



# Essential Mathematics

A / M

Cover Art provided by Canberra College student Aidan Giddings

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## The ACT Senior Secondary System

The ACT senior secondary system recognises a range of university, vocational or life skills pathways.

The system is based on the premise that teachers are experts in their area: they know their students and community and are thus best placed to develop curriculum and assess students according to their needs and interests. Students have ownership of their learning and are respected as young adults who have a voice.

A defining feature of the system is school-based curriculum and continuous assessment. School-based curriculum provides flexibility for teachers to address students' needs and interests. College teachers have an opportunity to develop courses for implementation across ACT schools. Based on the courses that have been accredited by the BSSS, college teachers are responsible for developing programs of learning. A program of learning is developed by individual colleges to implement the courses and units they are delivering.

Teachers must deliver all content descriptions; however, they do have flexibility to emphasise some content descriptions over others. It is at the discretion of the teacher to select the texts or materials to demonstrate the content descriptions. Teachers can choose to deliver course units in any order and teach additional (not listed) content provided it meets the specific unit goals.

School-based continuous assessment means that students are continually assessed throughout years 11 and 12, with both years contributing equally to senior secondary certification. Teachers and students are positioned to have ownership of senior secondary assessment. The system allows teachers to learn from each other and to refine their judgement and develop expertise.

Senior secondary teachers have the flexibility to assess students in a variety of ways. For example: multimedia presentation, inquiry-based project, test, essay, performance and/or practical demonstration may all have their place. College teachers are responsible for developing assessment instruments with task specific rubrics and providing feedback to students.

The integrity of the ACT Senior Secondary Certificate is upheld by a robust, collaborative and rigorous structured consensus-based peer reviewed moderation process. System moderation involves all Year 11 and 12 teachers from public, non-government and international colleges delivering the ACT Senior Secondary Certificate.

Only students who desire a pathway to university are required to sit a general aptitude test, referred to as the ACT Scaling Test (AST), which moderates student course scores across subjects and colleges. Students are required to use critical and creative thinking skills across a range of disciplines to solve problems. They are also required to interpret a stimulus and write an extended response.

Senior secondary curriculum makes provision for student-centred teaching approaches, integrated and project-based learning inquiry, formative assessment and teacher autonomy. ACT Senior Secondary Curriculum makes provision for diverse learners and students with mild to moderate intellectual disabilities, so that all students can achieve an ACT Senior Secondary Certificate.

The ACT Board of Senior Secondary Studies (BSSS) leads senior secondary education. It is responsible for quality assurance in senior secondary curriculum, assessment and certification. The Board consists of representatives from colleges, universities, industry, parent organisations and unions. The Office of the Board of Senior Secondary Studies (OBSSS) consists of professional and administrative staff who support the Board in achieving its objectives and functions.

## **ACT Senior Secondary Certificate**

Courses of study for the ACT Senior Secondary Certificate:

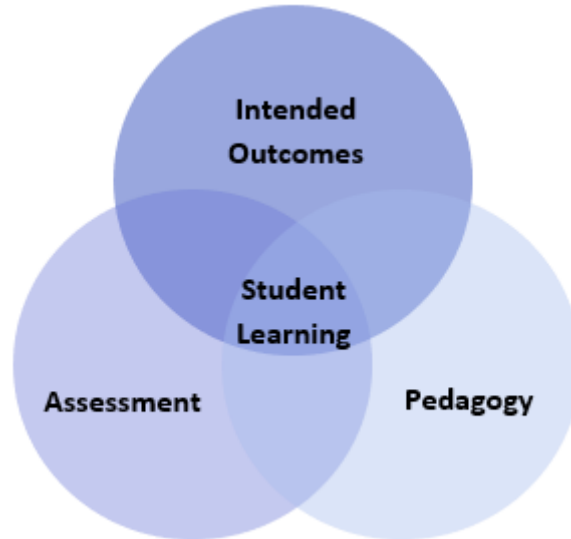
- provide a variety of pathways, to meet different learning needs and encourage students to complete their secondary education
- enable students to develop the essential capabilities for twenty-first century learners
- empower students as active participants in their own learning
- engage students in contemporary issues relevant to their lives
- foster students' intellectual, social and ethical development
- nurture students' wellbeing, and physical and spiritual development
- enable effective and respectful participation in a diverse society.

Each course of study:

- comprises an integrated and interconnected set of knowledge, skills, behaviours and dispositions that students develop and use in their learning across the curriculum
- is based on a model of learning that integrates intended student outcomes, pedagogy and assessment
- outlines teaching strategies which are grounded in learning principles and encompass quality teaching
- promotes intellectual quality, establish a rich learning environment and generate relevant connections between learning and life experiences
- provides formal assessment and certification of students' achievements.

## 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 affects 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)*

## General Capabilities

All courses of study for the ACT Senior Secondary 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)
- critical and creative thinking
- personal and social
- ethical behaviour
- intercultural understanding.

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

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

Elaboration of these General Capabilities and priorities is available on the ACARA website at [www.australiancurriculum.edu.au](http://www.australiancurriculum.edu.au).

### Literacy in Mathematics

In the senior years these 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.

### Numeracy in Mathematics

The students who undertake this subject will continue to develop their numeracy skills at a more sophisticated level than in Years F to 10. 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 about gambling.



### **Information and Communication Technology (ICT) Capability in Mathematics**

In the senior years students use ICT both to develop theoretical mathematical understanding and apply mathematical knowledge to a range of problems. They use software aligned with areas of work and society with which they may be involved such as for statistical analysis, algorithm generation, data representation and manipulation, and complex calculation. They use digital tools to make connections between mathematical theory, practice and application; for example, to use data, to address problems, and to operate systems in authentic situations.

### **Critical and Creative Thinking in Mathematics**

Students compare predictions with observations when evaluating a theory. They check the extent to which their theory-based predictions match observations. They assess whether, if observations and predictions don't match, it is due to a flaw in theory or method of applying the theory to make predictions – or both. They revise, or reapply their theory more skilfully, recognising the importance of self-correction in the building of useful and accurate theories and making accurate predictions.

### **Personal and Social Capability in Mathematics**

In the senior years students develop personal and social competence in Mathematics through setting and monitoring personal and academic goals, taking initiative, building adaptability, communication, teamwork and decision-making.

The elements of personal and social competence relevant to Mathematics mainly include the application of mathematical skills for their decision-making, life-long learning, citizenship and self-management. In addition, students will work collaboratively in teams and independently as part of their mathematical explorations and investigations.

### **Ethical Understanding in Mathematics**

In the senior years students develop ethical behaviour in Mathematics through decision-making connected with ethical dilemmas that arise when engaged in mathematical calculation and the dissemination of results and the social responsibility associated with teamwork and attribution of input.

The areas relevant to Mathematics include issues associated with ethical decision-making as students work collaboratively in teams and independently as part of their mathematical explorations and investigations. Acknowledging errors rather than denying findings and/or evidence involves resilience and examined ethical behaviour. Students develop increasingly advanced communication, research and presentation skills to express viewpoints.

### **Intercultural Understanding in Mathematics**

Students understand Mathematics as a socially constructed body of knowledge that uses universal symbols but has its origin in many cultures. Students understand that some languages make it easier to acquire mathematical knowledge than others. Students also understand that there are many culturally diverse forms of mathematical knowledge, including diverse relationships to number and that diverse cultural spatial abilities and understandings are shaped by a person's environment and language.

## **Cross-Curriculum Priorities**

### **Aboriginal and Torres Strait Islander Histories and Cultures**

The Senior Secondary Mathematics curriculum values the histories, cultures, traditions and languages of Aboriginal and Torres Strait Islander Peoples past and ongoing contributions to contemporary Australian society and culture. Through the study of mathematics within relevant contexts, opportunities will allow for the development of students' understanding and appreciation of the diversity of Aboriginal and Torres Strait Islander Peoples histories and cultures.

### **Asia and Australia's Engagement with Asia**

There are strong social, cultural and economic reasons for Australian students to engage with the countries of Asia and with the past and ongoing contributions made by the peoples of Asia in Australia. It is through the study of mathematics in an Asian context that students engage with Australia's place in the region. Through analysis of relevant data, students are provided with opportunities to further develop an understanding of the diverse nature of Asia's environments and traditional and contemporary cultures.

### **Sustainability**

Each of the senior Mathematics subjects provides the opportunity for the development of informed and reasoned points of view, discussion of issues, research and problem solving. Therefore, teachers are encouraged to select contexts for discussion connected with sustainability. Through analysis of data, students have the opportunity to research and discuss this global issue and learn the importance of respecting and valuing a wide range of world perspectives.

# Essential Mathematics

## A / M

### 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 physical 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.

Essential Mathematics focuses on enabling students to use mathematics effectively, efficiently and critically to make informed decisions in their daily lives. Essential Mathematics provides students with the mathematical knowledge, skills and understanding to solve problems in real contexts, in a range of workplace, personal, further learning and community settings. This subject offers students the opportunity to prepare for post-school options of employment and further training.

