project commenced at the draft syllabus development phase of the Board's syllabus development process, recognising the substantial work that ACARA has undertaken. Broad consultation with teachers and other interest groups will precede the finalisation of the syllabus.

The process and timeline for the development of the syllabus follows.

Timeline for the development of the Mathematics K–10 syllabus

Steps in the syllabus development process	**Date**
Directions for syllabus development	
K–10 Board Curriculum Committee established to provide advice to the Board of Studies during the syllabus development process, including actions for the development of a quality syllabus	Established May 2010
Endorsement of the Australian Curriculum content descriptions as the basis for development of the NSW syllabus	8 December 2010
Directions for Syllabus Development prepared	February to March 2011
Syllabus development	
Draft syllabus and survey prepared	March to May 2011
Consultation	14 June to 22 August 2011
Consultation report and final syllabus to K–10 Board Curriculum Committee	September 2011
Consultation report and final syllabus to Board of Studies for endorsement	October 2011
Publication of the syllabus	Term 4, 2011

Assisting respondents

The following icons are used to assist respondents:

ⓘ for your information	This icon indicates general information that assists in reading or understanding the information contained in the document. Text introduced by this icon will not appear in the final syllabus.
 consult	This icon indicates material on which responses and views are sought through consultation.

Note: Australian Curriculum content has a grey screen to differentiate it from NSW content. It looks like this:

Establish understanding of the language and processes of counting by naming numbers in sequences, initially to and from 20, moving from any starting point

Consultation

The *Mathematics K–10 Draft Syllabus* is accompanied by an online consultation survey on the Board of Studies website. The purpose of the survey is to obtain detailed comments from individuals and systems/organisations on the syllabus. Please comment on both the strengths and the weaknesses of the draft syllabus. Feedback will be considered when the draft syllabus is modified.

The consultation period is from 14 June to 22 August 2011.

Written responses may be forwarded to:

Curriculum Support Officer, Mathematics
GPO Box 5300
Sydney NSW 2001

faxed to: (02) 9367 8476 or emailed to: irene.potts@bos.nsw.edu.au

Structure of the draft syllabus

The draft syllabus has the following sections:

- The K–10 curriculum
- Rationale
- The place of *Mathematics K–10 Syllabus* in the K–12 curriculum
- Aim
- Objectives
- Outcomes
- Content
- Years 7–10 Life Skills outcomes and content
- Continuum of learning in Mathematics K–10
- Assessment.

Each section of the draft syllabus includes:

- an explanation of the section's purpose
- the material on which responses and views are sought through the consultation.

The draft syllabus

1 Introduction

1.1 The K–10 curriculum

This syllabus has been developed within the parameters set by the Board of Studies NSW in its *K–10 Curriculum Framework*. This framework ensures that K–10 syllabuses and curriculum requirements are designed to provide educational opportunities that:

- engage and challenge all students to maximise their individual talents and capabilities for lifelong learning
- enable all students to develop positive self-concepts and their capacity to establish and maintain safe, healthy and rewarding lives
- prepare all students for effective and responsible participation in their society, taking account of moral, ethical and spiritual considerations
- encourage and enable all students to enjoy learning, and to be self-motivated, reflective, competent learners who will be able to take part in further study, work or training
- promote a fair and just society that values diversity
- promote continuity and coherence of learning, and facilitate the transition between primary and secondary schooling.

The framework also provides a set of broad learning outcomes that summarise the knowledge, understanding, skills, values and attitudes essential for all students to succeed in and beyond their schooling. These broad learning outcomes indicate that students will:

- understand, develop and communicate ideas and information
- access, analyse, evaluate and use information from a variety of sources
- work collaboratively with others to achieve individual and collective goals
- possess the knowledge and skills necessary to maintain a safe and healthy lifestyle
- understand and appreciate the physical, biological and technological world and make responsible and informed decisions in relation to their world
- understand and appreciate social, cultural, geographical and historical contexts, and participate as active and informed citizens
- express themselves through creative activity and engage with the artistic, cultural and intellectual work of others
- understand and apply a variety of analytical and creative techniques to solve problems
- understand, interpret and apply concepts related to numerical and spatial patterns, structures and relationships
- be productive, creative and confident in the use of technology and understand the impact of technology on society
- understand the work environment and be equipped with the knowledge, understanding and skills to evaluate potential career options and pathways
- develop a system of personal values based on their understanding of moral, ethical and spiritual matters.

The broad learning outcomes of the *K–10 Curriculum Framework* are consistent with the *Melbourne Declaration on Educational Goals for Young Australians (December 2008)*. These goals are:

> Goal 1: Australian schooling promotes equity and excellence
> Goal 2: All young Australians become successful learners, confident and creative individuals, and active and informed citizens.

The way in which learning in the *Mathematics K–10 Syllabus* will contribute to the curriculum and to the student's achievement of the broad learning outcomes is outlined in the draft syllabus rationale.

In accordance with *the K–10 Curriculum Framework* and the Board's *Statement of Equity Principles*, the *Mathematics K–10 Syllabus* takes into account the diverse needs of all students. It identifies essential knowledge, understanding, skills, values and attitudes. It enunciates clear standards of what students are expected to know and be able to do in K–10. It provides structures and processes by which teachers can provide continuity of study for all students. It contains advice to assist teachers to program learning for those students who have gone beyond achieving the outcomes through their study of the essential content.

