

MATHEMATICS

**Course
Framework**

From 2014



MATHEMATICS COURSE FRAMEWORK

INTRODUCTION

All courses of study for the ACT Year 12 Certificate should enable students to develop essential capabilities for twenty-first century learners. These 'capabilities' comprise an integrated and interconnected set of knowledge, skills, behaviours and dispositions that students develop and use in their learning across the curriculum.

The capabilities include:

- Literacy
- Numeracy
- Information and communication technology (ICT) capability
- Critical and creative thinking
- Personal and social capability
- Ethical behaviour
- Intercultural understanding

Courses of study for the ACT Year 12 Certificate should be both relevant to the lives of students and incorporate the contemporary issues they face. Hence, courses address the following three priorities:

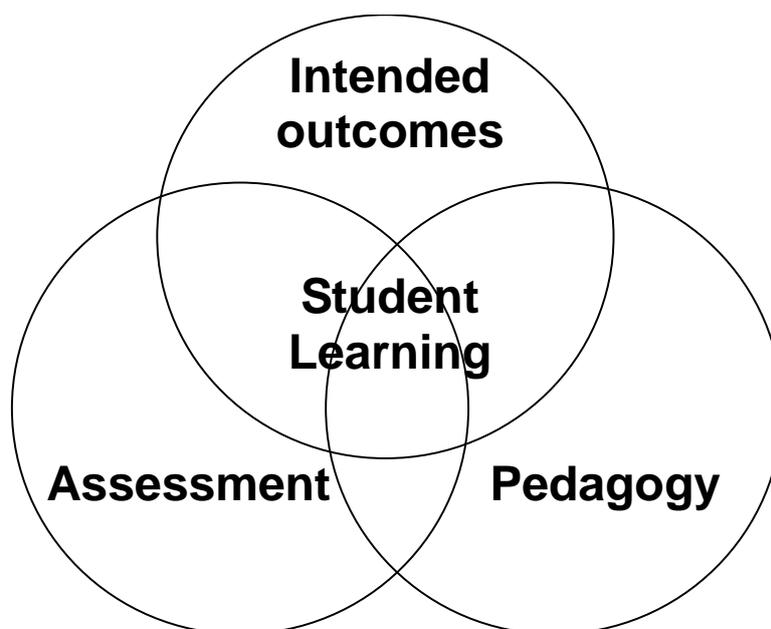
- Aboriginal and Torres Strait Islander histories and cultures
- Asia and Australia's engagement with Asia
- Sustainability

Elaboration of these student capabilities and priorities are available on the ACARA website at www.australiancurriculum.edu.au.

COURSE FRAMEWORKS

Course Frameworks provide the basis for the development and accreditation of any course within a broad subject area and provide a common basis for the assessment, moderation and reporting of student outcomes in courses based on the Framework.

Course Frameworks support a model of learning that integrates intended student outcomes, pedagogy and assessment. This model is underpinned by a set of beliefs and a set of learning principles.



Underpinning beliefs

- All students are able to learn.
- Learning is a partnership between students and teachers.
- Teachers are responsible for advancing student learning.

Learning principles

Learning builds on existing knowledge, understandings and skills.

(Prior knowledge)

1. When learning is organised around major concepts, principles and significant real world issues, within and across disciplines, it helps students make connections and build knowledge structures.

(Deep knowledge and connectedness)

Learning is facilitated when students actively monitor their own learning and consciously develop ways of organising and applying knowledge within and across contexts.

(Metacognition)

Learners' sense of self and motivation to learn affects learning.

(Self-concept)

Learning needs to take place in a context of high expectations.

(High expectations)

Learners learn in different ways and at different rates.

(Individual differences)

Different cultural environments, including the use of language, shape learners' understandings and the way they learn.

(Socio-cultural effects)

Learning is a social and collaborative function as well as an individual one.

(Collaborative learning)

Learning is strengthened when learning outcomes and criteria for judging learning are made explicit and when students receive frequent feedback on their progress.

(Explicit expectations and feedback)

Scope of Mathematics Course Framework

The scope of the Mathematics Course Framework includes, but is not limited to, the following senior secondary Australian Curriculum courses:

- Essential Mathematics
- General Mathematics
- Mathematical Methods
- Specialist Mathematics.

This document should be read in conjunction with the senior secondary Mathematics Australian Curriculum courses. Copies of these documents are available at www.australiancurriculum.edu.au.

A, T, and M courses may be developed under this framework. Eligibility to study an M course is determined by BSSS Modified course policy. Modified courses/units are designed for students:

- who satisfy the Education and Training Directorate Disability Criteria accepted as a common definition for census and other system processes by all sectors, public and non-government,
- where the principal has deemed exceptional circumstances due to the students' significant needs and previous levels of support.

Provisions for students with special needs are outlined in the *BSSS Equitable Assessment and Special Consideration in Assessment in Years 11 and 12* guidelines.

RATIONALE

Mathematics is the study of order, relation and pattern. From its origins in counting and measuring, it has evolved in highly sophisticated and elegant ways to become the language used to describe much of the modern world. Statistics is the study of ways of collecting and extracting information from data and of methods of using that information to describe and make predictions about the behaviour of aspects of the real world, in the face of uncertainty. Together, mathematics and statistics provide a framework for thinking and a means of communication that is powerful, logical, concise and precise.

The study of mathematics focuses on enabling students to develop fluency in skills including calculations, problem-solving, reasoning and further develops analytical thought and inquiry. In mathematics, students identify appropriate mathematical processes, transfer skills between contexts, make informed decisions, make connections and develop mathematical arguments.

GOALS

All courses based on this Course Framework should enable students to develop:

- understanding of concepts and techniques drawn from mathematics and statistics
- ability to solve applied problems using concepts and techniques drawn from mathematics and statistics
- capacity to choose and use technology appropriately
- reasoning and inquiry in mathematical and statistical contexts
- interpretation of mathematical and statistical information
- capacity to communicate in a concise and systematic manner using appropriate mathematical and statistical language.

Literacy in Mathematics

In the senior years literacy skills and strategies enable students to express, interpret, and communicate complex mathematical information, ideas and processes. Mathematics provides a specific and rich context for students to develop their ability to read, write, visualise and talk about complex situations involving a range of mathematical ideas. Students can apply and further develop their literacy skills and strategies by shifting between verbal, graphic, numerical and symbolic forms of representing problems in order to formulate, understand and solve problems and communicate results. Students learn to communicate their findings in different ways, using multiple systems of representation and data displays to illustrate the relationships they have observed or constructed.¹

Numeracy in Mathematics

The students who undertake this subject will continue to develop their numeracy skills. This subject contains financial applications of Mathematics that will assist students to become literate consumers of investments, loans and superannuation products. It also contains statistics topics that will equip students for the ever-increasing demands of the information age. Students will also learn about the probability of certain events occurring and will therefore be well equipped to make informed decisions in life, workplace and leisure.²

Concepts, Knowledge and Skills

Courses developed under this Framework provide details of course content through the component units of the course. While this content will differ according to the particular course, all content will be chosen to enable students to work towards the achievement of the common and agreed goals of the Framework.