For all content areas of Essential Mathematics, the proficiency strands of understanding, fluency, problem solving and reasoning from the F–10 curriculum are still applicable and should be inherent in students' learning of the subject. Each of these proficiencies is essential, and all are mutually reinforcing. For all content areas, practice allows students to develop fluency in their skills. Students will encounter opportunities for problem solving, such as finding the volume of a solid so that the amount of liquid held in a container can be compared with what is written on the label, or finding the interest on a sum of money to enable comparison between different types of loans. In Essential Mathematics, reasoning includes critically interpreting and analysing information represented through graphs, tables and other statistical representations to make informed decisions. The ability to transfer mathematical skills between contexts is a vital part of learning in this subject. For example, familiarity with the concept of a rate enables students to solve a wide range of practical problems, such as fuel consumption, travel times, interest payments, taxation, and population growth.

The content of the Essential Mathematics subject is designed to be taught within contexts that are relevant to the needs of the particular student cohort. The skills and understandings developed throughout the subject will be further enhanced and reinforced through presentation in an area of interest to the students.

### Goals

Essential Mathematics aims to develop students:

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

## Student Group

### Links to Foundation to Year 10

For all content areas of Essential Mathematics, the proficiency strands of Understanding, Fluency, Problem Solving and Reasoning from the F–10 curriculum are still very much applicable and should be inherent in students’ learning of the subject. Each strand is essential, and all are mutually reinforcing. For all content areas, practice allows students to develop fluency in their skills. They will encounter opportunities for problem solving, such as finding the volume of a solid to enable the amount of liquid that is held in the container to be compared with what is written on the label, or finding the interest on an amount in order to be able to compare different types of loans. In Essential Mathematics, reasoning includes critically interpreting and analysing information represented through graphs, tables and other statistical representations to make informed decisions. The ability to transfer mathematical skills between contexts is a vital part of learning in this subject. For example, familiarity with the concept of a rate enables students to solve a wide range of practical problems, such as fuel consumption, travel times, interest payments, taxation, and population growth.

## Organisation of Content

Essential Mathematics focuses on using mathematics effectively, efficiently and critically to make informed decisions. It provides students with the mathematical knowledge, skills and understanding to solve problems in real contexts for a range of workplace, personal, further learning and community settings. This subject provides the opportunity for students to prepare for post-school options of employment and further training.

Essential Mathematics has four units each of which contains a number of topics. It is intended that the topics be taught in a context relevant to students’ needs and interests. In Essential Mathematics, students use their knowledge and skills to investigate realistic problems of interest which involve the application of mathematical relationships and concepts.

	Unit 1	Unit 2	Unit 3	Unit 4
<b>Essential Mathematics</b>	<ul style="list-style-type: none"> <li>• Calculations, percentages and rates</li> <li>• Measurement</li> <li>• Algebra</li> <li>• Graphs</li> </ul>	<ul style="list-style-type: none"> <li>• Representing and comparing data</li> <li>• Percentages</li> <li>• Rates and ratios</li> <li>• Time and motion</li> </ul>	<ul style="list-style-type: none"> <li>• Measurement</li> <li>• Scales, plans and models</li> <li>• Graphs</li> <li>• Data collection</li> </ul>	<ul style="list-style-type: none"> <li>• Probability and relative frequencies</li> <li>• Earth geometry and time zones</li> <li>• Loans and compound interest</li> </ul>

## Unit Titles

- Unit 1: Essential Mathematics
- Unit 2: Essential Mathematics
- Unit 3: Essential Mathematics
- Unit 4: Essential Mathematics

### Unit 1: Essential Mathematics

This unit provides students with the mathematical skills and understanding to solve problems relating to calculations, applications of measurement, the use of formulas to find an unknown quantity, and the interpretation of graphs. Teachers are encouraged to apply the content of all topics in contexts which are meaningful and of interest to their students. A variety of approaches could be used to achieve this. Two contexts which could be used in this unit are Mathematics and foods and Earning and managing money. However, these contexts may not be relevant for all students, and teachers are encouraged to find a suitable context that will make the mathematical topics of this unit relevant for their particular student cohort.

### Unit 2: Essential Mathematics

This unit provides students with the mathematical skills and understanding to solve problems related to representing and comparing data, percentages, rates and ratios, and time and motion. Teachers are encouraged to apply the content of all topics in contexts which are meaningful and of interest to the students. A variety of approaches could be used to achieve this purpose. Two possible contexts which could be used in this unit to achieve this goal are Mathematics and cars and Mathematics and independent living. However, these contexts may not be relevant for all students, and teachers are encouraged to find a suitable context that will make the mathematical topics of this unit relevant for their particular student cohort.

### Unit 3: Essential Mathematics

This unit provides students with the mathematical skills and understanding to solve problems related to measurement, scales, plans and models, drawing and interpreting graphs, and data collection. Teachers are encouraged to apply the content of all topics in contexts which are meaningful and of interest to the students. A variety of approaches could be used to achieve this purpose. Two possible contexts which could be used in this unit to achieve this goal are Mathematics and design and Mathematics and medicine. However, these contexts may not be relevant for all students and teachers are encouraged to find a suitable context that will make the mathematical topics of this unit relevant for their particular student cohort.

### Unit 4: Essential Mathematics

This unit provides students with the mathematical skills and understanding to solve problems related to probability, earth geometry and time zones, and loans and compound interest. Teachers are encouraged to apply the content of all topics in contexts which are meaningful and of interest to the students. A variety of approaches could be used to achieve this purpose. Two possible contexts which could be used in this unit are Mathematics of finance and Mathematics of travelling. However, these contexts may not be relevant for all students and teachers are encouraged to find a suitable context that will make the mathematical topics of this unit relevant for their particular student cohort.

## Assessment

The identification of criteria within the achievement standards and assessment task types and weightings provides 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 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 C). It is highly desirable that assessment tasks engage students in demonstrating higher order thinking.

**Rubrics** are constructed for individual tasks, informing 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

Students will be assessed on the degree to which they demonstrate:

- concepts and techniques
- reasoning and communications.

## Assessment Task Types

### Suggested tasks:

- project/assignment
- modelling projects
- portfolio
- journal
- validation activity
- presentation such as a pitch, poster, vodcast, interview
- practical activity such as a demonstration
- test/examination
- online adaptive tasks/quiz

### Weightings in A/T/M 1.0 Units:

No task to be weighted more than 50% for a standard 1.0 unit.

## Additional Assessment Information

### Requirements

- For a standard unit (1.0), students must complete a minimum of three assessment tasks and a maximum of five.
- For a half standard unit (0.5), students must complete a minimum of two and a maximum of three assessment tasks.
- Students should experience a variety of task types (test and non-test) and different modes of communication to demonstrate the Achievement Standards.
- Students are required to undertake at least one problem solving investigation task each semester. This task may be completed individually or collaboratively. They are required to plan, enquire into and draw conclusions about key unit concepts. Students may respond in forms such as modelling projects, problem solving and practical activities.
- Assessment tasks for a standard (1.0) or half-standard (0.5) unit must be informed by the Achievement Standards.

### Advice

- It is recommended that the total component of unsupervised tasks be no greater than 30%.
- For tasks completed in unsupervised conditions, schools need to have mechanisms to uphold academic integrity, for example, student declaration, plagiarism software, oral defence, interview, other validation tasks

## Achievement Standards

Years 11 and 12 achievement standards are written for A-T courses. A single achievement standard is written for M courses.

A Year 12 student in any unit is assessed using the Year 12 achievement standards. A Year 11 student in any unit is assessed using the Year 11 achievement standards. Year 12 achievement standards reflect higher expectations of student achievement compared to the Year 11 achievement standards. Years 11 and 12 achievement standards are differentiated by cognitive demand, the number of dimensions and the depth of inquiry.

An achievement standard cannot be used as a rubric for an individual assessment task. Assessment is the responsibility of the college. Student tasks may be assessed using rubrics or marking schemes devised by the college. A teacher may use the achievement standards to inform development of rubrics. The verbs used in achievement standards may be reflected in the rubric. In the context of combined Years 11 and 12 classes, it is best practice to have a distinct rubric for Years 11 and 12. These rubrics should be available for students prior to completion of an assessment task so that success criteria are clear.

Student achievement in A, T and M units is reported based on system standards as an A-E grade. Grade descriptors and standard work samples where available, provide a guide for teacher judgement of students' achievement over the unit.

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.