1.2 Students with special education needs

The rationale, aim, objectives, outcomes and content of the *Mathematics K–10 Syllabus* have been designed to accommodate teaching approaches that support the learning needs of all students. The stage statements and the continuum of learning can help teachers identify the starting point for instruction for every student, including those with special education needs.

Most students with special education needs will participate fully in learning experiences based on the regular syllabus outcomes and content. Students may require additional support, including adjustments to teaching, learning and assessment activities.

Collaborative curriculum planning will determine the most appropriate curriculum options for students with special education needs in keeping with their interests, strengths, goals and learning needs.

Students with special education needs can access the syllabus outcomes and content in a range of ways including:

- under regular course arrangements
- through content from a different stage
- with curriculum adjustments
- through Years 7-10 Life Skills outcomes and content.

Curriculum adjustments are measures or actions taken in relation to teaching, learning and assessment that enable a student to access syllabus outcomes and content. These adjustments may involve:

- classroom organisation
- appropriate materials and resources to support teaching and learning activities
- the amount of content to be covered in a particular lesson or unit of work or the time allocated to complete work
- additional demonstration of key concepts and skills by the teacher, teacher's aide or a peer
- a range of appropriate learning activities with structured opportunities for guided and independent practice and effective feedback
- additional support through group work, peer or volunteer tutoring, and other individual assistance.

For some students with special education needs, particularly those students with an intellectual disability, it may be determined that the Stage 4 and Stage 5 outcomes are not appropriate, even with adjustments to teaching, learning and assessment. For these students, the Years 7–10 Life Skills outcomes and content can provide the basis for developing a

relevant and meaningful age-appropriate program. A range of curriculum adjustments should be explored before a decision is made to access Years 7–10 Life Skills outcomes and content.

Kindergarten – Year 6

In Kindergarten to Year 6, it is important for all students to have the opportunity to participate fully in and progress through the curriculum. As they move through the developmental stages of learning, students demonstrate individual strengths and establish preferred ways of learning.

There are several curriculum options for students with special education needs in K-6. Students may engage with syllabus outcomes and content with adjustments, and/or may engage with outcomes and content from an earlier stage. All decisions regarding curriculum options for students with special education needs should be made through the collaborative curriculum planning process, to ensure that syllabus outcomes and content reflect the learning needs and priorities of individual students.

In addition, the NSW K-6 curriculum provides for students with special education needs through:

- inclusive syllabus outcomes and content accessible by the full range of students
- additional advice and programming support for teachers on how to assist students to access the outcomes of the syllabus
- specific support documents for students with special education needs as part of the overall syllabus package.

Years 7–10

Students build on their achievement from Kindergarten to Year 6 as they undertake courses to meet the requirements for the School Certificate. For a small percentage of these students the provision of curriculum adjustments may be insufficient to enable access to the regular syllabus outcomes and content. In this case the Years 7–10 Life Skills outcomes and content may be appropriate.

The Years 7–10 Life Skills outcomes and content are developed from the objectives of the *Mathematics K–10 Syllabus*. Further information relating to accessing and implementing Mathematics Years 7–10 Life Skills outcomes and content can be found in the Mathematics support document and *Life Skills Years 7–10: Advice on Planning, Programming and Assessment.*

The Years 7–10 Life Skills outcomes and content are in Section 8 of the syllabus. Assessment and reporting information for students with special education needs is contained in Section 10.

School principals have the authority to approve student access to courses based on Years 7–10 Life Skills outcomes and content, and to determine the appropriateness of making adjustments to curriculum and assessment for individual students.

2 Rationale

ⓘ for your information

The rationale describes the distinctive nature of the subject and outlines its relationship to the contemporary world and current practice. It explains the place and purpose of the subject in the curriculum.

✍ consult

Mathematics is a reasoning and creative activity employing abstraction and generalisation to identify, describe and apply patterns and relationships. The symbolic nature of mathematics provides a powerful, precise and concise means of communication.

Mathematical ideas have evolved across all cultures over thousands of years and are constantly developing. Digital technologies facilitate this expansion of ideas, providing access to new tools for continuing mathematical exploration and invention. Mathematics is integral to scientific and technological advances in many fields of endeavour. In addition to its practical applications, the study of mathematics is a valuable pursuit in its own right, providing opportunities for originality, challenge and leisure.

Mathematics in K–10 provides students with skills and knowledge in Number and Algebra, Measurement and Geometry, and Statistics and Probability. It focuses on developing increasingly sophisticated and refined mathematical understanding, fluency, logical reasoning, analytical thought and problem-solving skills. These capabilities enable students to respond to familiar and unfamiliar situations by employing strategies to make informed decisions and solve problems in other subjects and in their everyday lives.

The study of mathematics provides opportunities for students to appreciate the elegance and power of mathematical reasoning and apply mathematical understanding creatively and efficiently. The study of the subject enables students to develop a positive self-concept as learners of mathematics, obtain enjoyment from mathematics, and become self-motivated learners through inquiry and active participation in challenging and engaging experiences.

The ability to make informed decisions and to interpret and apply mathematics in a variety of contexts, is an essential component of students' preparation for life in the 21st century. To participate fully in society students need to develop the capacity to critically evaluate ideas and arguments that involve mathematical concepts or that are presented in mathematical form.

3 The place of the Mathematics K–10 syllabus in the K–12 curriculum

ⓘ for your information

This section of the syllabus demonstrates the relationship between the K–10 syllabus and other associated courses. It shows the possible pathways of learning in the learning area.

