



MATHEMATICS

COURSE FRAMEWORK

INTRODUCTION

All programs of study for the ACT Year 12 Certificate should enable students to become:

- creative and critical thinkers
- enterprising problem-solvers
- skilled and empathetic communicators
- informed and ethical decision-makers
- environmentally and culturally aware citizens
- confident and capable users of technologies
- independent and self-managing learners
- collaborative team members

and provide students with:

- a comprehensive body of specific knowledge, principles and concepts
- a basis for self-directed and lifelong learning
- personal attributes enabling effective participation in society

Examples of these student capabilities are provided at Appendix A.

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.

Note: The names used for the courses in this Framework are subject to further discussion. Many in the mathematics teaching community feel the need to change the names to avoid confusion with similarly named courses in other states, and/or to distinguish the courses in this Framework from those in the previous Framework.

Courses available under the Mathematics Course Framework are:

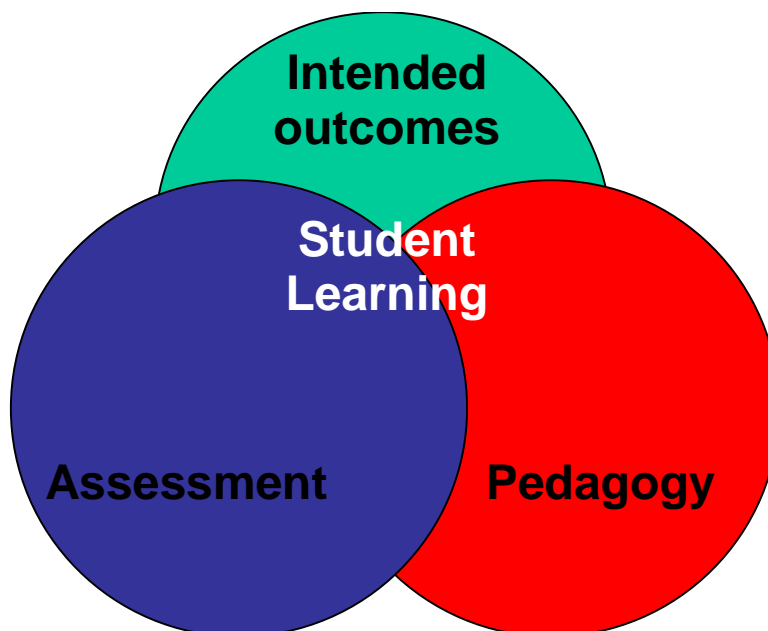
- Specialist Mathematics (T)
- Mathematical Methods (T)
- Mathematical Applications (T)
- General Mathematics (A)
- Maths for Living (A)

Educational institutions using the services of the ACTBSSS are not obliged to deliver all courses covered by this Framework. The requirements of the student cohort should determine course offerings.

Other opportunities to provide mathematics courses which allow greater flexibility in delivery and assessment than the courses described in this Framework are available through:

- the Contemporary Transitions Course Framework
- R units developed by colleges, which are not subject to the requirements of this 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

1. Learning builds on existing knowledge, understandings and skills.
(*Prior knowledge*)
2. 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*)
3. Learning is facilitated when students actively monitor their own learning and consciously develop ways of organising and applying knowledge within and across contexts.
(*Metacognition*)
4. Learners' sense of self and motivation to learn affect learning.
(*Self-concept*)
5. Learning needs to take place in a context of high expectations.
(*High expectations*)

6. Learners learn in different ways and at different rates.
(*Individual differences*)
7. Different cultural environments, including the use of language, shape learners' understandings and the way they learn.
(*Socio-cultural effects*)
8. Learning is a social and collaborative function as well as an individual one.
(*Collaborative learning*)
9. 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*)

RATIONALE

'Mathematics involves observing, representing and investigating patterns and relationships in social and physical phenomena and between mathematical objects themselves. Mathematics is the science of patterns. The mathematician seeks patterns in number, in space, in science, in computers, and in imagination. Mathematical theories explain the relation between patterns...Applications of mathematics use these patterns to explain and predict natural phenomena.'