**Achievement Standards for Mathematics A Course – Year 11**

	<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>
<b>Concepts and Techniques</b>	<ul style="list-style-type: none"> <li>• applies mathematical concepts in a variety of complex contexts to routine and non-routine problems</li> <li>• select and applies mathematical techniques to solve routine and non-routine problems in a variety of complex contexts</li> <li>• uses digital technologies effectively to solve routine and non-routine problems in a variety of contexts</li> </ul>	<ul style="list-style-type: none"> <li>• applies mathematical concepts in a variety of contexts to routine and non-routine problems</li> <li>• applies mathematical techniques to solve routine and non-routine problems in a variety of contexts</li> <li>• uses digital technologies appropriately to solve routine and non-routine problems in a variety of contexts</li> </ul>	<ul style="list-style-type: none"> <li>• applies mathematical concepts in some contexts to routine and non-routine problems</li> <li>• applies simple mathematical techniques to solve routine problems in some contexts</li> <li>• uses digital technologies appropriately to solve routine problems in some contexts</li> </ul>	<ul style="list-style-type: none"> <li>• applies simple mathematical concepts in limited contexts to routine problems</li> <li>• applies simple mathematical techniques to solve routine problems in limited contexts</li> <li>• uses digital technologies to solve routine problems in structured contexts</li> </ul>	<ul style="list-style-type: none"> <li>• applies simple mathematical concepts in structured contexts</li> <li>• applies simple mathematical techniques to solve routine problems in structured contexts</li> <li>• uses digital technologies to solve routine problems in structured contexts</li> </ul>
<b>Reasoning and Communications</b>	<ul style="list-style-type: none"> <li>• represents some complex mathematical concepts in numerical and graphical form in routine and non-routine problems for a variety of contexts</li> <li>• communicates mathematical information in oral, written and/or multimodal forms, which are well reasoned, using accurate and appropriate language</li> <li>• reflects with insight on own thinking and learning, evaluates planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• evaluates the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>• represents mathematical concepts in numerical and graphical form in routine and non-routine problems for a variety of contexts</li> <li>• communicates mathematical information in oral, written and/or multimodal forms, which are clear, using accurate and appropriate language</li> <li>• reflects on own thinking and learning, analyses inter and intrapersonal skills including planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• analyses the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>• represents mathematical concepts in numerical and graphical form to some routine and non-routine problems for routine contexts</li> <li>• communicates mathematical judgements in oral, written and/or multimodal forms, using appropriate language</li> <li>• reflects on own thinking and learning, explains planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• explains the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>• represents simple mathematical concepts in numerical or graphical form in routine problems for routine contexts</li> <li>• communicates simple mathematical judgements in oral, written and/or multimodal forms, with some use of appropriate language</li> <li>• reflects on their own thinking with some reference to planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• describes the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>• represents simple mathematical concepts in numerical or graphical form in routine problems for structured contexts</li> <li>• communicates simple mathematical information in oral, written and/or multimodal forms, with limited use of appropriate language</li> <li>• reflects on their own thinking with little or no reference to planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• identifies some ways in which Mathematics is used to generate knowledge in the public good</li> </ul>

**Achievement Standards for Mathematics A Course – Year 12**

	<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>
<b>Concepts and Techniques</b>	<ul style="list-style-type: none"> <li>• applies mathematical concepts in a variety of complex contexts to routine and non-routine problems</li> <li>• select and applies mathematical techniques to solve routine and non-routine problems in a variety of contexts</li> <li>• uses digital technologies effectively to solve routine and non-routine problems in a variety of contexts</li> </ul>	<ul style="list-style-type: none"> <li>• applies mathematical concepts in a variety of contexts to routine and non-routine problems</li> <li>• applies mathematical techniques to solve routine and non-routine problems in a variety of contexts</li> <li>• uses digital technologies appropriately to solve routine and non-routine problems in a variety of contexts</li> </ul>	<ul style="list-style-type: none"> <li>• applies mathematical concepts in some contexts to routine and non-routine problems</li> <li>• applies simple mathematical techniques to solve routine problems in some contexts</li> <li>• uses digital technologies appropriately to solve routine problems in some contexts</li> </ul>	<ul style="list-style-type: none"> <li>• applies simple mathematical concepts in limited contexts to routine problems</li> <li>• uses simple mathematical techniques to solve routine problems in limited contexts</li> <li>• uses digital technologies to solve routine problems in limited contexts</li> </ul>	<ul style="list-style-type: none"> <li>• applies simple mathematical concepts in structured contexts</li> <li>• uses simple mathematical techniques to solve routine problems in structured contexts</li> <li>• uses digital technologies to solve routine problems in structured contexts</li> </ul>
<b>Reasoning and Communications</b>	<ul style="list-style-type: none"> <li>• represents <del>some</del> complex mathematical concepts in numerical and graphical form in routine and non-routine problems in a variety of contexts</li> <li>• communicates mathematical information in oral, written and/or multimodal forms, which are logical and reasoned, using appropriate language</li> <li>• analyse the reasonableness of solutions to routine and non-routine problems in a variety of contexts</li> <li>• reflects with insight on their own thinking and that of others and evaluates planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• evaluates the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>• represents mathematical concepts in numerical and graphical form in routine and non-routine problems in a variety of contexts</li> <li>• communicates mathematical information in oral, written and/or multimodal forms, which are logical and clear, using appropriate language</li> <li>• explains the reasonableness of solutions to routine and non-routine problems</li> <li>• reflects on their own thinking and analyses planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• analyses the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>• represents mathematical concepts in numerical and graphical form to some routine and non-routine problems in some contexts</li> <li>• communicates mathematical judgements in oral, written and/or multimodal forms, using appropriate language</li> <li>• describes the reasonableness of solutions to some routine and non-routine problems</li> <li>• reflects on their own thinking and explains planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• explains the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>• represents simple mathematical concepts in numerical or graphical form in routine problems in structured contexts</li> <li>• communicates simple mathematical judgements in oral, written and/or multimodal forms, with some use of appropriate language</li> <li>• describes the appropriateness of solutions to routine problems</li> <li>• reflects on their own thinking with some reference to planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• describes the potential of Mathematics to generate knowledge in the public good</li> </ul>	<ul style="list-style-type: none"> <li>• represents simple mathematical concepts in numerical or graphical form in structured contexts</li> <li>• communicates simple mathematical information in oral, written and/or multimodal forms, with limited use of appropriate language</li> <li>• identifies solutions to routine problems</li> <li>• reflects on their own thinking with little or no reference to planning, time management, use of appropriate strategies to work independently and collaboratively</li> <li>• identifies some ways in which Mathematics is used to generate knowledge in the public good</li> </ul>

**Achievement Standards for Mathematics M Course – Years 11 and 12**

	<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>
<b>Concepts and Techniques</b>	<ul style="list-style-type: none"> <li>• applies numeracy skills in a variety of contexts to routine and non-routine problems, with independence</li> <li>• uses digital technologies effectively to solve routine and non-routine problems in a variety of contexts, with independence</li> </ul>	<ul style="list-style-type: none"> <li>• applies numeracy skills in a variety of contexts to routine and non-routine problems, with some independence</li> <li>• uses digital technologies appropriately to solve routine and non-routine problems in a variety of contexts, with some independence</li> </ul>	<ul style="list-style-type: none"> <li>• applies numeracy skills in some contexts to routine and non-routine problems, with assistance</li> <li>• uses digital technologies appropriately to solve routine problems in limited contexts, with assistance</li> </ul>	<ul style="list-style-type: none"> <li>• applies simple numeracy skills in limited contexts to routine problems, with repeated cueing</li> <li>• uses digital technologies to solve routine problems in structured contexts, with repeated cueing</li> </ul>	<ul style="list-style-type: none"> <li>• applies simple numeracy skills in structured contexts, with direct instruction</li> <li>• uses digital technologies efficiently to solve routine and non-routine problems in a variety of contexts, with direct instruction</li> </ul>
<b>Reasoning and Communications</b>	<ul style="list-style-type: none"> <li>• represents numeracy skills in numerical and graphical form in routine and non-routine problems in a variety of contexts, with independence</li> <li>• communicates mathematical information in oral, written and/or multimodal forms, using appropriate language, with independence</li> <li>• reflects with insight on own thinking and learning in mathematics, with independence</li> </ul>	<ul style="list-style-type: none"> <li>• represents numeracy skills in numerical and graphical form in routine and non-routine problems, with some independence</li> <li>• communicates mathematical information in oral, written and/or multimodal forms, using appropriate language, with some independence</li> <li>• reflects on own thinking and learning in mathematics, with some independence</li> </ul>	<ul style="list-style-type: none"> <li>• represents numeracy skills in numerical and graphical form in some routine and non-routine problems, with assistance</li> <li>• communicates mathematical information in oral, written and/or multimodal forms, using appropriate language, with assistance</li> <li>• reflects on own thinking and learning in mathematics, with assistance</li> </ul>	<ul style="list-style-type: none"> <li>• represents simple numeracy skills in numerical or graphical form in routine problems, with repeated cueing</li> <li>• communicates simple mathematical information in oral, written and/or multimodal forms, using appropriate language, with repeated cueing</li> <li>• reflects on own thinking and learning in mathematics, with repeated cueing</li> </ul>	<ul style="list-style-type: none"> <li>• represents simple numeracy skills in numerical or graphical form in structured contexts, with direct instruction</li> <li>• communicates simple mathematical information in oral, written and/or multimodal forms, using appropriate language, with direct instruction</li> <li>• reflects on own thinking and learning in mathematics, with frequent prompting</li> </ul>

## Unit 1: Essential Mathematics

**Value: 1.0**

**Unit 1a: Essential Mathematics**

**Value: 0.5**

**Unit 1b: Essential Mathematics**

**Value: 0.5**

### Unit Description

This unit provides students with the mathematical skills and understanding to solve problems relating to calculations, applications of measurement, the use of formulas to find an unknown quantity, and the interpretation of graphs. Teachers are encouraged to apply the content of the four topics in this unit – ‘Calculations, percentages and rates’, ‘Measurement’, ‘Algebra’ and ‘Graphs’ – in contexts which are meaningful and of interest to their students. A variety of approaches can be used to achieve this purpose. Two possible contexts which may be used are Mathematics and foods and Earning and managing money. However, as these contexts may not be relevant to all students, teachers are encouraged to find suitable contexts relevant to their particular student cohort.