✍ consult

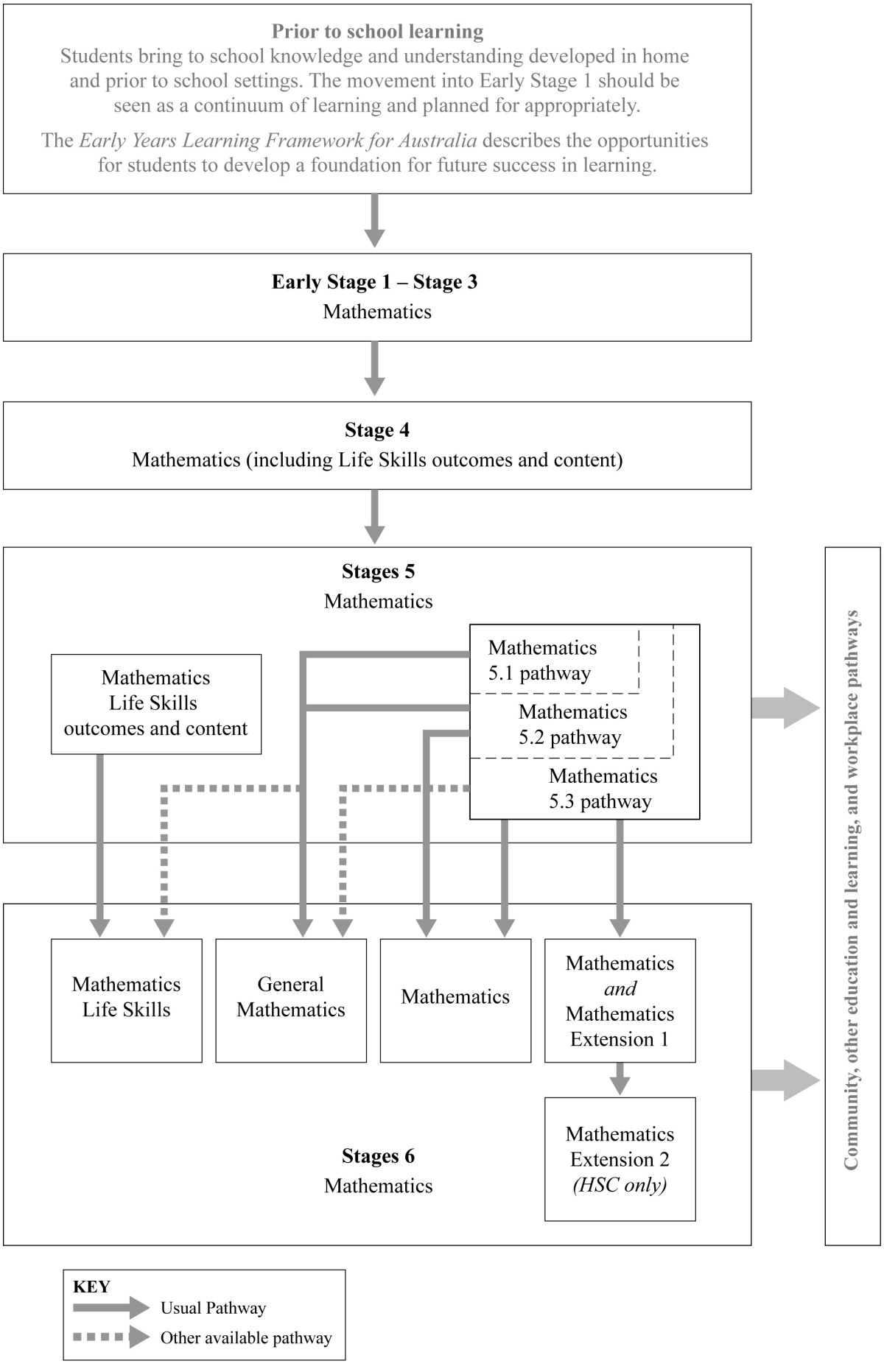
The *Mathematics K–10 Syllabus* describes a continuum of mathematics learning from Kindergarten to Year 10. The Stage 6 syllabuses describe the Preliminary and HSC courses in Years 11 and 12 and therefore represent the mathematics learning for all students who study mathematics in those years.

The following diagram represents available pathways of learning in mathematics from Early Stage 1 to Stage 6.

Students exhibit a wide range of mathematical skills, abilities and aspirations. Some students may be aiming to develop the mathematical skills necessary to function in daily life and various work contexts. Other students may seek to address more challenging mathematics to prepare them for the highest-level courses in Year 11 and Year 12.

For this reason Stage 5 content has been provided showing three pathways. These pathways are not rigid courses. Students following the 5.1 pathway may go on to study some or all of the 5.2 content. Similarly, students following the 5.2 pathway may complete some or all of the 5.3 content.

The Mathematics Life Skills outcomes and content are designed to provide a relevant and meaningful program of study for a small percentage of students with special education needs, for whom the Stage 4 and/or Stage 5 outcomes and content of the *Mathematics K–10 Syllabus* are not appropriate.