Concepts and Knowledge

Algebra

Calculus

Complex numbers

Conics

Data and statistics

Financial arithmetic

Functions

Geometry

Kinematics and dynamics

Logic and proof

Matrices

Measurement

Networks and decision mathematics

Number and operations

Probability

Trigonometry

Vectors

¹ Senior Secondary Mathematics Australian Curriculum

² Senior Secondary Mathematics Australian Curriculum

Skills

Analysis

Communication

Computational fluency

Measurement

Modelling

Problem solving

Reasoning and proof

Vocational Courses

There are no vocational courses under this Course Framework.

TEACHING STRATEGIES

Course developers are encouraged to outline teaching strategies that are grounded in the Learning Principles and encompass quality teaching. Pedagogical techniques and assessment tasks should promote intellectual quality, establish a rich learning environment and generate relevant connections between learning and life experiences.

Teaching strategies that are particularly relevant and effective in Mathematics include, but are not limited to the following techniques.

Review prior learning

- brainstorming, individual, pair and group work
- student reflection of relevant concepts and skills
- diagnostic tests

Introduce new material

- link topic to prior mathematical knowledge, practical applications exposure to quality visual imagery/materials through a variety of media
- experimentation and manipulation of concrete materials
- investigation through the use of technology
- motivate study through the intrinsic beauty of the topic and relevance to future life experiences
- narrative and historical contexts

Provide demonstration, guided practice and application

- teacher demonstration, modelling and peer tutoring
- teacher scaffolding to facilitate analysis of concepts
- engagement of industry professionals, including guest speakers, demonstrators and mentors
- simulated real life and work scenarios
- online materials
- opportunities to develop modelling or problem solving skills in practical contexts

Promote independent practice and application

- research strategies and time management
- problem solving strategies

- mentoring and peer tutoring
- practice and reinforcement of learning by way of revision, worksheets, tests and demonstrations
- encourages responsibility for their own learning
- regular and meaningful feedback
- discussions, debates and student presentations
- longer-term activities such as investigative, research and project tasks
- development of student prepared summaries to be used in supervised assessment tasks (reducing the need to memorise formulas and procedures). This allows equity of access, especially for students whose first language is not English

Link to next task or skill area

- links with the broader Mathematics curriculum
- For Modified courses, teaching strategies should be underpinned by the principles of the Disability Discrimination Act and reflect contemporary pedagogical practices in meeting the needs of students with specific learning deficits or disabilities.

ASSESSMENT

The identification of assessment criteria and assessment tasks types and weightings provide a common and agreed basis for the collection of evidence of student achievement.

Assessment Criteria (the dimensions of quality that teachers look for in evaluating student work) provide a common and agreed basis for judgement of performance against unit and course goals, within and across colleges. Over a course, teachers must use all of these criteria to assess students' performance, but are not required to use all criteria on each task. Assessment criteria are to be used holistically on a given task and in determining the unit grade.

Assessment Tasks elicit responses that demonstrate the degree to which students have achieved the goals of a unit based on the assessment criteria. The Common Curriculum Elements (CCE) is a guide to developing assessment tasks that promote a range of thinking skills (see Appendix A). It is highly desirable that assessment tasks engage students in demonstrating higher order thinking.

Rubrics use the assessment criteria relevant for a particular task and can be used to assess a continuum that indicates levels of student performance against each criterion.

Assessment Criteria

Technology, its selection and appropriate use, is an integral part of all the following criteria. Students will be assessed on the degree to which they demonstrate:

- Knowledge – knowledge of mathematical facts, techniques and formulae presented in the unit
- Application – appropriate selection and application of mathematical skills in mathematical modelling and problem solving
- Reasoning – ability to use reasoning to support solutions and conclusions (in T courses only)
- Communication – interpretation and communication of mathematical ideas in a form appropriate for a given use or audience.

Assessment Task Types

Assessment for A Courses

Task Type	Weighting for 1.0 and 0.5 units	
Tests: <ul style="list-style-type: none"> - For example: - Multiple choice - Short answer - Extended questions 	40-75%	
Non-Test Tasks (in-class): <ul style="list-style-type: none"> - For example: - Validation activities - Modelling - Investigations - Problem solving - Journals - Portfolios - Presentations - Practical activities 	0-60%	25-60%
Take Home Tasks: <ul style="list-style-type: none"> - For example: - Modelling - Investigations - Portfolios - Practical activities 	0-30%	

Additional Assessment Advice for A Courses

- For a standard 1.0 unit, a minimum of **three** and a maximum of **five** assessment items.
- For a half-standard 0.5 unit, minimum of **two** and a maximum of **three** assessment items.
- Each unit (standard 1.0 or half standard 0.5) should include at least two different types of tasks. It is recommended that, in standard 1.0 units, no assessment item should carry a weighting of greater than 45% of the unit assessment.
- Where possible, for tasks completed in unsupervised circumstances, validation of the students' work should be undertaken.
- It is recommended that students undertake a take home task. It may be worth 0% and lead into a non-zero weighted in-class validation.

Assessment Task Types

Assessment for T Courses

Task Type	Weighting for 1.0 and 0.5 units	
Tests: <ul style="list-style-type: none"> - For example: - Multiple choice - Short answer <li style="padding-left: 20px;">Extended questions 	40-75%	
Non-Test Tasks (in-class): <ul style="list-style-type: none"> - For example: - Validation activities - Modelling - Investigations - Problem solving - Journals - Portfolios - Presentations - Practical activities 	0-60%	25-60%
Take Home Tasks: <ul style="list-style-type: none"> - For example: - Modelling - Investigations - Portfolios - Practical activities 	0-30%	

Additional Assessment Advice for T Courses

- For a standard 1.0 unit, a minimum of **three** and a maximum of **five** assessment items.
- For a half-standard 0.5 unit, minimum of **two** and a maximum of **three** assessment items.
- Each unit (standard 1.0 or half standard 0.5) should include at least two different types of tasks. It is recommended that, in standard 1.0 units, no assessment item should carry a weighting of greater than 45% of the unit assessment.
- Where possible, for tasks completed in unsupervised circumstances, validation of the students' work should be undertaken.
- It is recommended that students undertake a take home task. It may be worth 0% and lead into a non-zero weighted in-class validation.
- It is desirable that students studying at tertiary level investigate Mathematics beyond the classroom and this should be reflected in the task type.