It is assumed that an extensive range of technological applications and techniques will be used in teaching this unit. The ability to choose when and when not to use some form of technology, and the ability to work flexibly with technology, are important skills.

### Specific Unit Goals

This unit should enable students to:

A course	M course
<ul style="list-style-type: none"> <li>• understand the concepts and techniques in calculations, measurement, algebra and graphs</li> <li>• apply reasoning skills and solve practical problems in calculations, measurement, algebra and graphs</li> <li>• communicate their arguments and strategies when solving problems using appropriate mathematical language</li> <li>• interpret mathematical information and ascertain the reasonableness of their solutions to problems.</li> </ul>	<ul style="list-style-type: none"> <li>• demonstrate techniques in calculations, measurement and graphs</li> <li>• able to substitute values into expressions</li> <li>• solve practical problems in calculations, measurement and graphs</li> <li>• communicate their strategies when solving problems using appropriate mathematical language</li> <li>• identify appropriate mathematical information</li> </ul>

## Content Descriptions

Further elaboration of the content of this unit is available on the ACARA Australian Curriculum website.

All knowledge, understanding and skills below must be delivered:

A course	M course
<b>Topic 1: Calculations, percentages and rates</b>	
<p><b>Calculations</b></p> <ul style="list-style-type: none"> <li>• solve practical problems requiring basic number operations</li> <li>• apply arithmetic operations according to their correct order</li> <li>• ascertain the reasonableness of answers to arithmetic calculations</li> <li>• use leading-digit approximation to obtain estimates of calculations</li> <li>• use a calculator for multi-step calculations</li> <li>• check results of calculations for accuracy</li> <li>• recognise the significance of place value after the decimal point</li> <li>• evaluate decimal fractions to the required number of decimal places</li> <li>• round up or round down numbers to the required number of decimal places</li> <li>• apply approximation strategies for calculations</li> </ul>	<p><b>Calculations</b></p> <ul style="list-style-type: none"> <li>• use basic number operations</li> <li>• use arithmetic operations in indicated order</li> <li>• ascertain the reasonableness of answers to arithmetic calculations</li> <li>• use a calculator for multi-step calculations</li> <li>• recognise the significance of place value</li> <li>• round up or round down numbers</li> <li>• apply number sense strategies for calculations</li> </ul>
<p><b>Percentages</b></p> <ul style="list-style-type: none"> <li>• calculate a percentage of a given amount</li> <li>• determine one amount expressed as a percentage of another</li> <li>• apply percentage increases and decreases in situations; for example, mark-ups, discounts and GST (</li> </ul>	<p><b>Percentages</b></p> <ul style="list-style-type: none"> <li>• calculate a percentage of a given amount</li> <li>• apply percentage increases and decreases; for example, mark-ups, discounts and GST</li> </ul>
<p><b>Rates</b></p> <ul style="list-style-type: none"> <li>• identify common usage of rates; for example, km/h as a rate to describe speed, beats/minute as a rate to describe pulse</li> <li>• convert units of rates occurring in practical situations to solve problems</li> <li>• use rates to make comparisons; for example, using unit prices to compare best buys, comparing heart rates after exercise</li> </ul>	<p><b>Rates</b></p> <ul style="list-style-type: none"> <li>• identify common rates; for example, km/h as a rate to describe speed</li> <li>• use rates in practical situations</li> <li>• use rates to make comparisons; for example, using unit prices to compare best buys</li> </ul>

A course	M course
<b>Topic 2: Measurement</b>	
<p><b>Linear measure</b></p> <ul style="list-style-type: none"> <li>• use metric units of length, their abbreviations, conversions between them, and appropriate levels of accuracy and choice of units</li> <li>• estimate lengths</li> <li>• convert between metric units of length and other length units</li> <li>• calculate perimeters of familiar shapes, including triangles, squares, rectangles, and composites of these</li> </ul>	<p><b>Linear measure</b></p> <ul style="list-style-type: none"> <li>• use metric units of length with their abbreviations, conversions between them</li> <li>• estimate lengths</li> <li>• convert between metric units of length</li> <li>• calculate perimeters of familiar shapes; for example triangles, squares and rectangles</li> </ul>
<p><b>Area measure</b></p> <ul style="list-style-type: none"> <li>• use metric units of area, their abbreviations, conversions between them, and appropriate choices of</li> <li>• estimate the areas of different shapes</li> <li>• convert between metric units of area and other area units</li> <li>• calculate areas of rectangles and triangle</li> </ul>	<p><b>Area measure</b></p> <ul style="list-style-type: none"> <li>• use metric units of area with their abbreviations</li> <li>• estimate the areas of different shapes using a grid</li> <li>• calculate areas of rectangles and triangles</li> </ul>
<p><b>Mass</b></p> <ul style="list-style-type: none"> <li>• use metric units of mass, their abbreviations, conversions between them, and appropriate choices of units</li> <li>• estimate the mass of different objects</li> </ul>	<p><b>Mass</b></p> <ul style="list-style-type: none"> <li>• use metric units of mass with their abbreviations</li> <li>• estimate the mass of different objects</li> </ul>
<p><b>Volume and capacity</b></p> <ul style="list-style-type: none"> <li>• use metric units of volume, their abbreviations, conversions between them, and appropriate choices of units</li> <li>• understand the relationship between volume and capacity</li> <li>• estimate volume and capacity of various objects</li> <li>• calculate the volume of objects, such as cubes and rectangular and triangular prisms</li> </ul>	<p><b>Volume and capacity</b></p> <ul style="list-style-type: none"> <li>• use metric units of volume with their abbreviations</li> <li>• use metric units of capacity</li> <li>• estimate volume of various shapes</li> <li>• estimate the capacity of various shapes</li> </ul>

A course	M course
<p><b>Units of energy</b></p> <ul style="list-style-type: none"> <li>• use units of energy to describe consumption of electricity, such as kilowatt hours</li> <li>• use units of energy used for foods, including calories (</li> <li>• use units of energy to describe the amount of energy in activity, such as kilojoules</li> <li>• convert from one unit of energy to another.</li> </ul>	<p><b>Units of energy</b></p> <ul style="list-style-type: none"> <li>• use units of energy such as kilowatt hours</li> <li>• use units of energy such as calories and kilojoules</li> </ul>
<b>Topic 3: Algebra</b>	
<p><b>Single substitution</b></p> <ul style="list-style-type: none"> <li>• substitute numerical values into algebraic expressions; for example, substitute different values of <math>x</math> to evaluate the expressions <math>\frac{3x}{5}</math>, <math>5(2x - 4)</math>, <math>\frac{3x}{5}</math>, <math>5(2x - 4)</math>.</li> </ul>	<p><b>Single substitution</b></p> <ul style="list-style-type: none"> <li>• substitute numerical values into algebraic expressions</li> </ul>
<p><b>General substitution</b></p> <ul style="list-style-type: none"> <li>• substitute given values for the other pronumerals in a mathematical formula to find the value of the subject of the formula</li> </ul>	<p><b>General substitution</b></p> <ul style="list-style-type: none"> <li>• substitute given values in a mathematical formula to find the value of the subject</li> </ul>
<b>Topic 4: Graphs</b>	
<p><b>Reading and interpreting graphs</b></p> <ul style="list-style-type: none"> <li>• interpret information presented in graphs, such as conversion graphs, line graphs, step graphs, column graphs and picture graphs</li> <li>• interpret information presented in two-way tables</li> <li>• discuss and interpret graphs found in the media and in factual texts</li> </ul>	<p><b>Reading and interpreting graphs</b></p> <ul style="list-style-type: none"> <li>• use information presented in graphs, for example conversion graphs, line graphs, step graphs, column graphs and picture graphs</li> <li>• discuss graphs found in the media and texts</li> </ul>
<p><b>Drawing graphs</b></p> <ul style="list-style-type: none"> <li>• determine which type of graph is best used to display a dataset</li> <li>• use spreadsheets to tabulate and graph data</li> <li>• draw a line graph to represent any data that demonstrate a continuous change, such as hourly temperature</li> </ul>	<p><b>Drawing graphs</b></p> <ul style="list-style-type: none"> <li>• use graph to display a dataset</li> <li>• use spreadsheets to make tables and graphs of data</li> <li>• draw a simple line graph</li> </ul>

## **A guide to reading and implementing content descriptions**

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

### **Assessment**

Refer to pages 10-12.