Prior to school learning
Students bring to school knowledge and understanding developed in home and prior to school settings. The movement into Early Stage 1 should be seen as a continuum of learning and planned for appropriately.
The Early Years Learning Framework for Australia describes the opportunities for students to develop a foundation for future success in learning.
Early Stage 1 – Stage 3
Mathematics
Stage 4
Mathematics (including Life Skills outcomes and content)
Stages 5
Mathematics
Mathematics Life Skills outcomes and content
Mathematics 5.1 pathway
Mathematics 5.2 pathway
Mathematics 5.3 pathway
Mathematics Life Skills
General Mathematics
Mathematics
Mathematics and Mathematics Extension 1
Mathematics Extension 2 (HSC only)
Stages 6
Mathematics
Community, other education and learning, and workplace pathways
KEY
Usual Pathway
Other available pathway

4 Aim

ⓘ for your information

The aim provides a succinct statement of the overall purpose of the syllabus. It indicates the general educational benefits for students from programs based on the syllabus.

✍ consult

The aim of Mathematics in K–10 is to develop students that:

- are confident, creative users and communicators of mathematics, able to investigate, represent and interpret situations in their personal and work lives and as active citizens
- recognise connections between the areas of mathematics and other disciplines and appreciate mathematics as an accessible and enjoyable discipline to study.

5 Objectives

ⓘ for your information

Objectives provide specific statements of the intention of a syllabus. They amplify the aim and provide direction to teachers on the teaching and learning process emerging from the syllabus. They define, in broad terms, the knowledge, understanding, skills and values and attitudes to be developed through study in the subject. They act as organisers for the intended outcomes.

Objectives will be organised under the areas of:

- knowledge, understanding and skills
- values and attitudes.

✍ consult

Knowledge, understanding and skills

Students:

- understand and connect related mathematical concepts, choosing, applying and communicating approaches in order to investigate and solve problems
- develop efficient strategies for numerical calculation, recognise patterns, describe relationships and apply algebraic techniques and generalisation
- identify, visualise and quantify time, location and shape, applying formulae, strategies and geometric reasoning
- collect, represent, analyse, interpret and evaluate data, assign and use probabilities, and make sound judgements.

Values and attitudes

Students:

- appreciate mathematics as an essential and relevant part of life, recognising that its cross-cultural development has been largely in response to human needs
- demonstrate interest, enjoyment and confidence in the pursuit and application of mathematical knowledge, understanding and skills to solve everyday problems
- develop and demonstrate perseverance in undertaking mathematical challenges.

6 Outcomes

ⓘ for your information

Syllabus outcomes express the specific intended results from teaching the syllabus. They provide clear statements of the knowledge, understanding, skills, values and attitudes expected to be gained by most students as a result of effective teaching and learning. They are derived from the objectives of the syllabus.

✍ consult

Table of objectives and outcomes

Early Stage 1 – Stage 3

Objective Students: • understand and connect related mathematical concepts, choosing, applying and communicating approaches in order to investigate and solve problems			
Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
ES1.1 describes mathematical situations using everyday and mathematical language, concrete materials, imagery and informal recordings	1.1 describes mathematical situations using everyday and mathematical language, actions, materials, diagrams and symbols	2.1 uses appropriate terminology and symbols to describe and represent mathematical ideas	3.1 describes and represents mathematical situations using appropriate terminology and conventions
ES1.2 explores problems using appropriate representations, actions, technology and/or trial and error	1.2 investigates and describes methods to solve problems	2.2 selects and uses appropriate mental, written or technological strategies to solve problems	3.2 selects and applies appropriate strategies in undertaking investigations and solving problems, including using technology
ES1.3 supports conclusions using appropriate reasoning	1.3 supports conclusions by explaining or demonstrating how answers were obtained	2.3 explains the reasoning used to check the accuracy of a statement	3.3 gives a valid reason for supporting one possible solution over another

Objective Students: • develop efficient strategies for numerical calculation, recognise patterns, describe relationships and apply algebraic techniques and generalisation			
Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
ES1.4 counts and represents numbers, combines, separates and groups collections of objects	1.4 counts, represents and uses numbers in a range of mental strategies involving the four operations	2.4 counts, records and uses numbers in mental and written strategies involving the four operations	3.4 selects and applies appropriate strategies to calculate using the four operations
ES1.5 describes two equal parts as halves	1.5 represents halves, quarters and eighths	2.5 represents commonly used fractions and decimals	3.5 calculates with simple decimals, fractions and percentages
ES1.6 creates repeating geometric and number patterns that increase or decrease	1.6 creates and completes a variety of patterns and builds number relationships	2.6 generates number patterns and completes simple number sentences by calculating missing values	3.6 analyses geometric and number patterns and completes number sentences involving the four operations

Objective Students: • identify, visualise and quantify time, location and shape, applying formulae, strategies and geometric reasoning			
Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
ES1.7 describes and compares lengths, areas, volumes, capacities and masses	1.7 measures and estimates lengths, areas, volumes, capacities and masses using informal units	2.7 calculates lengths, areas, volumes, capacities and masses using formal units	3.7 selects appropriate units to calculate lengths, areas, volumes, capacities and masses
ES1.8 sequences events, describes duration of activities using everyday language and reads clocks on the hour	1.8 describes, compares and orders duration of events and reads clocks on the half- and quarter-hour	2.8 reads, records and compares time in one-minute intervals and converts between time units	3.8 uses twenty-four hour time and twelve-hour notation, interprets timetables and constructs timelines

ES1.9 represents three- and two-dimensional figures, describes position and follows simple directions	1.9 investigates three- and two-dimensional figures, describes position and comprehends directions	2.9 makes and compares three-dimensional objects, identifies two-dimensional shapes and angles, and uses simple maps and plans	3.9 identifies and constructs three-dimensional objects, applies properties of two-dimensional shapes, measures angles and uses grid reference systems