(*National Statement on Mathematics for Australian Schools 1991 p4*)

- Mathematics is a way of thinking that encourages learners to reflect critically and reason logically.
- Mathematics employs a vital, concise and unambiguous form of communication that represents and explains by means of a symbolic system with written, spoken and visual aspects.
- Mathematics is thus a powerful tool with wide ranging applications, which include: solving quantitative problems, analysing relations among patterns and structures and explaining and predicting natural phenomena.
- Mathematics is also a creative activity with its own intrinsic value involving invention, intuition, imagination and exploration.
- Mathematics is a pervasive feature of modern society. A sound knowledge and appreciation of the subject are essential for informed citizenship.

A senior secondary education in Mathematics aims to enable students to deal successfully with the future mathematical demands of their work, further study, and personal life. It should:

- promote the development of mathematical knowledge, concepts and skills
- provide students with a variety of applications and problem solving contexts
- contribute to the development of those distinctive logical, quantitative and relational thought processes that assist people in becoming rational decision makers
- encourage students to develop proficiency in communicating mathematics

- provide students with opportunities for success in mathematics in a challenging and supportive learning environment
- incorporate the changes in knowledge and skills which the continuing growth in technology has brought to mathematics
- acknowledge and build upon the individual mathematical experiences brought to the classroom by each student
- promote an awareness and understanding of the uses, significance and value of mathematics within various contexts – social, scientific, technological, environmental, economic, cultural, political, and historical.

GOALS

Course Framework Goals focus on the essentials that students should know and be able to do as a result of studying any course covered by this Framework. They are **intended student outcomes**.

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

- select critically and use effectively mathematical language, concepts, processes and skills in a variety of contexts and applications at an appropriate level
- display the confidence to use mathematics in making informed decisions, both at work and in their personal lives
- communicate mathematical ideas effectively and creatively to diverse audiences
- be competent in the use of appropriate technology in the learning and application of mathematics
- recognise and evaluate the influence and importance of mathematics in modern society
- work both independently and co-operatively in modelling, investigating and solving mathematical problems.

COURSE DESCRIPTIONS

T Courses

Specialist Mathematics

This T course is designed for students who intend subsequent tertiary study in quantitative disciplines requiring a strong, deep understanding of mathematics, such as mathematical studies, actuarial studies, physical sciences, engineering, computer sciences, economics. For accurate information about tertiary courses, pre-requisites and assumed knowledge, students should consult current publications from the institutions or providers.

This course emphasises the development of a sophisticated understanding of abstract concepts and the ability to deal rigorously with extended logical arguments. Mathematical relationships and techniques are taught in ways that provide students with the opportunity to reason inductively and deductively, to make inferences and generalisations and communicate their mathematical understandings confidently.

Students are provided with opportunities to analyse complex problems arising in both theoretical and practical situations.

In those topics which are common to both the Specialist and Methods courses, it is intended that there be a greater depth and breadth of treatment in the Specialist course. This is provided by more emphasis on structure and proof, by incorporating harder and more abstract questions, and more challenging assessment items.

Students enrolling in this course should demonstrate an excellent grasp of Year 10 Mathematics at Advanced Level or its equivalent.

Mathematical Methods

This T course is designed for students who intend subsequent tertiary study in disciplines in which a sound and broad knowledge of mathematics is required, such as the behavioural sciences, the social sciences, applied sciences, business.

This course emphasises the acquisition and understanding of abstract mathematical concepts, relationships and techniques, incorporating practical explorations and meaningful applications. Students are provided with opportunities to analyse and solve real world problems, and to communicate their reasoning through logical arguments.

Students enrolling in this course should demonstrate a reasonable grasp of Year 10 Mathematics at Advanced Level or its equivalent.

Mathematical Applications

This T course is designed as a suitable preparation for general tertiary entry or for students intending tertiary study in areas where mathematical content is not emphasised. The course is intended to present mathematics as an organised body of useful knowledge and provides students with the skills and confidence necessary to apply this knowledge to practical situations. The content, therefore, need not be prescriptive but does need to develop the students' ability to think logically and communicate succinctly.

Students enrolling in this course should have demonstrated success in their studies of Year 10 Mathematics at a minimum of an Intermediate Level.

A Courses

General Mathematics and Maths for Living

These A courses are designed to provide students with opportunities for continuing mathematical growth. The purpose of the courses is to provide an appropriate mathematical background for students who either wish to enter occupations or continue training in areas that require the use of basic mathematical and statistical techniques. The courses focus on mathematical skills and techniques that have direct application to everyday activity and the treatment of topics contrasts with the more abstract approach taken in the T Mathematics courses.