## Unit 2: Essential Mathematics

**Value: 1.0**

**Unit 2a: Essential Mathematics**

**Value: 0.5**

**Unit 2b: Essential Mathematics**

**Value: 0.5**

### Unit Description

This unit provides students with the mathematical skills and understanding to solve problems related to representing and comparing data, percentages, rates and ratios, the mathematics of finance, and time and motion. Teachers are encouraged to apply the content of the four topics in this unit – ‘Representing and comparing data’, ‘Percentages’, ‘Rates and ratios’ and ‘Time and motion’ – in a context which is meaningful and of interest to their students. A variety of approaches can be used to achieve this purpose. Two possible contexts which may be used are Mathematics and cars and Mathematics and independent living. However, as these contexts may not be relevant to all students, teachers are encouraged to find suitable contexts relevant to their particular student cohort.

It is assumed that an extensive range of technological applications and techniques will be used in teaching this unit. The ability to choose when and when not to use some form of technology, and the ability to work flexibly with technology, are important skills.

### Specific Unit Goals

This unit should enable students to:

A course	M course
<ul style="list-style-type: none"> <li>• understand the concepts and techniques used in representing and comparing data, percentages, rates and ratios, and time and motion</li> <li>• apply reasoning skills and solve practical problems in representing and comparing data, percentages, rates and ratios, and time and motion</li> <li>• communicate their arguments and strategies when solving mathematical and statistical problems using appropriate mathematical or statistical language</li> <li>• interpret mathematical and statistical information and ascertain the reasonableness of their solutions to problems</li> </ul>	<ul style="list-style-type: none"> <li>• know of techniques used in representing and comparing data, percentages, rates and ratios, and time and motion</li> <li>• solve practical problems by representing and comparing data</li> <li>• communicate strategies when solving mathematical using appropriate mathematical language</li> <li>• describe some of their solutions to problems involving mathematical and statistical information</li> </ul>

## Content Descriptions

Further elaboration of the content of this unit is available on the ACARA Australian Curriculum website.

All knowledge, understanding and skills below must be delivered:

A course	M course
<b>Topic 1: Representing and comparing data</b>	
<p><b>Classifying data</b></p> <ul style="list-style-type: none"> <li>• identify examples of categorical data</li> <li>• identify examples of numerical data</li> </ul>	<p><b>Classifying data</b></p> <ul style="list-style-type: none"> <li>• identify examples of categorical data</li> <li>• identify examples of numerical data</li> </ul>
<p><b>Data presentation and interpretation</b></p> <ul style="list-style-type: none"> <li>• display categorical data in tables and column graphs</li> <li>• display numerical data as frequency distributions, dot plots, stem and leaf plots, and histograms</li> <li>• recognise and identify outliers</li> <li>• compare the suitability of different methods of data presentation in real-world contexts</li> </ul>	<p><b>Data presentation and interpretation</b></p> <ul style="list-style-type: none"> <li>• display categorical data in tables and column graphs using technology only</li> <li>• display numerical data; for example as frequency distributions, dot plots, stem and leaf plots, and histograms</li> <li>• recognise outliers</li> <li>• identify appropriate data presentation</li> </ul>
<p><b>Summarising and interpreting data</b></p> <ul style="list-style-type: none"> <li>• identify the mode</li> <li>• calculate measures of central tendency, the arithmetic mean and the median</li> <li>• investigate the suitability of measures of central tendency in various real-world contexts</li> <li>• investigate the effect of outliers on the mean and the median</li> <li>• calculate and interpret quartiles, deciles and percentiles</li> <li>• use informal ways of describing spread, such as spread out/dispersed, tightly packed, clusters, gaps, more/less dense regions, outliers</li> <li>• calculate and interpret statistical measures of spread, such as the range, interquartile range and standard deviation</li> <li>• investigate real-world examples from the media illustrating inappropriate uses, or misuses, of measures of central tendency and spread</li> </ul>	<p><b>Summarising and interpreting data</b></p> <ul style="list-style-type: none"> <li>• identify the mode from sorted data</li> <li>• find measures of central tendency, the arithmetic mean and the median</li> <li>• identify appropriate measures of central tendency in real-world contexts</li> <li>• find quartiles</li> <li>• use informal ways of describing spread, such as spread out/dispersed, tightly packed, outliers</li> <li>• discuss real-world examples from the media illustrating measures of central tendency and spread</li> </ul>

A course	M course
<p><b>Comparing data sets</b></p> <ul style="list-style-type: none"> <li>• compare back-to-back stem plots for different data-sets</li> <li>• complete a five number summary for different datasets</li> <li>• construct box plots using a five number summary</li> <li>• compare the characteristics of the shape of histograms using symmetry, skewness and bimodality</li> </ul>	<p><b>Comparing data sets</b></p> <ul style="list-style-type: none"> <li>• produce back-to-back stem plots for sorted data-sets</li> <li>• five number summary</li> <li>• construct box plots using a five number summary</li> <li>• identify the differences in shape of histograms</li> </ul>
<b>Topic 2: Percentages</b>	
<p><b>Percentage calculations</b></p> <ul style="list-style-type: none"> <li>• review calculating a percentage of a given amount</li> <li>• review one amount expressed as a percentage of another</li> </ul>	<p><b>Percentage calculations</b></p> <ul style="list-style-type: none"> <li>• review calculating a percentage of a given amount</li> </ul>
<p><b>Applications of percentages</b></p> <ul style="list-style-type: none"> <li>• determine the overall change in a quantity following repeated percentage changes; for example, an increase of 10% followed by a decrease of 10%</li> <li>• calculate simple interest for different rates and periods</li> </ul>	<p><b>Applications of percentages</b></p> <ul style="list-style-type: none"> <li>• use repeated percentage changes; for example, an increase of 10% followed by a decrease of 10%</li> <li>• calculate simple interest for periods in years only</li> </ul>
<b>Topic 3: Rates and ratios</b>	
<p><b>Ratios</b></p> <ul style="list-style-type: none"> <li>• demonstrate an understanding of the elementary ideas and notation of ratio</li> <li>• understand the relationship between fractions and ratio</li> <li>• express a ratio in simplest form</li> <li>• find the ratio of two quantities</li> <li>• divide a quantity in a given ratio</li> <li>• use ratio to describe simple scales</li> </ul>	<p><b>Ratios</b></p> <ul style="list-style-type: none"> <li>• elementary ideas and notation of ratio</li> <li>• convert between fractions and ratio</li> <li>• express a ratio in simplest form</li> <li>• find the ratio of two quantities when units are comparable</li> <li>• divide a quantity in a given ratio</li> </ul>

A course	M course
<p><b>Rates</b></p> <ul style="list-style-type: none"> <li>• review identifying common usage of rates such as km/h</li> <li>• convert between units for rates; for example, km/h to m/s, mL/min to L/h</li> <li>• complete calculations with rates, including solving problems involving direct proportion in terms of rate.</li> <li>• use rates to make comparisons</li> <li>• use rates to determine costs; for example, calculating the cost of a tradesman using rates per hour, call-out fees</li> </ul>	<p><b>Rates</b></p> <ul style="list-style-type: none"> <li>• review identifying common usage of rates such as km/h</li> <li>• complete calculations with rates</li> <li>• use rates to make comparisons</li> <li>• use rates to determine costs; for example, the cost of a tradesman using hourly rate, call-out fees</li> </ul>
<p><b>Topic 4: Time and motion</b></p>	
<p><b>Time</b></p> <ul style="list-style-type: none"> <li>• use units of time, conversions between units, fractional, digital and decimal representations</li> <li>• represent time using 12-hour and 24-hour clocks</li> <li>• calculate time intervals, such as time between, time ahead, time behind</li> <li>• interpret timetables, such as bus, train and ferry timetables</li> <li>• use several timetables and electronic technologies to plan the most time-efficient routes</li> <li>• interpret complex timetables, such as tide charts, sunrise charts and moon phases</li> <li>• compare the time taken to travel a specific distance with various modes of transport</li> </ul>	<p><b>Time</b></p> <ul style="list-style-type: none"> <li>• use units of time, conversions between units</li> <li>• use time with 12-hour and 24-hour clocks (</li> <li>• calculate time intervals (</li> <li>• interpret public transport timetables</li> <li>• use timetables and technology to plan the most time-efficient routes</li> <li>• compare the time taken to travel a specific distance with various modes of transport using technology (e.g. Google maps)</li> </ul>
<p><b>Distance</b></p> <ul style="list-style-type: none"> <li>• use scales to find distances, such as on maps; for example, road maps, street maps, bushwalking maps, online maps and cadastral maps</li> <li>• optimise distances through trial-and-error and systematic methods; for example, shortest path, routes to visit all towns, and routes to use all roads</li> </ul>	<p><b>Distance</b></p> <ul style="list-style-type: none"> <li>• use straightforward scales to find distances; for example, road maps, street maps, online maps</li> <li>• optimise distances through trial-and-error methods; for example, shortest path to visit all towns</li> </ul>