Objective Students: • collect, represent, analyse, interpret and evaluate data, assign and use probabilities, and make sound judgements			
Early Stage 1 outcomes A student:	**Stage 1 outcomes** A student:	**Stage 2 outcomes** A student:	**Stage 3 outcomes** A student:
ES1.10 represents and interprets data displays made from objects and pictures	1.10 gathers and organises data, represents data in column and picture graphs and interprets the results	2.10 selects effective data collection methods, and constructs, compares and interprets data displays	3.10 uses appropriate data collection methods, constructs and interprets a range of data displays and analyses small data sets
ES1.11 recognises and labels the elements of chance in familiar activities	1.11 recognises and describes the elements of chance in everyday events	2.11 describes and compares chance events in social and experimental contexts	3.11 orders the likelihood of simple events on a number line from 0 to 1

Stage 4 – Stage 5

Objective Students: • understand and connect related mathematical concepts, choosing, applying and communicating approaches in order to investigate and solve problems			
Stage 4 outcomes	**Stage 5 outcomes**		
A student:	**5.1 pathway** A student:	**5.2 pathway** A student:	**5.3 pathway** A student:
4.1 represents mathematical ideas using appropriate terminology, diagrams and symbolism	5.1.1 communicates mathematical ideas using appropriate terminology, diagrams and symbolism	5.2.1 selects appropriate notations and conventions to communicate mathematical ideas and solutions	5.3.1 uses and interprets formal definitions and generalisations when explaining solutions and/or conjectures

4.2 applies appropriate mathematical techniques to solve problems	5.1.2 selects and uses appropriate strategies to solve problems	5.2.2 analyses mathematical or real-life situations, systematically applying appropriate strategies to solve problems	5.3.2 connects and generalises mathematical ideas and techniques to analyse and solve problems efficiently
4.3 recognises and explains mathematical relationships using reasoning	5.1.3 provides reasoning to support conclusions which are appropriate to the context	5.2.3 constructs arguments to prove and justify results	5.3.3 uses deductive reasoning in presenting arguments and formal proofs

Objective Students: • develop efficient strategies for numerical calculation, recognise patterns, describe relationships and apply algebraic techniques and generalisation			
Stage 4 outcomes	**Stage 5 outcomes**		
A student:	**5.1 pathway** A student:	**5.2 pathway** A student:	**5.3 pathway** A student:
4.4 operates efficiently with different representations of numbers and numerical relationships, including financial calculations	5.1.4 operates with numbers of any magnitude and performs calculations regarding earning, spending and investing money	5.2.4 performs calculations involving compound interest	5.3.4 operates with fractional indices, surds and logarithms
4.5 generalises number properties to operate with algebraic expressions and solves linear equations	5.1.5 generalises index laws to operate with algebraic expressions	5.2.5 selects and applies appropriate algebraic techniques to simplify and operate with quadratic expressions and algebraic fractions	5.3.5 systematically selects and applies appropriate algebraic techniques to operate fluently with algebraic expressions
		5.2.6 applies appropriate techniques to solve linear and simple quadratic equations, inequalities and simultaneous equations	5.3.6 applies appropriate techniques to solve linear and non-linear equations
4.6 graphs and interprets linear relationships on the number plane	5.1.6 calculates distance, midpoint and gradient on the number plane and graphs linear and simple non-linear relationships	5.2.7 graphs and interprets a range of linear and non-linear relationships	5.3.7 uses and interprets appropriate formulae to graph and analyse linear and non-linear relationships

<table>
<tr><td colspan="4">Objective
Students:
• identify, visualise and quantify time, location and shape, applying formulae, strategies and geometric reasoning</td></tr>
<tr><td>Stage 4 outcomes</td><td colspan="3">Stage 5 outcomes</td></tr>
<tr><td>A student:</td><td>5.1 pathway
A student:</td><td>5.2 pathway
A student:</td><td>5.3 pathway
A student:</td></tr>
<tr><td rowspan="2">4.7
calculates time durations, lengths and areas of plane shapes, and volumes of prisms and cylinders</td><td rowspan="2">5.1.7
selects and applies appropriate formulae to calculate areas and surface areas of prisms, and uses trigonometry</td><td rowspan="2">5.2.8
selects and applies appropriate formulae to calculate surface areas and volumes of cylinders and composite solids, and applies bearings to right-angled triangles</td><td>5.3.8
calculates surface areas and volumes of pyramids, cones, spheres and their composites</td></tr>
<tr><td>5.3.9
uses and graphs trigonometric relationships and calculates attributes of non-right-angled triangles</td></tr>
<tr><td>4.8
identifies and uses angle relationships and properties of plane shapes, including transformations and congruent figures</td><td>5.1.8
recognises and applies the properties of similar figures and scale drawings</td><td>5.2.9
calculates the angle sum of any polygon and applies results for proving triangles are congruent or similar</td><td>5.3.10
determines properties of plane shapes using deductive reasoning and formulates proofs using formal geometric arguments</td></tr>
</table>