Courses can be developed to address the needs of a variety of students. Colleges developing more than one A course should clearly identify target groups and clearly differentiate between the courses.

It is envisaged that these two courses will contain similar core topics. However, these topics will be treated and assessed more rigorously in the General Mathematics course than in the Maths for Living course. As a guide, General Mathematics courses parallel the Mathematics-General courses endorsed under the previous Framework, while Maths for Living courses parallel the Trade and Business Mathematics course endorsed under the previous Framework.

Students enrolling in these courses could bring a wide variety of mathematical experiences from previous studies.

COURSE STRUCTURE

Maths for Living (A), General Mathematics (A), Mathematical Applications (T), Mathematical Methods (T) and Specialist Mathematics (T) may be studied as minor or major courses. Specialist Mathematics may also be studied as a major-minor or double major course.

Under this structure, it is intended that, subject to other relevant BSSS policies, students will be certificated in only one Mathematics course. It is envisaged that students will have identified their appropriate course by the end of Year 11. Where students change courses during their study of Mathematics, they should be certificated in the course in which they conclude their study.

Guide to the Selection of Content

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

Essential Concepts and Skills

The content of the following section has been adapted from material on the website of the National Council of Teachers of Mathematics, at the time of publication.

All courses developed under this Framework will be based on the essential concepts and skills inherent in the subject area, as outlined below. All courses should enable students to understand these concepts and acquire these skills at an appropriate level.

Students studying T courses in Mathematics should be able to fully integrate the use of graphics calculator technology – or equivalent technologies – into their mathematics learning.

The essential **concepts** of Mathematics include the following:

Number and Operations

Number pervades all areas of mathematics. Students should understand:

- the different kinds of numbers
- the different ways of representing numbers
- the different operations that can be applied to numbers and how these operations relate to each other.

Geometry

Geometry offers ways for understanding and reflecting on our physical environment and is an essential tool in the study of many other topics in mathematics. Students should understand:

- the characteristics and properties of two- and three- dimensional geometrical objects
- the use of coordinate geometry and/or representational systems to specify locations and describe spatial relationships.

Pattern and Symmetry

Pattern and symmetry are central concepts in mathematics. Students should understand:

- the different kinds of patterns and symmetries, both numerical and geometrical, that arise in various mathematical contexts.

Measurement

Measurement is a key mathematical concept due both to its usefulness in everyday life and its vital role in the physical and social sciences. Students should understand:

- the distinction between a qualitative and quantitative approach to investigations
- the measurable attributes of objects and the units and systems of measurement.

Representation

Representation is crucial to the organisation and communication of mathematical ideas. Students should understand:

- the different ways of representing mathematical concepts and relationships – graphical, diagrammatic, symbolic
- the power and utility of clear and concise representations for the gaining of mathematical knowledge and insight
- that the range of representations used in mathematics is not fixed but is constantly expanding as part of the process of mathematical discovery.

Connections

Mathematics is a highly integrated field of study. It should be seen and experienced as a connected whole rather than as a collection of isolated skills and arbitrary rules.

Students should understand:

- the many and varied connections among mathematical ideas
- that recognising such connections is invaluable for deepening one's knowledge of mathematics
- that mathematics can be applied to a wide range of contexts outside of the mathematics classroom.

The essential **skills** inherent in Mathematics include the following:

Computational fluency

Students should be able to:

- employ efficient and accurate methods of calculation
- confidently use computational technology
- make reasonable estimates.

Measurement

Students should be able to:

- employ appropriate techniques and a variety of technologies , tools and formulae to determine measurements in various contexts to suitable degrees of accuracy.

Reasoning and Proof

Students (particularly those studying T courses developed under this Framework) should be able to:

- recognise that verification and justification are fundamental aspects of mathematics
- develop and evaluate various types of mathematical arguments and proofs at appropriate levels of rigour
- make and investigate mathematical conjectures.

Problem Solving

Students should be able to:

- formulate different kinds of mathematical problems (open-ended/closed, pure/applied) by various means – including extensions of existing problems
- apply and adapt a variety of strategies (e.g. using diagrams, searching for patterns, trying special values or cases) to solve problems
- monitor and reflect systematically on the problem solving process, recognising the dynamic and cyclic nature of mathematical problem solving.