Assessment Task Types

Assessment for M Courses

Task Type	Weighting for 1.0 and 0.5 units	
Tests: <ul style="list-style-type: none"> - For example: - Multiple choice - Short answer - Extended questions - Verbal tasks 	10-90%	
Non-Test Tasks (in-class): <ul style="list-style-type: none"> - For example: - Validation activities - Modelling - Investigations - Problem solving - Journals - Portfolios - Presentations - Practical activities - Verbal tasks - Class work 	0-90%	10-90%
Take Home Tasks: <ul style="list-style-type: none"> - For example: - Modelling - Investigations - Portfolios - Practical activities 	0-60%	

Additional Assessment Advice for M Courses

- For a standard 1.0 unit, a minimum of **three** and a maximum of **five** assessment items.
- For a half-standard 0.5 unit, minimum of **two** and a maximum of **three** assessment items.
- Each unit (standard 1.0 or half standard 0.5) should include at least two different types of tasks. It is recommended that, in standard 1.0 units, no assessment item should carry a weighting of greater than 45% of the unit assessment.
- Where possible, for tasks completed in unsupervised circumstances, validation of the students' work should be undertaken.
- It is recommended that students undertake a take home task. It may be worth 0% and lead into a non-zero weighted in-class validation.

ACHIEVEMENT STANDARDS

Grade descriptors provide a guide for teacher judgement of students' achievement, based on the assessment criteria, over a unit of work in this subject. Grades are organized on an A-E basis and represent standards of achievement.

Grades are awarded on the proviso that the assessment requirements have been met. Teachers will consider, when allocating grades, the degree to which students demonstrate their ability to complete and submit tasks within a specified time frame.

The following descriptors are consistent with the **system grade descriptors**.

Unit Grades for A Courses

Technology, its selection and appropriate use, is an integral part of all the following descriptors.

	<i>A student who achieves the grade A typically</i>	<i>A student who achieves the grade B typically</i>	<i>A student who achieves the grade C typically</i>	<i>A student who achieves the grade D typically</i>	<i>A student who achieves the grade E typically</i>
Knowledge	<ul style="list-style-type: none"> • Demonstrates a very high level of proficiency in the use of mathematical facts, techniques and formulae. 	<ul style="list-style-type: none"> • Demonstrates a high level of proficiency in the use of mathematical facts, techniques and formulae. 	<ul style="list-style-type: none"> • Demonstrates some proficiency in the use of mathematical facts, techniques and formulae. 	<ul style="list-style-type: none"> • Demonstrates limited use of mathematical facts, techniques and formulae. 	<ul style="list-style-type: none"> • Demonstrates very limited use of mathematical facts, techniques and formulae.
Application	<ul style="list-style-type: none"> • Selects and applies appropriate mathematical techniques to solve practical problems. 	<ul style="list-style-type: none"> • Selects and generally applies appropriate mathematical techniques to solve practical problems. 	<ul style="list-style-type: none"> • With direction, selects and applies mathematical techniques to solve practical problems. 	<ul style="list-style-type: none"> • Solves some practical mathematical problems. 	<ul style="list-style-type: none"> • With guidance, solves some mathematical practical problems.
Communication	<ul style="list-style-type: none"> • Is consistently accurate and appropriate in presentation of mathematical ideas. 	<ul style="list-style-type: none"> • Is generally accurate and appropriate in presentation of mathematical ideas. 	<ul style="list-style-type: none"> • Presents some mathematical ideas. 	<ul style="list-style-type: none"> • Presents some mathematical ideas with guidance. 	<ul style="list-style-type: none"> • Presents some mathematical ideas with guidance.

Unit Grades for T Courses

Technology, its selection and appropriate use, is an integral part of all the following descriptors.

	<i>A student who achieves the grade A typically</i>	<i>A student who achieves the grade B typically</i>	<i>A student who achieves the grade C typically</i>	<i>A student who achieves the grade D typically</i>	<i>A student who achieves the grade E typically</i>
Knowledge	<ul style="list-style-type: none"> • Demonstrates very high level of proficiency in the use of mathematical facts, techniques and formulae. 	<ul style="list-style-type: none"> • Demonstrates high level of proficiency in the use of mathematical facts, techniques and formulae. 	<ul style="list-style-type: none"> • Demonstrates some proficiency in the use of mathematical facts, techniques and formulae studied. 	<ul style="list-style-type: none"> • Demonstrates limited use of mathematical facts, techniques and formulae studied. 	<ul style="list-style-type: none"> • Demonstrates very limited use of mathematical facts, techniques and formulae studied.
Application	<ul style="list-style-type: none"> • Selects, extends and applies appropriate mathematical modelling and problem solving techniques. 	<ul style="list-style-type: none"> • Selects and applies appropriate mathematical modelling and problem solving techniques. 	<ul style="list-style-type: none"> • With direction, applies a mathematical model. Solves most problems. 	<ul style="list-style-type: none"> • Solves some mathematical problems independently. 	<ul style="list-style-type: none"> • Solves some mathematical problems with guidance.
Reasoning	<ul style="list-style-type: none"> • Uses mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions; justifies procedures. 	<ul style="list-style-type: none"> • Uses mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions. 	<ul style="list-style-type: none"> • Uses some mathematical reasoning to develop logical arguments. 	<ul style="list-style-type: none"> • Uses some mathematical reasoning to develop simple logical arguments. 	<ul style="list-style-type: none"> • Uses limited reasoning to justify conclusions.
Communication	<ul style="list-style-type: none"> • Is consistently accurate and appropriate in presentation of mathematical ideas in different contexts. 	<ul style="list-style-type: none"> • Is generally accurate and appropriate in presentation of mathematical ideas in different contexts. 	<ul style="list-style-type: none"> • Presents mathematical ideas in different contexts. 	<ul style="list-style-type: none"> • Presents some mathematical ideas. 	<ul style="list-style-type: none"> • Presents some mathematical ideas with guidance.

Unit Grades for M Courses

Technology, its selection and appropriate use, is an integral part of all the following descriptors.