<table>
<tr><td colspan="4">Objective
Students:
• collect, represent, analyse, interpret and evaluate data, assign and use probabilities, and make sound judgements</td></tr>
<tr><td>Stage 4 outcomes</td><td colspan="3">Stage 5 outcomes</td></tr>
<tr><td>A student:</td><td>5.1 pathway
A student:</td><td>5.2 pathway
A student:</td><td>5.3 pathway
A student:</td></tr>
<tr><td>4.9
collects, represents, analyses and interprets single data sets using appropriate statistical displays and measures of location</td><td>5.1.9
investigates and evaluates techniques of large-data collection, and compares data sets using statistical displays and measures</td><td>5.2.10
represents, describes and compares single variable and bivariate data sets using statistical displays and measures</td><td rowspan="2">5.3.11
compares and quantifies statistical relationships for single variable and bivariate data sets, evaluating the usefulness of statistics in prediction and planning</td></tr>
<tr><td>4.10
represents and calculates probabilities of simple and compound events</td><td>5.1.10
calculates relative frequencies to estimate probabilities of simple and compound events</td><td>5.2.11
describes and determines probabilities for multi-step events</td></tr>
</table>

Years 7–10 Life Skills outcomes

For students with special education needs, particularly those students with an intellectual disability, it may be determined that the Stage 4 and 5 outcomes and content are not appropriate. For these students, Life Skills outcomes and content can provide a relevant and meaningful program – see section 8.

7 Content

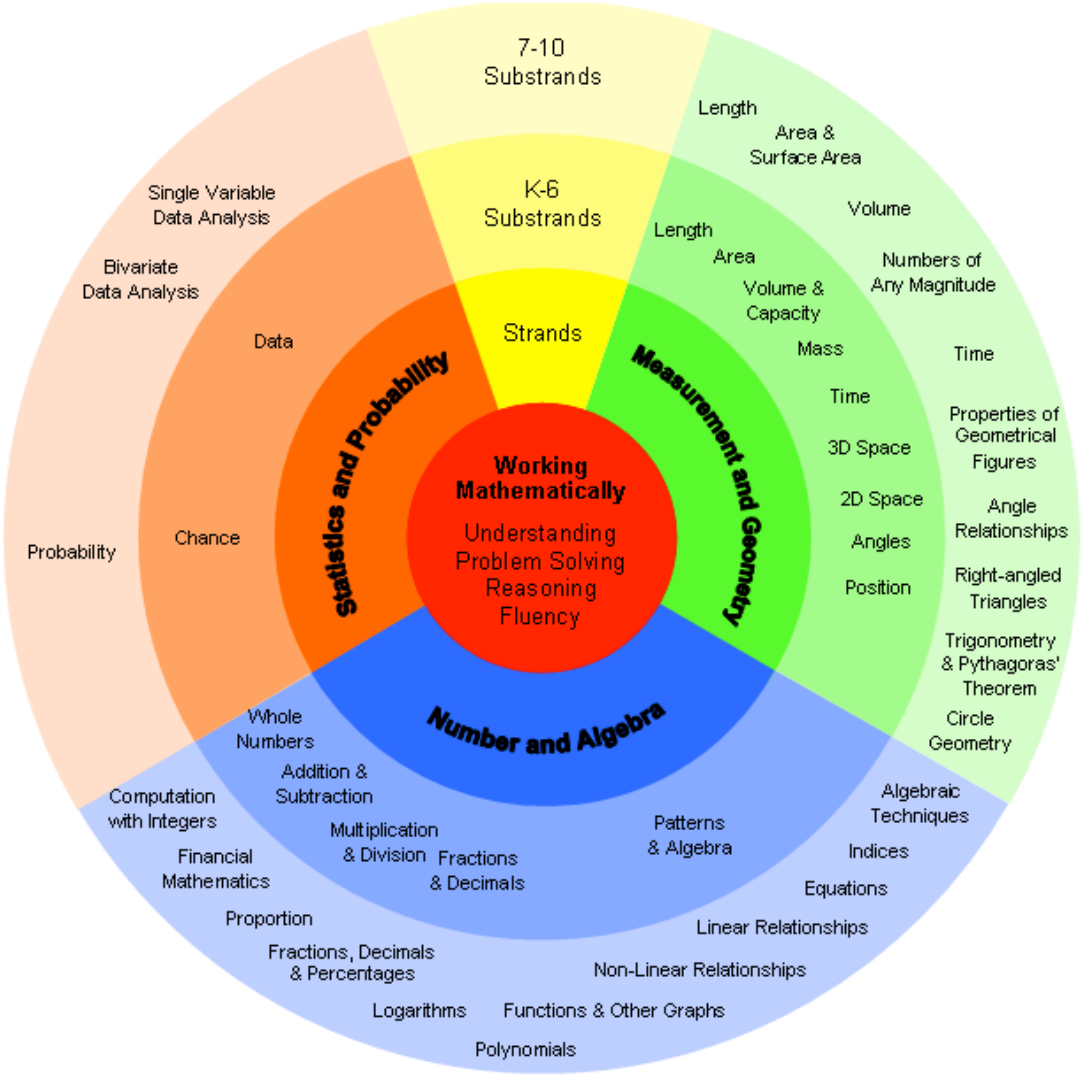
7.1 Organisation of content

ⓘ for your information

Content includes knowledge, understanding, skills, values and attitudes, and describes the substance of the subject matter that is to be studied. Syllabus content reflects a balance between the acquisition of knowledge and the processes of learning so that students are encouraged to engage in, take responsibility for, and continue their own learning.

✍ consult

Essential content



This graph represents the relationships between the strands and substrands only.
It is not intended to indicate the amount of time spent studying each strand or substrand.