Modelling

Students should be able to:

- identify situations in which a mathematical model would be appropriate and useful
- select and use suitable representations to model physical, social and mathematical phenomena
- explore a model mathematically and interpret the results in terms of the original situation
- validate a model, identifying its assumptions, strengths and limitations.

Communication

Students should be able to:

- communicate their mathematical thinking coherently and clearly to peers, teachers and others
- use appropriate representations to express their mathematical ideas precisely.

Recommended Content

Note: In the following content descriptions, the order in which topics are listed does not imply a sequencing of the content in any course developed.

T Courses

Core Content for Specialist Mathematics

Students studying a major in Specialist Mathematics should cover the core content of Mathematical Methods. In those topics which are common to both the Specialist and Methods courses, it is intended that there be a greater depth and breadth of treatment at the Specialist level. This may involve extending to additional areas within a topic and/or allowing for more emphasis on structure and proof, by incorporating harder and more abstract questions, and more challenging assessment items.

Core content for the Specialist Mathematics major:

- the real number system and its structure properties
- functions and relations – algebraic and graphical treatment of functions and relations, polynomials, the six basic trigonometric functions, inverse trigonometric functions exponential and logarithmic functions, rational functions, general forms of circles and ellipses, applications
- differential calculus of the above functions; the product, quotient and chain rules; applications including maxima/minima and related rates
- integral calculus involving the above functions; applications including area and volume
- probability and statistics - counting techniques including permutations and combinations; measures of central tendency and dispersion; discrete and continuous probability distributions including binomial and normal; correlation and regression
- arithmetic and geometric sequences and series, difference equations, applications including financial models
- matrices as an algebraic system, applications including the solution of systems of equations and the geometric interpretation of such solutions, transformations in the plane.

Additional units in the course could include the following topics:

- further algebra – polynomial study; complex numbers in various forms, loci in the Argand Plane; the fundamental theorem of algebra
- vectors - in 2 and 3 dimensions including scalar and vector products and applications
- logic and proof – methods of proof with applications to topics such as number theory, deductive geometry
- further calculus – parametric and implicit differentiation; integration techniques such as substitution, partial fractions, integration by parts and use of recurrence formulae; differential equations
- plane geometry – the conic sections including focus/directrix definitions and representation in various forms, with applications
- iterative processes – logistic growth, chaos theory
- numerical methods – various algorithms for locating approximate solutions of equations, approximating areas
- modelling with exponential and periodic functions – applications such as wave models, the logistic model and damped oscillations
- further abstract algebra – sets and relations, groups, permutation groups, cyclic groups, isomorphisms
- further statistics - confidence intervals, significance testing
- graph theory – definitions, matrix representation, planar graphs, paths, circuits, trees and optimisation algorithms
- kinematics and mechanics.

Core Content for Mathematical Methods:

- the real number system and its structure properties;
- functions and relations – algebraic and graphical treatment of functions and relations, including polynomials, the six basic trigonometric functions, exponential and logarithmic functions, circles, applications including models of growth and decay
- differential calculus of the above functions; the product, quotient and chain rules; applications including maxima/minima and related rates
- integral calculus involving the above functions; applications including area and volume
- probability and statistics - counting techniques including permutations and combinations; measures of central tendency and dispersion; discrete and continuous probability distributions including binomial and normal; correlation and regression
- arithmetic and geometric sequences and series; applications including financial models
- introduction to the algebra of matrices, applications.

Core Content for Mathematical Applications:

- univariate and bivariate data – collecting, summarising and analysing data; measures of central tendency and dispersion; the normal distribution and applications; correlation and regression, time series, applications in social contexts
- applied geometry and trigonometry – properties of plane and solid figures; location in plane and spherical co-ordinate systems; trigonometry of the general triangle; applications such as construction, surveying, navigation and earth geometry
- modelling relationships – linear, parabolic and exponential relationships; constant and percentage change; applications of mathematical models such as growth and decay, break-even analysis
- exploration of number patterns including arithmetic and geometric progressions
- financial applications – simple and compound interest; taxation; investment; loans
- introduction to matrices.

A courses

Note: These A courses cover similar core content, with developers distinguishing between courses by depth of treatment, choice of applications, and nature of assessment items as appropriate to the target groups.