	<i>A student who achieves an A grade typically, independently</i>	<i>A student who achieves a B grade typically, with some assistance</i>	<i>A student who achieves a C grade typically, with occasional assistance</i>	<i>A student who achieves a D grade typically, with continuous guidance</i>	<i>A student who achieves an E grade typically, with direct instruction</i>
Knowledge	<ul style="list-style-type: none"> demonstrates proficiency in use of simple mathematical facts, techniques and formulae 	<ul style="list-style-type: none"> demonstrates use of simple mathematical facts, techniques and formulae with some accuracy 	<ul style="list-style-type: none"> uses simple mathematical facts, techniques and formulae with some accuracy 	<ul style="list-style-type: none"> uses basic mathematical facts and techniques with limited accuracy 	<ul style="list-style-type: none"> uses basic mathematical facts and techniques with limited accuracy
Application	<ul style="list-style-type: none"> selects and applies techniques to solve practical mathematical problems 	<ul style="list-style-type: none"> selects and generally applies appropriate techniques to solve practical mathematical problems 	<ul style="list-style-type: none"> selects and applies techniques to solve practical mathematical problems 	<ul style="list-style-type: none"> solves some practical mathematical problems 	<ul style="list-style-type: none"> solves some practical mathematical problems
Communication	<ul style="list-style-type: none"> is accurate and appropriate in presentation of mathematical ideas 	<ul style="list-style-type: none"> is generally accurate in presentation of mathematical ideas 	<ul style="list-style-type: none"> presents some mathematical ideas 	<ul style="list-style-type: none"> presents some mathematical ideas 	<ul style="list-style-type: none"> presents some mathematical ideas

MODERATION

Moderation is a system designed and implemented to:

- provide comparability in the system of school-based assessment
- form the basis for valid and reliable assessment in senior secondary schools
- involve the ACT Board of Senior Secondary Studies and colleges in cooperation and partnership
- maintain the quality of school-based assessment and the credibility, validity and acceptability of Board certificates.

Moderation commences within individual colleges. Teachers develop assessment programs and instruments, apply assessment criteria, and allocate Unit Grades, according to the relevant Course Framework. Teachers within course teaching groups conduct consensus discussions to moderate marking or grading of individual assessment instruments and unit grade decisions.

The Moderation Model

Moderation within the ACT encompasses structured, consensus-based peer review of Unit Grades for all accredited courses, as well as statistical moderation of course scores, including small group procedures, for 'T' courses.

Moderation by Structured, Consensus-based Peer Review

Review is a subcategory of moderation, comprising the review of standards and the validation of Unit Grades. In the review process, Unit Grades, determined for Year 11 and Year 12 student assessment portfolios that have been assessed in schools by teachers under accredited courses, are moderated by peer review against system wide criteria and standards. This is done by matching student performance with the criteria and standards outlined in the unit grade descriptors as stated in the Course Framework. Advice is then given to colleges to assist teachers with, and/or reassure them on, their judgements.

Preparation for Structured, Consensus-based Peer Review

Each year, teachers teaching a Year 11 class are asked to retain originals or copies of student work completed in Semester 2. Similarly, teachers teaching a Year 12 class should retain originals or copies of student work completed in Semester 1. Assessment and other documentation required by the Office of the Board of Senior Secondary Studies should also be kept. Year 11 work from Semester 2 of the previous year is presented for review at Moderation Day 1 in March, and Year 12 work from Semester 1 is presented for review at Moderation Day 2 in August.

In the lead up to Moderation Day, a College Course Presentation (comprised of a document folder and a set of student portfolios) is prepared for each A and T course and any M units offered by the school, and is sent in to the Office of the Board of Senior Secondary Studies.

Teachers of C courses are required to present portfolios of student work for verification that units are taught and assessed as documented and validation that assessments meet industry standards. The Moderation Officer will report any concerns to the Board.

The College Course Presentation

The package of materials (College Course Presentation) presented by a college for review on moderation days in each course area will comprise the following:

- a folder containing supporting documentation as requested by the Office of the Board through memoranda to colleges
- a set of student portfolios containing marked and/or graded written and non-written assessment responses on which the unit grade decision has been made is to be included in the student review portfolios.

Specific requirements for subject areas and types of evidence to be presented for each moderation day will be outlined by the Board Secretariat through memoranda and Information Papers.

COURSE FRAMEWORK GROUP

Name	College
Jacob Woolley	the Canberra College
Lisa Walker	Narrabundah College
Wayne Semmens	Melba Copeland Secondary School
Erin Gallagher	Hawker College

Appendix A – Common Curriculum Elements

Common curriculum elements assist in the development of high quality assessment tasks by encouraging breadth and depth and discrimination in levels of achievement.

Organisers	Elements	Examples
create, compose and apply	apply	ideas and procedures in unfamiliar situations, content and processes in non-routine settings
	compose	oral, written and multimodal texts, music, visual images, responses to complex topics, new outcomes
	represent	images, symbols or signs
	create	creative thinking to identify areas for change, growth and innovation, recognise opportunities, experiment to achieve innovative solutions, construct objects, imagine alternatives
	manipulate	images, text, data, points of view
analyse, synthesise and evaluate	justify	arguments, points of view, phenomena, choices
	hypothesise	statement/theory that can be tested by data
	extrapolate	trends, cause/effect, impact of a decision
	predict	data, trends, inferences
	evaluate	text, images, points of view, solutions, phenomenon, graphics
	test	validity of assumptions, ideas, procedures, strategies
	argue	trends, cause/effect, strengths and weaknesses
	reflect	on strengths and weaknesses
	synthesise	data and knowledge, points of view from several sources
	analyse	text, images, graphs, data, points of view
	examine	data, visual images, arguments, points of view
investigate	issues, problems	
organise, sequence and explain	sequence	text, data, relationships, arguments, patterns
	visualise	trends, futures, patterns, cause and effect
	compare/contrast	data, visual images, arguments, points of view
	discuss	issues, data, relationships, choices/options
	interpret	symbols, text, images, graphs
	explain	explicit/implicit assumptions, bias, themes/arguments, cause/effect, strengths/weaknesses
	translate	data, visual images, arguments, points of view
	assess	probabilities, choices/options
	select	main points, words, ideas in text
identify, summarise and plan	reproduce	information, data, words, images, graphics
	respond	data, visual images, arguments, points of view
	relate	events, processes, situations
	demonstrate	probabilities, choices/options
	describe	data, visual images, arguments, points of view
	plan	strategies, ideas in text, arguments
	classify	information, data, words, images
	identify	spatial relationships, patterns, interrelationships
summarise	main points, words, ideas in text, review, draft and edit	