The content presented in a Stage represents the knowledge, skills and understanding that are to be achieved by a typical student by the end of that Stage. It is acknowledged that students learn at different rates and in different ways, so that there will be students who have not achieved the outcomes for the Stage/s prior to that identified with their stage of schooling. For example, some students will achieve Stage 3 outcomes during Year 5, while the majority will achieve them by the end of Year 6. Other students might not develop the same understanding until Year 7 or later.

The *Mathematics K–10 Syllabus* is organised into three content strands and one proficiency strand. The syllabus is written with the flexibility to enable students to work at different Stages in different strands. For example, students could be working on Stage 4 content in one strand, and Stage 3 content in another.

Number and Algebra

The skills developed in the Number and Algebra strand are fundamental to the other strands of this syllabus and are developed across all Stages.

Measurement and Geometry

The Measurement and Geometry strand provides students with opportunities to explore and quantify measurements of three-dimensional objects, two-dimensional shapes and the world around them. Students also engage with concepts of position and movement.

Statistics and Probability

The Statistics and Probability strand includes the collection, organisation, display and analysis of data as well as the calculation of theoretical and experimental probabilities for simple and compound events.

Working Mathematically

As an essential component of the learning process, students engage in genuine mathematical activity and develop the skills to become flexible and creative users of mathematics.

Working Mathematically encompasses four interrelated proficiencies:

Understanding

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

Fluency

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

Problem Solving

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

Reasoning

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

These proficiencies describe how content is explored or developed – that is, the thinking and doing of mathematics. They provide the language to build in the developmental aspects of the learning of mathematics. At times the focus may be on a particular proficiency or group of proficiencies, but often the four proficiencies overlap.

The proficiencies are integrated into the content strands; *Problem Solving* is directly identified through content points, where appropriate. The proficiencies emphasise the active engagement that students are to undertake with the content. While not all proficiencies apply to all content, they indicate the breadth of mathematical actions that teachers are to emphasise.

Teachers are encouraged to extend students' mastery of the proficiencies by creating opportunities for their development through the learning experiences that they design.

Working Mathematically is linked to a syllabus objective and a set of outcomes. This approach has been adopted to ensure students' mastery of the proficiencies becomes increasingly sophisticated over the years of schooling.

Pathways of learning in Stage 5

The arrangement of content in Stage 5 acknowledges the wide range of achievement of students in Mathematics. Three pathways (5.1, 5.2 and 5.3) have been identified for Stage 5:

- the 5.1 pathway is designed to meet the needs of students who are continuing with Stage 4 outcomes when they enter Year 9
- the 5.2 pathway builds on and includes the content of 5.1 and is designed for students who have achieved Stage 4 outcomes generally by the end of Year 8
- the 5.3 pathway builds on and includes the content of 5.2 and is designed for students who have achieved Stage 4 outcomes before the end of Year 8.

A multitude of other pathways and thus endpoints, are also possible; for example, some students may achieve all the 5.2 outcomes and a selection of 5.3 outcomes before the end of Year 10.

When planning learning experiences for students in Years 9 and 10, teachers need to consider courses of study that students plan to follow beyond Stage 5. The table below outlines these considerations for current Stage 6 Board Developed Mathematics courses. Other students may access Stage 6 Mathematics through Board Endorsed or Life Skills courses.

Stage 5 pathway	**Intended Stage 6 Board Developed course of study**	**Recommended content from pathway above that studied in Stage 5 (if not all content)**
5.1	General Mathematics	5.2 substrands: *Financial Mathematics* *Non-linear Relationships* *Trigonometry* *Single Variable Data Analysis* (identified by ◊)
5.2	Mathematics	5.3 substrands*:* *Surds and Indices* *Algebraic Techniques* *Linear Relationships* At least some of 5.3 substrands: *Trigonometry and Pythagoras' Theorem* *Properties of Geometrical Figures* (identified by §)
5.3	Mathematics Extension 1	5.3 substrands: *Polynomials* *Logarithms* *Circle Geometry* *Functions and Other Graphs* (identified by #)

Calculators

To achieve the outcomes for Stages 4 and 5, the use of a calculator that incorporates the features generally associated with 'scientific calculators' is mandatory. Information on the calculating devices permitted by the Board of Studies can be found on the Board's website.

Additional content

In addition to the essential content that relates to the outcomes listed in each of the strands, teachers may wish to include in their teaching and learning programs other material in order to broaden and deepen students' knowledge, skills and understanding, to meet students' interests, or to stimulate student interest in other areas of mathematics.

The following list contains possible topics for inclusion as additional content in teaching and learning programs. This additional content is not essential, nor is it required as prerequisite knowledge for other content in the K–12 Mathematics curriculum. The list of additional content below is not exhaustive; teachers are encouraged to investigate additional content to meet the capabilities and interests of their students.