Core Content for General Mathematics

Students studying General Mathematics course would be expected to cover the core content at a greater depth and breadth of treatment than the Maths for Living course. This may involve extending to additional areas within a topic and/or introduction of other topics and/or more challenging assessment items.

Core Content:

- statistics – collecting, summarising and interpreting univariate and bivariate data; calculation and interpretation of measures of central tendency and dispersion; graphical representations
- interpretation of a range of quantitative information in a variety of formats and co-ordinate systems – maps, tables, manuals and media reports
- numerical calculation and interpretation – percentages, ratio, proportion, rates; applications in areas such as money, health and business
- measurement – metric units, length, area, volume, capacity, mass, time, use of formulae, applications such as health, construction and manufacturing
- understanding chance – experimental and theoretical probability; informed decision making in situations involving uncertainty.

Core Content for Maths for Living:

- statistics – collecting, summarising and interpreting univariate and bivariate data; calculation and interpretation of measures of central tendency and dispersion; graphical representations
- interpretation of a range of quantitative information in a variety of formats and co-ordinate systems – maps, tables, manuals and media reports
- numerical calculation and interpretation – percentages, ratio, proportion, rates; applications in areas such as money, health and business
- measurement – metric units, length, area, volume, capacity, mass, time, use of formulae, applications such as health, construction and manufacturing
- understanding chance – experimental and theoretical probability; informed decision making in situations involving uncertainty.

Vocational Courses

There are currently no vocational courses under this Course Framework.

PEDAGOGY

Teaching strategies

Teaching strategies that are particularly relevant and effective in Mathematics recognise that students in their final years of secondary schooling need to:

- discover their own individual optimal learning style
- form positive attitudes towards the value of mathematics and look forward to opportunities for further study
- develop a capacity for independent learning.

Such strategies include:

- discussion between teacher and students, and between students
- teacher – guided learning
- appropriate practical work
- consolidation and practice of fundamental skills and routines
- sequenced investigations to scaffold learning
- participation in group activities
- individual problem solving, including the application of mathematics to everyday situations
- opportunities to develop modelling or problem solving skills in practical contexts
- 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

- use of appropriate technology to aid concept development and as a tool for problem solving. All courses should incorporate the appropriate use of suitable technology to facilitate the learning and teaching of mathematics. This could include the use of some of the following technologies: graphics calculators, spreadsheets, graphing packages, dynamic geometry systems, statistical analysis packages and computer algebra systems.

ASSESSMENT

The purpose of including assessment task types (with examples of tasks) and assessment criteria in Course Frameworks is to provide a common and agreed basis for the collection of evidence of student achievement. This collection of evidence enables a comparison of achievement within and across colleges, through moderation processes. This enables valid, fair and equitable reporting of student achievement on the ACT Year 12 Certificate.

Assessment tasks elicit responses that demonstrate the degree to which students have achieved the goals of a unit (and the course as a whole).

Assessment Task Types (with **weightings**) group assessment tasks in ways that reflect agreed shared practice in the subject area and facilitate the comparison of student work across different assessment tasks.

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 use all of these criteria to assess students' performance, but do not necessarily use all criteria on each task. Assessment criteria are to be used holistically on a given task and in determining the unit grade.

Assessment Rubrics draw on the general course framework criteria to develop assessment criteria for a task type and a continuum which indicates levels of student performance against each criterion.

Colleges may find rubrics useful in assessing and providing feedback to students on individual assessment tasks. A variety of rubrics, which could be used as models, have been developed in various colleges.

Assessment Task Types

Across the course, the recommended task types and weightings are:

Task Type	Weighting
Tests: For example: <ul style="list-style-type: none">- Multiple Choice- Short Answer- Extended Questions	40-75%
Non-Test Tasks: For example: <ul style="list-style-type: none">- Modelling- Investigations- Problem solving- Journals- Portfolios- Presentations- Practical activities	25-60%

Each unit (standard 1.0 or half standard 0.5) should include at least 2 different types of tasks. It is recommended that, in standard units, no assessment item should carry a weighting of less than 5% or greater than 45% of the unit assessment.

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.

Additional Assessment Advice

Where possible, for tasks completed in unsupervised circumstances, validation of the students' work should be undertaken.