Appendix A – Common Curriculum Elements: **Glossary of Verbs**

Verbs	Definition
Analyse	Consider in detail for the purpose of finding meaning or relationships, and identifying patterns, similarities and differences
Apply	Use, utilise or employ in a particular situation
Argue	Give reasons for or against something
Assess	Make a Judgement about the value of
Classify	Arrange into named categories in order to sort, group or identify
Compare	Estimate, measure or note how things are similar or dissimilar
Compose	The activity that occurs when students produce written, spoken, or visual texts
Contrast	Compare in such a way as to emphasise differences
Create	Bring into existence, to originate
Demonstrate	Give a practical exhibition an explanation
Describe	Give an account of characteristics or features
Discuss	Talk or write about a topic, taking into account different issues or ideas
Evaluate	Examine and judge the merit or significance of something
Examine	Determine the nature or condition of
Explain	Provide additional information that demonstrates understanding of reasoning and /or application
Extrapolate	Infer from what is known
Hypothesise	Put forward a supposition or conjecture to account for certain facts and used as a basis for further investigation by which it may be proved or disproved
Identify	Recognise and name
Interpret	Draw meaning from
Investigate	Plan, inquire into and draw conclusions about
Justify	Show how argument or conclusion is right or reasonable
Manipulate	Adapt or change
Plan	Strategies,develop a series of steps, processes
Predict	Suggest what might happen in the future or as a consequence of something
Reflect	The thought process by which students develop an understanding and appreciation of their own learning. This process draws on both cognitive and affective experience
Relate	Tell or report about happenings, events or circumstances
Represent	Use words, images, symbols or signs to convey meaning
Reproduce	Copy or make close imitation
Respond	React to a person or text
Select	Choose in preference to another or others
Sequence	Arrange in order
Summarise	Give a brief statement of the main points
Synthesise	Combine elements (information/ideas/components) into a coherent whole
Test	Examine qualities or abilities
Translate	Express in another language or form, or in simpler terms
Visualise	The ability to decode, interpret, create, question, challenge and evaluate texts that communicate with visual images as well as, or rather than, words

Achievement Standards for Essential Mathematics (A) for Units 1 and 2

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge of concepts of measurement, financial mathematics and statistics in routine and non-routine problems in a variety of contexts selects and applies techniques in measurement, financial mathematics and statistics to solve routine and non-routine problems in a variety of contexts uses digital technologies effectively to display and organise mathematical and statistical information to solve routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of measurement, financial mathematics and statistics in routine and non-routine problems selects and applies techniques in measurement, financial mathematics and statistics to solve routine and non-routine problems uses digital technologies appropriately to display and organise mathematical and statistical information to solve routine and non-routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of measurement, financial mathematics and statistics in routine problems selects and applies techniques in measurement, financial mathematics and statistics to solve routine problems uses digital technologies to display and organise mathematical and statistical information to solve routine problems 	<ul style="list-style-type: none"> demonstrates familiarity with concepts of measurement, financial mathematics and statistics uses simple techniques in measurement, financial mathematics and statistics uses digital technologies to display and organise simple mathematical and statistical information 	<ul style="list-style-type: none"> demonstrates limited familiarity with concepts of measurement, financial mathematics or statistics uses simple techniques in a structures context uses digital technologies for arithmetic calculations
Reasoning and Communication	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts communicates clear and reasoned observations and judgments using appropriate mathematical and statistical language interprets solutions to routine and non-routine problems in a variety of contexts explains the reasonableness of results and solutions to routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems communicates clear observations and judgments using appropriate mathematical and statistical language interprets solutions to routine and non-routine problems explains the reasonableness of results and solutions to routine and non-routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine problems communicates observations and judgments using appropriate mathematical and statistical language interprets solutions to routine problems describes the reasonableness of results and solutions to routine problems 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in numerical, graphical and symbolic form describes observations using mathematical and statistical language describes solutions to routine problems describes the appropriateness of the results of calculations 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in a structured context describes simple observations identifies solutions to routine problems demonstrates limited familiarity with the appropriateness of the results of calculations

Achievement Standards for Essential Mathematics (A) for Units 3 and 4

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge of concepts of measurement, scales, graphs and statistics in routine and non-routine problems in a variety of contexts selects and applies techniques in measurement, scales, graphs and statistics to solve routine and non-routine problems in a variety of contexts uses digital technologies effectively to display and organise mathematical and statistical information to solve routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of measurement, scales, graphs and statistics in routine and non-routine problems selects and applies techniques in measurement, scales, graphs and statistics to solve routine and non-routine problems uses digital technologies appropriately to display and organise mathematical and statistical information to solve routine and non-routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of measurement, scales, graphs and statistics in routine problems selects and applies techniques in measurement, scales, graphs and statistics to solve routine problems uses digital technologies to display and organise mathematical and statistical information to solve routine problems 	<ul style="list-style-type: none"> demonstrates familiarity with concepts of measurement, scales, graphs and statistics uses simple techniques in measurement, scales, graphs and statistics uses digital technologies to display and organise simple mathematical and statistical information 	<ul style="list-style-type: none"> demonstrates limited familiarity with concepts of measurement, scales, graphs and statistics uses simple techniques in a structured context uses digital technologies for arithmetic calculations
Reasoning and Communication	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts communicates clear and reasoned observations and judgments using appropriate mathematical and statistical language interprets the solutions to routine and non-routine problems in a variety of contexts explains the reasonableness of results and solutions to routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems communicates clear observations and judgments using appropriate mathematical and statistical language interprets the solutions to routine and non-routine problems explains the reasonableness of results and solutions to routine and non-routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine problems communicates observations and judgments using appropriate mathematical and statistical language interprets the solutions to routine problems describes the reasonableness of results and solutions to routine problems 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in numerical, graphical and symbolic form describes observations using mathematical and statistical language describes the solutions to routine problems describes the appropriateness of the results of calculations 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in a structured context describes simple observations identifies the solutions to routine problems demonstrates limited familiarity with the appropriateness of the results of calculations