Additional content: Number and Algebra	
Early Stage 1 – Stage 3	**Stage 4 – Stage 5**
Calculating methods and devices, eg abacus, Napier's Bones, Russian Peasant Method, Egyptian Method	
Exploration of numbers such as perfect and amicable numbers	
Number bases other than 10	
Construction of magic squares	
Logic puzzles	
Number theory	
Codes	
Other monetary systems	Cube root formula Algorithm for finding square roots Matrices and vectors Linear programming Finite differences Three-dimensional coordinate geometry Polar coordinates

Additional content: Measurement and Geometry	
Early Stage 1 – Stage 3	**Stage 4 – Stage 5**
Fractals	
Navigation – latitude and longitude	
Further tessellations (including semi-regular tessellations)	
Semi-regular polyhedra; truncated, snub-nosed and stellated solids	
The history of the calendar	Heron's formula for the area of a triangle
Other measuring devices such as sundials	Non-metric units of measurement
Alternate measurement systems	Surveying
Unusual units of measurement	Knots
Perspective drawing	Networks
Pentominoes	Topology
	Planes of symmetry of solids
	Construction of inscribed, circumscribed and described circles for a triangle
	Constructions using ruler and compasses
	Golden section
	Golden mean construction
	Non-Euclidean geometry

Additional content: Statistics and Probability	
Early Stage 1 – Stage 3	**Stage 4 – Stage 5**
Further exploration of random number generators	The normal distribution
	Set theory

Content presentation

Sections 7.2 – 7.7 contain the essential content for Early Stage 1 to Stage 5. Within each Stage, the outcomes, content, background information and advice about language are organised into substrands within the three content strands. The content is comprised of the statements of knowledge and skills and associated Working Mathematically proficiencies.

There are some substrands that contain the development of several concepts within a Stage. To enable ease of programming, the content has been separated into two parts. The first typically contains early concept development and the second continues with further development of the concepts.

Life Skills

Life Skills outcomes and content are in section 8 of the syllabus.

Cross-curriculum areas

ⓘ for your information

The Board of Studies has described cross-curriculum areas that are to be included in syllabuses. In K–10 syllabuses, the identified areas will be embedded in the descriptions of content. The cross-curriculum areas address issues, perspectives and policies that will assist students to achieve the broad learning outcomes defined in the Board of Studies *K–10 Curriculum Framework*. The cross-curriculum areas take account of the general capabilities and cross-curriculum priorities in the Australian Curriculum.

Knowledge, understanding, skills, values and attitudes derived from the cross-curriculum areas will be included in Board syllabuses, while ensuring that subject integrity is maintained.

✍ consult

Critical and creative thinking [CCT]

In Mathematics, students use critical and creative thinking when identifying similarities and differences in mathematical situations, exploring properties of shapes, setting up statistical investigations, comparing actual to expected results, approximating and estimating, interpreting data displays, examining misleading data, and interpolating and extrapolating. Critical and creative thinking is integral in Mathematics when posing problems, modelling situations, choosing approaches to problems, justifying choices and strategies used, checking the reasonableness of solutions, reflecting on solutions to problems and giving reasons to explain mathematical ideas.

Ethical understanding [EU]

There are opportunities in the *Mathematics K–10 Syllabus* for students to develop and apply ethical understanding when collecting and displaying data, interpreting misleading graphs and displays, examining selective use of data by individuals and organisations, and detecting and eliminating bias in the reporting of information.

Information and communication technologies [ICT]

Students use ICT effectively and appropriately when they use spreadsheets, databases and dynamic geometry, computer algebra and graphing software to investigate mathematical ideas and represent mathematics in a variety of ways to aid understanding. Students use ICT to explore properties of angles and shapes including symmetry, create designs that involve shapes and transformations, informally measure length and area, represent three-dimensional objects, represent position and paths, visualise and manipulate objects, develop formulae for perimeter and area, investigate congruency and similarity, create patterns, record and display data in various forms, graph and interpret lines and curves, investigate compound interest, solve equations graphically, compare data sets, calculate measures of location and spread, model probability experiments, and use the internet to gather and analyse data presented by the media.

Intercultural understanding [IU]

In Mathematics, intercultural understanding is demonstrated through examining patterns in historical art and design, learning about culturally specific calendar days, comparing money, examining current and historic number systems, and showing awareness of cultural sensitivities when collecting data.

Literacy [L]

Mathematics has many terms and expressions particular to the subject, while also using words from everyday language that have different meanings within a mathematical context. Students are provided with opportunities to learn mathematical vocabulary and the conventions for communicating mathematics in written form, including its symbols and structure, as well as verbally through description and explanation. Mathematical literacy also extends to interpreting information from mathematical texts such as tables, graphs and other representations.

Numeracy [N]

Students become numerate as they develop the capacity to recognise and understand the role of mathematics in the world around them and the confidence, willingness and ability to apply mathematics to their lives in constructive and meaningful ways.

To be numerate is to use mathematics effectively to meet the general demands of life at home, in work and for participation in community and civic life. The *Mathematics K–10 Syllabus* provides students with opportunities to build their abilities in calculation with number, developing patterns and relationships, proportional and spatial reasoning, statistical literacy, measurement and calculation of probabilities. Highly numerate students interpret, apply and critically evaluate mathematical strategies, and communicate mathematical reasoning in a range of practical situations.

Personal and social competence [PSC]

The elements of personal and social competence relevant to mathematics include giving and following directions, visualisation and mapping skills, interpreting timetables and calendars, calculating with money and the GST, using price comparison websites, evaluating discount offers, investigating payment on terms and conducting statistical investigations in a team.

Work and enterprise [WE]

Students develop work-related knowledge, skills and understanding through constructing budgets, calculating wage and salary earnings, investigating and determining leave loading, using deductions and PAYG instalments to calculate a tax liability or refund, and investigating tax rebates and levies. Students perform calculations involving discounts, profit and loss, and use statistics to predict future earnings, monitor inventory and use information gained from surveys.