Course developers should not have too many assessment items that count towards a unit grade or score, as this detracts from assessing depth of knowledge and skill.

Relating Assessment Task Types And Assessment Criteria To The Course Framework Goals

The congruence between goals, assessment task types (the evidence) and the assessment criteria (the basis for judging the evidence) is vital in teaching and learning.

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

The following table shows these relationships.

GOALS	ASSESSMENT TASK TYPES	ASSESSMENT CRITERIA
<ul style="list-style-type: none"> • select critically and use effectively mathematical language, concepts, processes and skills in a variety of contexts and applications at an appropriate level • display the confidence to use mathematics in making informed decisions, both at work and in their personal lives • communicate mathematical ideas effectively and creatively to diverse audiences • be competent in the use of technology in the learning and application of mathematics • recognise and evaluate the influence and importance of mathematics in modern society • work both independently and co-operatively in modelling, investigating and solving mathematical problems 	<p>Tests</p> <p>For example:</p> <ul style="list-style-type: none"> - Multiple Choice - Short Answer - Extended Questions <p>Non-Test Tasks</p> <p>For example:</p> <ul style="list-style-type: none"> - Modelling - Investigations - Problem solving - Journals - Portfolios - Presentations - Practical activities 	<ul style="list-style-type: none"> • 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 • Communication – interpretation and communication of mathematical ideas in a form appropriate for a given use or audience

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 T Courses

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

	Knowledge	Application	Reasoning	Communication
A student who achieves the grade A	Demonstrates very high level of proficiency in the use of facts, techniques and formulae.	Selects, extends and applies appropriate modelling and problem solving techniques.	Uses mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions; justifies procedures.	Is consistently accurate and appropriate in presentation of mathematical ideas in different contexts.
A student who achieves the grade B	Demonstrates high level of proficiency in the use of facts, techniques and formulae.	Selects and applies appropriate modelling and problem solving techniques.	Uses mathematical reasoning to develop logical arguments in support of conclusions, results and/or decisions.	Is generally accurate and appropriate in presentation of mathematical ideas in different contexts.
A student who achieves the grade C	Demonstrates some proficiency in the use of facts, techniques and formulae studied.	With direction, applies a model. Solves most problems.	Uses some mathematical reasoning to develop logical arguments.	Presents mathematical ideas in different contexts.
A student who achieves the grade D	Demonstrates limited use of the facts, techniques and formulae studied.	Solves some problems independently.	Uses some mathematical reasoning to develop simple logical arguments.	Presents some mathematical ideas.
A student who achieves the grade E	Demonstrates very limited use of the facts, techniques and formulae studied.	Solves some problems with guidance.	Uses limited reasoning to justify conclusions.	Presents some mathematical ideas with guidance.

Unit Grades for A Courses

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

	Knowledge	Application	Communication
A student who achieves the grade A	Demonstrates a very high level of proficiency in the use of facts, techniques and formulae.	Selects and applies appropriate techniques to solve practical problems.	Is consistently accurate and appropriate in presentation of mathematical ideas.
A student who achieves the grade B	Demonstrates a high level of proficiency in the use of facts, techniques and formulae.	Selects and generally applies appropriate techniques to solve practical problems.	Is generally accurate and appropriate in presentation of mathematical ideas.
A student who achieves the grade C	Demonstrates some proficiency in the use of facts, techniques and formulae.	With direction, selects and applies techniques to solve practical problems.	Presents some mathematical ideas.
A student who achieves the grade D	Demonstrates limited use of facts, techniques and formulae.	Solves some practical problems.	Presents some mathematical ideas with guidance.
A student who achieves the grade E	Demonstrates very limited use of facts, techniques and formulae.	With guidance, solves some practical problems.	Presents some mathematical ideas with guidance.

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 judgments.

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.

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 and completed criteria and standards feedback forms. Evidence of all 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.

BIBLIOGRAPHY

References for Curriculum Development

At the time of writing this Framework, developments in curriculum at both local and National level are occurring.

Course developers should acquaint themselves with the published outcomes of the P-10 revision of the ACT curriculum, currently titled “*Within Reach of Us All*” and ensure that courses written under this Framework articulate with Mathematics courses developed for Year 10 students.

The foreshadowed implementation of a National Australian Certificate of Education is likely to result in National curriculum documents. Course developers should consult any relevant documents from this source.