Achievement Standards for General Mathematics (T) for Units 1 and 2

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge of concepts of consumer arithmetic, algebra and matrices, linear equations, geometry and trigonometry, and statistics, in routine and non-routine problems in a variety of contexts selects and applies techniques in mathematics and statistics to solve routine and non-routine problems in a variety of contexts develops, selects and applies mathematical and statistical models to solve routine and non-routine problems in a variety of contexts uses digital technologies effectively to graph, display and organise mathematical and statistical information to solve a range of routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of consumer arithmetic, algebra and matrices, linear equations, geometry and trigonometry, and statistics, in routine and non-routine problems selects and applies techniques in mathematics and statistics to solve routine and non-routine problems selects and applies mathematical and statistical models to routine and non-routine problems uses digital technologies appropriately to graph, display and organise mathematical and statistical information to solve a range of routine and non-routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of consumer arithmetic, algebra and matrices, linear equations, geometry and trigonometry, and statistics, that apply to routine problems selects and applies techniques in mathematics and statistics to solve routine problems applies mathematical and statistical models to routine problems uses digital technologies to graph, display and organise mathematical and statistical information to solve routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of consumer arithmetic, algebra and matrices, linear equations, geometry and trigonometry, and statistics uses simple techniques in mathematics and statistics in routine problems demonstrates familiarity with mathematical and statistical models uses digital technologies to display some mathematical and statistical information in routine problems 	<ul style="list-style-type: none"> demonstrates limited familiarity with simple concepts of consumer arithmetic, algebra and matrices, linear equations, geometry and trigonometry, and statistics uses simple techniques in a structured context demonstrates limited familiarity with mathematical or statistical models uses digital technologies for arithmetic calculations and to display limited mathematical and statistical information
Reasoning and Communication	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts communicates mathematical and statistical judgments and arguments which are succinct and reasoned using appropriate language interprets the solutions to routine and non-routine problems in a variety of contexts explains the reasonableness of the results and solutions to routine and non-routine problems in a variety of contexts identifies and explains the validity and limitations of models used when developing solutions to routine and non-routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems communicates mathematical and statistical judgments and arguments which are clear and reasoned using appropriate language interprets the solutions to routine and non-routine problems explains the reasonableness of results and solutions to routine and non-routine problems identifies and explains limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine problems communicates mathematical and statistical arguments using appropriate language interprets the solutions to routine problems describes the reasonableness of results and solutions to routine problems identifies limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in numerical, graphical or symbolic form in routine problems communicates simple mathematical and statistical information using appropriate language describes solutions to routine problems describes the appropriateness of the results of calculations identifies limitations of simple models 	<ul style="list-style-type: none"> represents simple mathematical or statistical information in a structured context communicates simple mathematical or statistical information identifies solutions to routine problems demonstrates limited familiarity with the appropriateness of the results of calculations identifies simple models

Achievement Standards for General Mathematics (T) for Units 3 and 4

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge of concepts of statistics, growth and decay in sequences, graphs and networks, and financial mathematics in routine and non-routine problems in a variety of contexts selects and applies techniques in mathematics and statistics to solve routine and non-routine problems in a variety of contexts develops, selects and applies mathematical and statistical models to routine and non-routine problems in a variety of contexts uses digital technologies effectively to graph, display and organise mathematical and statistical information to solve a range of routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of statistics, growth and decay in sequences, graphs and networks, and financial mathematics in routine and non-routine problems selects and applies techniques in mathematics and statistics to solve routine and non-routine problems selects and applies mathematical and statistical models to routine and non-routine problems uses digital technologies appropriately to graph, display and organise mathematical and statistical information to solve a range of routine and non-routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of statistics, growth and decay in sequences, graphs and networks, and financial mathematics that apply to routine problems selects and applies techniques in mathematics and statistics to solve routine problems applies mathematical and statistical models to routine problems uses digital technologies to graph, display and organise mathematical and statistical information to solve routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of statistics, growth and decay in sequences, graphs and networks, and financial mathematics uses simple techniques in mathematics and statistics in routine problems demonstrates familiarity with mathematical and statistical models uses digital technologies to display some mathematical and statistical information in routine problems 	<ul style="list-style-type: none"> demonstrates limited familiarity with simple concepts of statistics, growth and decay in sequences, graphs and networks, and financial mathematics uses simple techniques in a structured context demonstrates limited familiarity with mathematical or statistical models uses digital technologies for arithmetic calculations and to display limited mathematical and statistical information
Reasoning and Communication	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts communicates mathematical and statistical judgments and arguments which are succinct and reasoned using appropriate language interprets the solutions to routine and non-routine problems in a variety of contexts explains the reasonableness of the results and solutions to routine and non-routine problems in a variety of contexts identifies and explains the validity and limitations of models used when developing solutions to routine and non-routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems communicates mathematical and statistical judgments and arguments which are clear and reasoned using appropriate language interprets the solutions to routine and non-routine problems explains the reasonableness of the results and solutions to routine and non-routine problems identifies and explains limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine problems communicates mathematical and statistical arguments using appropriate language interprets the solutions to routine problems describes the reasonableness of the results and solutions to routine problems identifies limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in numerical, graphical or symbolic form in routine problems communicates simple mathematical and statistical information using appropriate language describes solutions to routine problems describes the appropriateness of the results of calculations identifies limitations of simple models 	<ul style="list-style-type: none"> represents simple mathematical or statistical information in a structured context communicates simple mathematical or statistical information identifies solutions to routine problems demonstrates limited familiarity with the appropriateness of the results of calculations identifies simple models

Achievement Standards for Mathematical Methods (T) for Units 1 and 2

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, calculus and statistics in routine and non-routine problems in a variety of contexts selects and applies techniques in functions, calculus and statistics to solve routine and non-routine problems in a variety of contexts develops, selects and applies mathematical and statistical models in routine and non-routine problems in a variety of contexts uses digital technologies effectively to graph, display and organise mathematical and statistical information and to solve a range of routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, calculus and statistics in routine and non-routine problems selects and applies techniques in functions, calculus and statistics to solve routine and non-routine problems selects and applies mathematical and statistical models in routine and non-routine problems uses digital technologies appropriately to graph, display and organise mathematical and statistical information and to solve a range of routine and non-routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, calculus and statistics that apply to routine problems selects and applies techniques in functions, calculus and statistics to solve routine problems applies mathematical and statistical models in routine problems uses digital technologies to graph, display and organise mathematical and statistical information to solve routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of simple functions, calculus and statistics uses simple techniques in functions, calculus and statistics in routine problems demonstrates familiarity with mathematical and statistical models uses digital technologies to display some mathematical and statistical information in routine problems 	<ul style="list-style-type: none"> demonstrates limited familiarity with concepts of simple functions, calculus and statistics uses simple techniques in a structured context demonstrates limited familiarity with mathematical or statistical models uses digital technologies for arithmetic calculations and to display limited mathematical and statistical information
Reasoning and Communication	<ul style="list-style-type: none"> represents functions, calculus and statistics in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts communicates mathematical and statistical judgments and arguments, which are succinct and reasoned, using appropriate language interprets the solutions to routine and non-routine problems in a variety of contexts explains the reasonableness of the results and solutions to routine and non-routine problems in a variety of contexts identifies and explains the validity and limitations of models used when developing solutions to routine and non-routine problems 	<ul style="list-style-type: none"> represents functions, calculus and statistics in numerical, graphical and symbolic form in routine and non-routine problems communicates mathematical and statistical judgments and arguments, which are clear and reasoned, using appropriate language interprets the solutions to routine and non-routine problems explains the reasonableness of the results and solutions to routine and non-routine problems identifies and explains the limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents functions, calculus and statistics in numerical, graphical and symbolic form in routine problems communicates mathematical and statistical arguments using appropriate language interprets the solutions to routine problems describes the reasonableness of results and solutions to routine problems identifies the limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents simple functions and distributions in numerical, graphical or symbolic form in routine problems communicates simple mathematical and statistical information using appropriate language describes solutions to routine problems describes the appropriateness of the result of calculations identifies the limitations of simple models used 	<ul style="list-style-type: none"> represents limited mathematical or statistical information in a structured context communicates simple mathematical and statistical information identifies solutions to routine problems describes with limited familiarity the appropriateness of the results of calculations identifies simple models