A course	M course
<p><b>Speed</b></p> <ul style="list-style-type: none"> <li>• identify the appropriate units for different activities, such as walking, running, swimming and flying</li> <li>• calculate speed, distance or time using the formula <math>speed = distance/time</math></li> <li>• calculate the time or costs for a journey from distances estimated from maps</li> <li>• interpret distance-versus-time graphs</li> <li>• calculate and interpret average speed; for example, a 4-hour trip covering 250 km</li> </ul>	<p><b>Speed</b></p> <ul style="list-style-type: none"> <li>• identify the appropriate units for activities, such as walking, running, swimming and flying</li> <li>• calculate speed, distance or time using the formula <math>speed = distance/time</math> arranged so that the unknown is the subject</li> <li>• calculate the time for a journey using distances estimated from maps</li> <li>• use distance-versus-time graphs</li> <li>• calculate average speed</li> </ul>

### A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

### Assessment

Refer to page 10-12.

## Unit 3: Essential Mathematics

**Value: 1.0**

**Unit 3a: Essential Mathematics**

**Value: 0.5**

**Unit 3b: Essential Mathematics**

**Value: 0.5**

### Unit Description

This unit provides students with the mathematical skills and understanding to solve problems related to measurement, scales, plans and models, drawing and interpreting graphs, and data collection. Teachers are encouraged to apply the content of the four topics in this unit – ‘Measurement’, ‘Scales, plans and models’, ‘Graphs’ and ‘Data collection’ – in a context which is meaningful and of interest to the students. A variety of approaches can be used to achieve this purpose. Two possible contexts which may be used in this unit are Mathematics and design and Mathematics and medicine. However, as these contexts may not be relevant to all students, teachers are encouraged to find suitable contexts relevant to their particular student cohort.

It is assumed that an extensive range of technological applications and techniques will be used in teaching this unit. The ability to choose when and when not to use some form of technology, and the ability to work flexibly with technology, are important skills.

### Specific Unit Goals

This unit should enable students to:

A course	M course
<ul style="list-style-type: none"> <li>• understand the concepts and techniques used in measurement, scales, plans and models, graphs, and data collection</li> <li>• apply reasoning skills and solve practical problems in measurement, scales, plans and models, graphs, and data collection</li> <li>• communicate their arguments and strategies when solving mathematical and statistical problems using appropriate mathematical or statistical language</li> <li>• interpret mathematical and statistical information and ascertain the reasonableness of their solutions to problems</li> </ul>	<ul style="list-style-type: none"> <li>• know of techniques used in measurement, scales, plans and models, graphs, and data collection</li> <li>• solve straightforward practical problems in measurement, scales, plans and models, graphs, and data collection</li> <li>• communicate their strategies when solving mathematical problems using appropriate language</li> <li>• describe their solutions to problems using mathematical and statistical information</li> </ul>

## Content Descriptions

Further elaboration of the content of this unit is available on the ACARA Australian Curriculum website.

All knowledge, understanding and skills below must be delivered:

A course	M course
<b>Topic 1: Measurement</b>	
<p><b>Linear measure</b></p> <ul style="list-style-type: none"> <li>• review metric units of length, their abbreviations, conversions between them, estimation of lengths, and appropriate choices of units</li> <li>• calculate perimeters of familiar shapes, including triangles, squares, rectangles, polygons, circles, arc lengths, and composites of these.</li> </ul>	<p><b>Linear measure</b></p> <ul style="list-style-type: none"> <li>• review metric units of length, their abbreviations, conversions, estimation of lengths, and appropriate units</li> <li>• calculate perimeters of familiar shapes; for example, triangles, squares, rectangles</li> </ul>
<p><b>Area measure</b></p> <ul style="list-style-type: none"> <li>• review metric units of area, their abbreviations, and conversions between them</li> <li>• use formulas to calculate areas of regular shapes, including triangles, squares, rectangles, parallelograms, trapeziums, circles and sectors</li> <li>• find the area of irregular figures by decomposition into regular shapes</li> <li>• find the surface area of familiar solids, including cubes, rectangular and triangular prisms, spheres and cylinders (</li> <li>• find the surface area of pyramids, such as rectangular- and triangular-based pyramids</li> <li>• use addition of the area of the faces of solids to find the surface area of irregular solids.</li> </ul>	<p><b>Area measure</b></p> <ul style="list-style-type: none"> <li>• review metric units of area and their abbreviations</li> <li>• calculate areas of regular shapes; for example, triangles, squares, rectangles, parallelograms, trapeziums, circles</li> <li>• find the area of irregular figures</li> <li>• find the surface area of familiar solids; for example, cubes, prisms, spheres and cylinders</li> <li>• find the surface area of pyramids</li> <li>• find the surface area of irregular solids.</li> </ul>
<p><b>Mass</b></p> <ul style="list-style-type: none"> <li>• review metric units of mass (and weight), their abbreviations, conversions between them, and appropriate choices of units</li> <li>• recognise the need for milligrams</li> <li>• convert between grams and milligrams.</li> </ul>	<p><b>Mass</b></p> <ul style="list-style-type: none"> <li>• review metric units of mass their abbreviations and appropriate choices of units</li> <li>• recognise uses for milligrams</li> <li>• convert between grams and milligrams.</li> </ul>

A course	M course
<p><b>Volume and capacity</b></p> <ul style="list-style-type: none"> <li>review metric units of volume, their abbreviations, conversions between them, and appropriate choices of units</li> <li>recognise relations between volume and capacity, recognising that <math>1\text{cm}^3 = 1\text{mL}</math> and <math>1\text{m}^3 = 1\text{kL}</math></li> <li>use formulas to find the volume and capacity of regular objects such as cubes, rectangular and triangular prisms and cylinders</li> <li>use formulas to find the volume of pyramids and spheres</li> </ul>	<p><b>Volume and capacity</b></p> <ul style="list-style-type: none"> <li>review metric units of volume, their abbreviations and appropriate choices of units</li> <li>find the volume of regular objects such as cubes, rectangular and triangular prisms and cylinders</li> <li>use formulas to find the volume of pyramids and spheres</li> </ul>
<b>Topic 2: Scales, plans and models</b>	
<p><b>Geometry</b></p> <ul style="list-style-type: none"> <li>recognise the properties of common two-dimensional geometric shapes and three-dimensional solids</li> <li>interpret different forms of two-dimensional representations of three-dimensional objects, including nets and perspective diagrams</li> <li>use symbols and conventions for the representation of geometric information; for example, point, line, ray, angle, diagonal, edge, curve, face and vertex (</li> </ul>	<p><b>Geometry</b></p> <ul style="list-style-type: none"> <li>recognise the properties of common two-dimensional geometric shapes and three-dimensional solids</li> <li>recognise nets as a two-dimensional representation of a 3D shape</li> <li>use symbols and conventions for geometric information; for example, point, line, ray, angle, diagonal, edge, curve, face and vertex</li> </ul>
<p><b>Interpret scale drawings</b></p> <ul style="list-style-type: none"> <li>interpret commonly used symbols and abbreviations in scale drawings</li> <li>find actual measurements from scale drawings, such as lengths, perimeters and areas</li> <li>estimate and compare quantities, materials and costs using actual measurements from scale drawings; for example, using measurements for packaging, clothes, painting, bricklaying and landscaping</li> </ul>	<p><b>Interpret scale drawings</b></p> <ul style="list-style-type: none"> <li>interpret commonly used symbols and abbreviations in scale drawings</li> <li>find actual measurements from scale drawings with simple scales such as <math>1\text{ cm} = 1\text{ m}</math></li> <li>estimate quantities and materials and find costs from scale drawings; for example, painting, landscaping and carpeting a room</li> </ul>
<p><b>Creating scale drawings</b></p> <ul style="list-style-type: none"> <li>understand and apply drawing conventions of scale drawings, such as scales in ratio, clear indications of dimensions, and clear labelling</li> <li>construct scale drawings by hand and by using software packages</li> </ul>	<p><b>Creating scale drawings</b></p> <ul style="list-style-type: none"> <li>apply drawing conventions of scale drawings, with clear indications of dimensions, and clear labelling</li> <li>construct scale drawings by using software packages</li> </ul>