Australian Education Council, 1991 *A national statement on mathematics for Australian schools*. Carlton, Vic: Curriculum Corporation.

WEBSITES

At the time of printing, the website of the ACT BSSS at <http://www.bsss.act.edu.au> contains useful links to relevant resources.

In particular, at the time of publication, the website addresses of the Departments of Education in the various Australian States and Territories are:

<http://www.decs.act.gov.au/>

<http://www.schools.nsw.edu.au/>

<http://www.deet.nt.gov.au/education/>

<http://education.qld.gov.au/>

http://www.decs.sa.gov.au/decs_home.asp

<http://www.education.tas.gov.au/>

<http://www.education.vic.gov.au/>

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The group gratefully acknowledges the work of previous groups who developed and revised the Mathematics Course Framework.

APPENDIX A

All programs of study for the ACT Year 12 Certificate should enable students to become:

	The examples are indicative and not exhaustive. Those in bold relate particularly to the Employability Skills; those in <i>italics</i> to the Across Curriculum Perspectives.
<ul style="list-style-type: none"> creative and critical thinkers 	exploring, imagining, observing, predicting, thinking laterally, generating ideas, inquiring and researching , interrogating, conceptualising, collecting and analysing data and information, classifying , interpreting, formulating hypotheses, generalising, synthesising, reflecting , justifying conclusions, understanding different perspectives, understanding and application of different thinking strategies, understanding of scientific and mathematical language, using scientific and mathematical techniques (eg estimating, reading and interpreting data, interpolation and extrapolation)
<ul style="list-style-type: none"> enterprising problem-solvers 	showing initiative, resourcefulness , resilience, persistence, assessing and taking risks, recognising and seizing opportunities, problem-posing, problem-identification, problem clarification , being practical, being innovative , using mathematical techniques, using appropriate technologies, working independently and/or collaboratively to achieve a solution, testing assumptions and solutions, modifying approaches
<ul style="list-style-type: none"> skilled and empathetic communicators 	oral and written skills in Standard Australian English, matching communication to audience and purpose , using terminology and style appropriate to particular disciplines, using mathematical language , creating and communicating meaning using multi-modal forms, imagining the feelings and views of others , respecting and valuing diversity
<ul style="list-style-type: none"> informed and ethical decision-makers 	finding information and using evidence as the basis for judgements and decisions, developing awareness of differing perspectives , having integrity, taking action, exploring and critically reflecting on own values, attitudes and beliefs
<ul style="list-style-type: none"> environmentally and culturally aware citizens 	understanding <i>the interconnectedness of the natural and constructed world</i> ; the <i>multicultural nature of Australian society</i> ; <i>Indigenous perspectives</i> ; and global economic, social and <i>environmental</i> issues; <i>respecting difference</i> , exercising rights and responsibilities, acting in the public sphere , understanding consequences of choices and decisions
<ul style="list-style-type: none"> confident and capable users of technologies 	having a range of IT skills , accessing and evaluating <i>information</i> , designing and making, communicating using technologies, choosing most appropriate technologies for the task , refining processes, willingness to learn new skills
<ul style="list-style-type: none"> independent and self-managing learners 	eg understanding self (<i>including gender</i>), having personal goals, evaluating and monitoring own performance, taking responsibility , flexibility in adapting course of action, openness to new ideas, managing time and resources, planning and organising
<ul style="list-style-type: none"> collaborative team members 	eg contributing to group effectiveness, building trust, capacity to take different roles within a team, respecting differing strengths (<i>including contributions of boys and girls</i>), skills in negotiation and compromise, sustaining commitment to achieve group goals

and provide students with

<ul style="list-style-type: none"> • a comprehensive body of specific knowledge, principles and concepts 	<p>through subjects, cross-disciplinary courses and/or projects, work experience</p>
<ul style="list-style-type: none"> • a basis for self-directed and lifelong learning 	<p>through understanding and managing self, developing capabilities and modelling an approach ('taking stock, taking steps') that prepares for an social and economic environment of greater individual responsibility</p>
<ul style="list-style-type: none"> • personal attributes enabling effective participation in society 	<p>developing social skills and capabilities for citizenship, work experience and recognition of outside learning; through understanding of a globalised knowledge society</p>