Achievement Standards for Mathematical Methods (T) for Units 3 and 4

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, integration and distributions in routine and non-routine problems in a variety of contexts selects and applies techniques in functions, integration and distributions to solve routine and non-routine problems in a variety of contexts develops, selects and applies mathematical and statistical models in routine and non-routine problems in a variety of contexts uses digital technologies effectively to graph, display and organise mathematical and statistical information and to solve a range of routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, integration and distributions in routine and non-routine problems selects and applies techniques in functions, integration and distributions to solve routine and non-routine problems selects and applies mathematical and statistical models in routine and non-routine problems uses digital technologies appropriately to graph, display and organise mathematical and statistical information and to solve a range of routine and non-routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, integration and distributions that apply to routine problems selects and applies techniques in functions, integration and distributions to solve routine problems applies mathematical and statistical models in routine problems uses digital technologies to graph, display and organise mathematical and statistical information to solve routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of simple functions, integration and distributions uses simple techniques in functions, integration and distributions in routine problems demonstrates familiarity with mathematical and statistical models uses digital technologies to display some mathematical and statistical information in routine problems 	<ul style="list-style-type: none"> demonstrates limited familiarity with concepts of simple functions, integration and distributions uses simple techniques in a structured context demonstrates limited familiarity with mathematical or statistical models uses digital technologies for arithmetic calculations and to display limited mathematical and statistical information
Reasoning and Communication	<ul style="list-style-type: none"> represents functions, integration and distributions in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts communicates mathematical and statistical judgments and arguments, which are succinct and reasoned, using appropriate language interprets the solutions to routine and non-routine problems in a variety of contexts explains the reasonableness of the results and solutions to routine and non-routine problems in a variety of contexts identifies and explains the validity and limitations of models used when developing solutions to routine and non-routine problems 	<ul style="list-style-type: none"> represents functions, integration and distributions in numerical, graphical and symbolic form in routine and non-routine problems communicates mathematical and statistical judgments and arguments, which are clear and reasoned, using appropriate language interprets the solutions to routine and non-routine problems explains the reasonableness of the results and solutions to routine and non-routine problems identifies and explains the limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents functions, integration and distributions in numerical, graphical and symbolic form in routine problems communicates mathematical and statistical arguments using appropriate language interprets the solutions to routine problems describes the reasonableness of results and solutions to routine problems identifies the limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents simple functions and distributions in numerical, graphical or symbolic form in routine problems communicates simple mathematical and statistical information using appropriate language describes solutions to routine problems describes the appropriateness of the result of calculations identifies limitations of simple models used 	<ul style="list-style-type: none"> represents limited mathematical or statistical information in a structured context communicates simple mathematical and statistical information identifies solutions to routine problems demonstrates limited familiarity with the appropriateness of the results of calculations identifies simple models

Achievement Standards for Specialist Mathematics (T) for Units 1 and 2

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge and understanding of the concepts of vectors, combinatorics, geometry, matrices, trigonometry and complex numbers in routine and non-routine problems in a variety of contexts synthesises information to select and apply techniques in mathematics to solve routine and non-routine problems in a variety of contexts develops, selects and applies mathematical models to routine and non-routine problems in a variety of contexts constructs mathematical proofs in a variety of contexts, and adapts previously seen mathematical proofs uses digital technologies effectively to graph, display and organise mathematical information to solve a range of routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> demonstrates knowledge of the concepts of vectors, combinatorics, geometry, matrices, trigonometry and complex numbers in routine and non-routine problems selects and applies techniques in mathematics to solve routine and non-routine problems selects and applies mathematical models to routine and non-routine problems constructs simple mathematical proofs, and adapts previously seen mathematical proofs uses digital technologies appropriately to graph, display and organise mathematical information to solve a range of routine and non-routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of the concepts of vectors, combinatorics, geometry, matrices, trigonometry and complex numbers that apply to routine problems selects and applies techniques in mathematics to solve routine problems applies mathematical models to routine problems reproduces previously seen mathematical proofs uses digital technologies to graph, display and organise mathematical information to solve routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of the concepts of vectors, combinatorics, geometry, matrices, trigonometry and complex numbers uses simple techniques in mathematics in routine problems demonstrates familiarity with mathematical models reproduces previously seen simple mathematical proofs uses digital technologies to display some mathematical information in routine problems 	<ul style="list-style-type: none"> demonstrates limited familiarity with simple concepts of vectors, combinatorics, geometry, matrices, trigonometry and complex numbers uses simple techniques in a structured context demonstrates limited familiarity with mathematical models demonstrates limited familiarity with mathematical proofs uses digital technologies for arithmetic calculations and to display limited mathematical information
Reasoning and Communication	<ul style="list-style-type: none"> represents mathematical information in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts communicates succinct and reasoned mathematical judgments and arguments, including proofs, using appropriate language interprets the solutions to routine and non-routine problems in a variety of contexts explains the reasonableness of the results and solutions to routine and non-routine problems in a variety of contexts identifies and explains the validity and limitations of models used when developing solutions to routine and non-routine problems 	<ul style="list-style-type: none"> represents mathematical information in numerical, graphical and symbolic form in routine and non-routine problems communicates clear and reasoned mathematical judgments and arguments, including simple proofs, using appropriate language interpret the solutions to routine and non-routine problems explains the reasonableness of the results and solutions to routine and non-routine problems identifies and explains limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents mathematical information in numerical, graphical and symbolic form in routine problems communicates mathematical arguments, including previously seen proofs, using appropriate language interprets the solutions to routine problems describes the reasonableness of the results and solutions to routine problems identifies limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents mathematical information in numerical, graphical or symbolic form in routine problems communicates mathematical information using appropriate language describes solutions to routine problems describes the appropriateness of the results of calculations identifies limitations of simple models 	<ul style="list-style-type: none"> represents simple mathematical information in a structured context communicates simple mathematical information identifies solutions to routine problems demonstrates limited familiarity with the appropriateness of the results of calculations identifies simple models