A course	M course
<p><b>Three dimensional objects</b></p> <ul style="list-style-type: none"> <li>• interpret plans and elevation views of models</li> <li>• sketch elevation views of different models</li> <li>• interpret diagrams of three-dimensional objects</li> </ul>	<p><b>Three dimensional objects</b></p> <ul style="list-style-type: none"> <li>• interpret plans and elevation views of models</li> <li>• sketch elevation views of simple models</li> <li>• interpret diagrams of three-dimensional objects</li> </ul>
<p><b>Right-angled triangles</b></p> <ul style="list-style-type: none"> <li>• apply Pythagoras' theorem to solve problems</li> <li>• apply the tangent ratio to find unknown angles and sides in right-angled triangles</li> <li>• work with the concepts of angle of elevation and angle of depression</li> <li>• apply the cosine and sine ratios to find unknown angles and sides in right-angled triangles</li> <li>• solve problems involving bearings</li> </ul>	<p><b>Right-angled triangles</b></p> <ul style="list-style-type: none"> <li>• apply Pythagoras' theorem</li> <li>• apply the tangent ratio in right-angled triangles</li> <li>• work with the concepts of angle of elevation and angle of depression</li> <li>• apply the cosine and sine ratios in right-angled triangles</li> </ul>
<b>Topic 3: Graphs</b>	
<p><b>Cartesian plane</b></p> <ul style="list-style-type: none"> <li>• demonstrate familiarity with Cartesian coordinates in two dimensions by plotting points on the Cartesian plane</li> <li>• generate tables of values for linear functions, including for negative values of <math>x</math></li> <li>• graph linear functions for all values of <math>x</math> with pencil and paper and with graphing software</li> </ul>	<p><b>Cartesian plane</b></p> <ul style="list-style-type: none"> <li>• plotting points on the Cartesian plane</li> <li>• generate tables of values for linear functions</li> <li>• graph linear functions with pencil and grid paper and with software</li> </ul>
<p><b>Using graphs</b></p> <ul style="list-style-type: none"> <li>• interpret and use graphs in practical situations, including travel graphs and conversion graphs</li> <li>• draw graphs from given data to represent practical situations</li> <li>• interpret the point of intersection and other important features of given graphs of two linear functions drawn from practical contexts; for example, the 'break-even' point</li> </ul>	<p><b>Using graphs</b></p> <ul style="list-style-type: none"> <li>• use graphs in practical situations; for example, conversion graphs</li> <li>• draw graphs from given data</li> <li>• find the point of intersection and other important features of given linear graphs; for example, the 'break-even' point. Use of technology important</li> </ul>

A course	M course
<b>Topic 4: Data collection</b>	
<p><b>Census</b></p> <ul style="list-style-type: none"> <li>• investigate the procedure for conducting a census</li> <li>• investigate the advantages and disadvantages of conducting a census.</li> </ul>	<p><b>Census</b></p> <ul style="list-style-type: none"> <li>• procedure for conducting a census</li> <li>• the advantages and disadvantages of conducting a census</li> </ul>
<p><b>Surveys</b></p> <ul style="list-style-type: none"> <li>• understand the purpose of sampling to provide an estimate of population values when a census is not used</li> <li>• investigate the different kinds of samples; for example, systematic samples, self-selected samples, simple random samples</li> <li>• investigate the advantages and disadvantages of these kinds of samples; for example, comparing simple random samples with self-selected samples</li> </ul>	<p><b>Surveys</b></p> <ul style="list-style-type: none"> <li>• using a sample</li> <li>• different kinds of samples; for example, systematic samples, simple random samples</li> <li>• investigate the advantages and disadvantages of these kinds of samples; for example, comparing simple random samples with self-selected samples</li> </ul>
<p><b>Simple survey procedure</b></p> <ul style="list-style-type: none"> <li>• identify the target population to be surveyed</li> <li>• investigate questionnaire design principles; for example, simple language, unambiguous questions, consideration of number of choices, issues of privacy and ethics, and freedom from bias</li> </ul>	<p><b>Simple survey procedure</b></p> <ul style="list-style-type: none"> <li>• identify the target population to be surveyed</li> <li>• use various questionnaires and note design principles; for example, simple language, unambiguous questions, consideration of number of choices, issues of privacy and ethics, and freedom from bias</li> </ul>
<p><b>Sources of bias</b></p> <ul style="list-style-type: none"> <li>• describe the faults in the collection of data process</li> <li>• describe sources of error in surveys; for example, sampling error and measurement error</li> <li>• investigate the possible misrepresentation of the results of a survey due to misunderstanding the procedure, or misunderstanding the reliability of generalising the survey findings to the entire population</li> <li>• investigate errors and misrepresentation in surveys, including examples of media misrepresentations of surveys</li> </ul>	<p><b>Sources of bias</b></p> <ul style="list-style-type: none"> <li>• describe sources of bias in surveys</li> <li>• investigate the possible misrepresentation of the results of a survey</li> <li>• investigate misrepresentation in surveys, including examples of media misrepresentations of surveys</li> </ul>

A course	M course
<p><b>Bivariate scatterplots</b></p> <ul style="list-style-type: none"> <li>• describe the patterns and features of bivariate data</li> <li>• describe the association between two numerical variables in terms of direction (positive/negative), form (linear/non-linear) and strength (strong/moderate/weak).</li> </ul>	<p><b>Bivariate scatterplots</b></p> <ul style="list-style-type: none"> <li>• bivariate data</li> <li>• describe the association between two numerical variables in terms of direction (positive/negative), form (linear/non-linear) and strength (strong/moderate/weak).</li> </ul>
<p><b>Line of best fit</b></p> <ul style="list-style-type: none"> <li>• identify the dependent and independent variable</li> <li>• find the line of best fit by eye</li> <li>• use technology to find the line of best fit</li> <li>• interpret relationships in terms of the variables</li> <li>• use technology to find the correlation coefficient (an indicator of the strength of linear association)</li> <li>• use the line of best fit to make predictions, both by interpolation and extrapolation</li> <li>• recognise the dangers of extrapolation</li> <li>• distinguish between causality and correlation through examples</li> </ul>	<p><b>Line of best fit</b></p> <ul style="list-style-type: none"> <li>• identify the dependent and independent variable</li> <li>• find the line of best fit by eye</li> <li>• use technology to find the line of best fit</li> <li>• relationships in terms of the variables</li> <li>• use technology to find the correlation coefficient (an indicator of the strength of linear association)</li> <li>• use the line of best fit to make predictions, both by interpolation and extrapolation</li> <li>• recognise the dangers of extrapolation</li> </ul>

### A guide to reading and implementing content descriptions

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

### Assessment

Refer to pages 10-12.

## Unit 4: Essential Mathematics

**Value: 1.0**

**Unit 4a: Essential Mathematics**

**Value: 0.5**

**Unit 4b: Essential Mathematics**

**Value: 0.5**

### Unit Description

This unit provides students with the mathematical skills and understanding to solve problems related to probability, Earth geometry and time zones, and loans and compound interest. Teachers are encouraged to apply the content of the three topics in this unit – ‘Probability and relative frequencies’, ‘Earth geometry and time zones’ and ‘Loans and compound interest’ – in a context which is meaningful and of interest to the students. A variety of approaches can be used to achieve this purpose. Two possible contexts which may be used in this unit are Mathematics of finance and Mathematics of travelling. However, as these contexts may not be relevant to all students, teachers are encouraged to find suitable contexts relevant to their particular student cohort.

It is assumed that an extensive range of technological applications and techniques will be used in teaching this unit. The ability to choose when and when not to use some form of technology, and the ability to work flexibly with technology, are important skills.

### Specific Unit Goals

This unit should enable students to:

A course	M course
<ul style="list-style-type: none"> <li>• understand the concepts and techniques used in probability and relative frequencies, earth geometry and time zones, loans and compound interest</li> <li>• apply reasoning skills and solve practical problems in probability and relative frequencies, earth geometry and time zones, loans and compound interest</li> <li>• communicate their arguments and strategies when solving mathematical problems using appropriate mathematical or statistical language</li> <li>• interpret mathematical information and ascertain the reasonableness of their solutions to problems</li> </ul>	<ul style="list-style-type: none"> <li>• identify techniques used in probability, earth geometry, time zones, loans and simple interest</li> <li>• solve basic practical problems in probability, earth geometry and time zones, loans and compound interest</li> <li>• communicate their strategies when solving mathematical problems using appropriate language</li> <li>• describe their solutions to problems involving mathematical information</li> </ul>

## Content Descriptions

Further elaboration of the content of this unit is available on the ACARA Australian Curriculum website.