Achievement Standards for Specialist Mathematics (T) for Units 3 and 4

	<i>A student who achieves an A grade typically</i>	<i>A student who achieves a B grade typically</i>	<i>A student who achieves a C grade typically</i>	<i>A student who achieves a D grade typically</i>	<i>A student who achieves an E grade typically</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge and understanding of concepts of functions, calculus, vectors and statistics in routine and non-routine problems in a variety of contexts synthesises information to select and apply techniques in mathematics to solve routine and non-routine problems in a variety of contexts develops, selects and applies mathematical models to routine and non-routine problems in a variety of contexts constructs mathematical proofs in a variety of contexts using a range of techniques uses digital technologies effectively to graph, display and organise mathematical information to solve a range of routine and non-routine problems in a variety of contexts 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, calculus, vectors and statistics in routine and non-routine problems synthesises information to select and apply techniques in mathematics to solve routine and non-routine problems selects and applies mathematical models to routine and non-routine problems constructs mathematical proofs in a variety of contexts and adapts previously seen mathematical proofs uses digital technologies appropriately to graph, display and organise mathematical information to solve a range of routine and non-routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, calculus, vectors and statistics that apply to routine problems selects and applies techniques in mathematics to solve routine problems applies mathematical models to routine problems constructs simple mathematical proofs and adapts previously seen mathematical proofs uses digital technologies to graph, display and organise mathematical information to solve routine problems 	<ul style="list-style-type: none"> demonstrates knowledge of concepts of functions, calculus, vectors and statistics uses simple techniques in mathematics in routine problems demonstrates familiarity with mathematical models reproduces previously seen mathematical proofs uses digital technologies to display some mathematical information in routine problems 	<ul style="list-style-type: none"> demonstrates limited familiarity with simple concepts of functions, calculus, vectors and statistics uses simple techniques in a structured context demonstrates limited familiarity with mathematical models reproduces previously seen simple mathematical proofs uses digital technologies for arithmetic calculations and to display limited mathematical information
Reasoning and Communication	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems in a variety of contexts communicates succinct and reasoned mathematical and statistical judgments and arguments, including proofs, using appropriate language interprets the solutions to routine and non-routine problems in a variety of contexts explains the reasonableness of the results and solutions to routine and non-routine problems in a variety of contexts identifies and explains the validity and limitations of models used when developing solutions to routine and non-routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine and non-routine problems communicates clear and reasoned mathematical and statistical judgments and arguments, including proofs, using appropriate language interpret the solutions to routine and non-routine problems explains the reasonableness of the results and solutions to routine and non-routine problems identifies and explains limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical and symbolic form in routine problems communicates mathematical and statistical arguments, including simple proofs, using appropriate language interprets the solutions to routine problems describes the reasonableness of the results and solutions to routine problems identifies limitations of models used when developing solutions to routine problems 	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, graphical or symbolic form in routine problems communicates mathematical and statistical arguments, including previously seen proofs, using appropriate language describes solutions to routine problems describes the appropriateness of the results of calculations identifies limitations of simple models 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in a structured context communicates simple mathematical and statistical information using appropriate language identifies solutions to routine problems demonstrates limited familiarity with the appropriateness of the results of calculations identifies simple models

Unit Grades for M Courses

	<i>A student who achieves an A grade typically, independently</i>	<i>A student who achieves a B grade typically, with some assistance</i>	<i>A student who achieves a C grade typically, with occasional assistance</i>	<i>A student who achieves a D grade typically, with continuous guidance</i>	<i>A student who achieves an E grade typically, with direct instruction</i>
Concepts and Techniques	<ul style="list-style-type: none"> demonstrates knowledge of mathematical concepts to solve routine problems, with explicit instruction and occasional assistance uses digital technologies to display and organise mathematical and statistical information to solve routine problems, with explicit instruction and occasional assistance 	<ul style="list-style-type: none"> demonstrates familiarity with mathematical concepts, with explicit instruction and occasional assistance uses digital technologies to display and organise simple mathematical information, with explicit instruction and occasional assistance 	<ul style="list-style-type: none"> demonstrates familiarity with some mathematical concepts, with explicit instruction and regular assistance uses digital technologies to display some mathematical and statistical information, with explicit instruction and regular assistance 	<ul style="list-style-type: none"> demonstrates limited familiarity with mathematical concepts, with explicit instruction and direct instruction uses digital technologies to display simple mathematical and statistical information, with explicit instruction and direct instruction 	<ul style="list-style-type: none"> demonstrates minimal knowledge of mathematical concepts, with explicit, continuous and direct instruction uses digital technologies for arithmetic and minimal statistical calculations, with explicit, continuous and direct instruction
Reasoning and Communication	<ul style="list-style-type: none"> represents mathematical and statistical information in numerical, and graphical form, with explicit instruction and occasional assistance summarises observations using mathematical and statistical language, with explicit instruction and occasional assistance interprets solutions to routine problems, with explicit instruction and occasional assistance 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in numerical and graphical form, with explicit instruction and occasional assistance describes observations using mathematical and statistical language, with explicit instruction and occasional assistance describes solutions to routine problems, with explicit instruction and occasional assistance 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in numerical and graphical form, with explicit instruction and regular assistance describes simple mathematical and statistical observations, with explicit instruction and regular assistance identifies solutions to problems, with explicit instruction and regular assistance 	<ul style="list-style-type: none"> represents simple mathematical and statistical information in numerical and graphical form, with explicit instruction and direct instruction records simple mathematical and statistical observations, with explicit instruction and direct instruction identifies simple solutions to problems, with explicit instruction and direct instruction 	<ul style="list-style-type: none"> represents minimal mathematical and statistical information in numerical and graphical form, with explicit, continuous and direct instruction records limited mathematical and statistical observations, with explicit, continuous instruction and direct instruction identifies minimal solutions to problems, with explicit, continuous instruction and direct instruction