All knowledge, understanding and skills below must be delivered:

A course	M course
<b>Topic 1: Probability and relative frequencies</b>	
<p><b>Probability expressions:</b></p> <ul style="list-style-type: none"> <li>• interpret commonly used probability statements, including ‘possible’, ‘probable’, ‘likely’, ‘certain’</li> <li>• describe ways of expressing probabilities formally using fractions, decimals, ratios, and percentages</li> </ul>	<p><b>Probability expressions:</b></p> <ul style="list-style-type: none"> <li>• interpret commonly used probability statements; for example ‘possible’, ‘likely’</li> <li>• expressing probabilities formally using simple fractions, and percentages</li> </ul>
<p><b>Simulations:</b></p> <ul style="list-style-type: none"> <li>• perform simulations of experiments using technology</li> <li>• recognise that the repetition of chance events is likely to produce different results</li> <li>• identify relative frequency as probability</li> <li>• identify factors that could complicate the simulation of real-world events</li> </ul>	<p><b>Simulations:</b></p> <ul style="list-style-type: none"> <li>• simulate experiments using technology or concrete apparatus</li> </ul>
<p><b>Simple probabilities:</b></p> <ul style="list-style-type: none"> <li>• construct a sample space for an experiment</li> <li>• use a sample space to determine the probability of outcomes for an experiment</li> <li>• use arrays or tree diagrams to determine the outcomes and the probabilities for experiments</li> </ul>	<p><b>Simple probabilities:</b></p> <ul style="list-style-type: none"> <li>• identify a sample space for an experiment</li> <li>• use sample spaces</li> <li>• use arrays or tree diagrams to explore outcomes and the probabilities for experiments</li> </ul>
<p><b>Probability applications</b></p> <ul style="list-style-type: none"> <li>• determine the probabilities associated with simple games</li> <li>• determine the probabilities of occurrence of simple traffic-light problems</li> </ul>	<p><b>Probability applications</b></p> <ul style="list-style-type: none"> <li>• probabilities associated with simple games</li> <li>• simple traffic-light problems</li> </ul>
<b>Topic 2: Earth geometry and time zones</b>	
<p><b>Location:</b></p> <ul style="list-style-type: none"> <li>• locate positions on Earth’s surface given latitude and longitude using GPS, a globe, an atlas, and digital technologies</li> <li>• find distances between two places on Earth on the same longitude</li> <li>• find distances between two places on Earth using appropriate technology</li> </ul>	<p><b>Location:</b></p> <ul style="list-style-type: none"> <li>• locate positions on Earth’s surface given latitude and longitude using a globe and digital technologies</li> <li>• find distances between two places on Earth on the same longitude</li> <li>• find distances between two places on Earth using appropriate technology</li> </ul>

A course	M course
<p><b>Time:</b></p> <ul style="list-style-type: none"> <li>• understand the link between longitude and</li> <li>• solve problems involving time zones in Australia and in neighbouring nations, making any necessary allowances for daylight saving</li> <li>• solve problems involving Greenwich Mean Time and the International Date Line</li> <li>• find time differences between two places on Earth</li> <li>• solve problems associated with time zones; for example, internet and phone usage</li> <li>• solve problems relating to travelling east and west, incorporating time zone changes</li> </ul>	<p><b>Time:</b></p> <ul style="list-style-type: none"> <li>• longitude and time</li> <li>• time zones in Australia and in neighbouring nations</li> <li>• solve simple problems involving Greenwich Mean Time and the International Date Line</li> <li>• time differences between places on Earth</li> <li>• simple problems associated with time zones; for example, internet and phone usage</li> </ul>
<p><b>Topic 3: Loans and compound interest</b></p>	
<p><b>Compound interest:</b></p> <ul style="list-style-type: none"> <li>• review the principles of simple interest</li> <li>• understand the concept of compound interest as a recurrence relation</li> <li>• consider similar problems involving compounding; for example, population growth</li> <li>• use technology to calculate the future value of a compound interest loan or investment and the total interest paid or earned</li> <li>• use technology to compare, numerically and graphically, the growth of simple interest and compound interest loans and investments</li> <li>• use technology to investigate the effect of the interest rate and the number of compounding periods on the future value of a loan or investment</li> </ul>	<p><b>Compound interest:</b></p> <ul style="list-style-type: none"> <li>• identify the principles of simple interest</li> <li>• know of compound interest</li> <li>• use technology (spreadsheet) to calculate simple loans</li> <li>• use spreadsheets to compare, numerically and graphically, the growth of simple interest and compound interest loans and investments</li> <li>• use spreadsheets to investigate the effect of the interest rate and the number of compounding periods on the future value of a loan or investment</li> </ul>
<p><b>Reducing balance loans (compound interest loans with periodic repayments):</b></p> <ul style="list-style-type: none"> <li>• use technology and a recurrence relation to model a reducing balance loan</li> <li>• investigate the effect of the interest rate and repayment amount on the time taken to repay a loan</li> </ul>	<p><b>Reducing balance loans (compound interest loans with periodic repayments):</b></p> <ul style="list-style-type: none"> <li>• use technology and a recurrence relation to model a reducing balance loan</li> <li>• use technology to investigate the effect of the interest rate and repayment amount on the time taken to repay a loan</li> </ul>

## **A guide to reading and implementing content descriptions**

Content descriptions specify the knowledge, understanding and skills that students are expected to learn and that teachers are expected to teach. Teachers are required to develop a program of learning that allows students to demonstrate all the content descriptions. The lens which the teacher uses to demonstrate the content descriptions may be either guided through provision of electives within each unit or determined by the teacher when developing their program of learning.

A program of learning is what a college provides to implement the course for a subject. It is at the discretion of the teacher to emphasis some content descriptions over others. The teacher may teach additional (not listed) content provided it meets the specific unit goals. This will be informed by the student needs and interests.

### **Assessment**

Refer to pages 10-12.

## Appendix A – Implementation Guidelines

### Available course patterns

A standard 1.0 value unit is delivered over at least 55 hours. To be awarded a course, students must complete at least the minimum units over the whole minor, major, major/minor or double major course.

Course	Number of standard units to meet course requirements
Minor	Minimum of 2 units
Major	Minimum of 3.5 units

Units in this course can be delivered in any order.

### Prerequisites for the course or units within the course

Nil.

### Arrangements for students continuing study in this course

Students who studied the previous course may undertake any units in this course provided there is no duplication of content.

### Duplication of Content Rules

Students cannot be given credit towards the requirements for a Senior Secondary Certificate for a unit that significantly duplicates content in a unit studied in another course. The responsibility for preventing undesirable overlap of content studied by a student rests with the principal and the teacher delivering the course. Students will only be given credit for covering the content once.

### Guidelines for Delivery

#### Program of Learning

A program of learning is what a school provides to implement the course for a subject. This meets the requirements for context, scope and sequence set out in the Board endorsed course. Students follow programs of learning in a college as part of their senior secondary studies. The detail, design and layout of a program of learning are a college decision.

The program of learning must be documented to show the planned learning activities and experiences that meet the needs of particular groups of students, taking into account their interests, prior knowledge, abilities and backgrounds. The program of learning is a record of the learning experiences that enable students to achieve the knowledge, understanding and skills of the content descriptions. There is no requirement to submit a program of learning to the OBSSS for approval. The Principal will need to sign off at the end of Year 12 that courses have been delivered as accredited.

#### Content Descriptions

Are all content descriptions of equal importance? No. It depends on the focus of study. Teachers can customise their program of learning to meet their own students' needs, adding additional content descriptions if desired or emphasising some over others. A teacher must balance student needs with their responsibility to teach all content descriptions. It is mandatory that teachers address all content descriptions and that students engage with all content descriptions.



## Half standard 0.5 units

Half standard units appear on the course adoption form but are not explicitly documented in courses. It is at the discretion of the college principal to split a standard 1.0 unit into two half standard 0.5 units. Colleges are required to adopt the half standard 0.5 units. However, colleges are not required to submit explicit documentation outlining their half standard 0.5 units to the BSSS. Colleges must assess students using the half standard 0.5 assessment task weightings outlined in the framework. It is the responsibility of the college principal to ensure that all content is delivered in units approved by the Board.

## 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 over two Moderation Days. In addition to Moderation Days, there is statistical moderation of course scores, including small group procedures, for T courses.

### Moderation by Structured, Consensus-based Peer Review

Consensus-based peer review involves the review of student work against system wide criteria and standards and the validation of Unit Grades. This is done by matching student performance with the criteria and standards outlined in the Achievement Standards, as stated in the Framework. Advice is then given to colleges to assist teachers with, or confirm, their judgments. In addition, feedback is given on the construction of assessment instruments.

### Preparation for Structured, Consensus-based Peer Review

Each year, teachers of Year 11 are asked to retain originals or copies of student work completed in Semester 2. Similarly, teachers of 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, T and M course/units offered by the school and is sent into 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, including marking schemes and rubrics for each assessment item
- 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 the *Requirements for Moderation Memoranda* and Information Papers.

### **Visual evidence for judgements made about practical performances**

It is a requirement that schools' judgements of standards to practical performances (A/T/M) be supported by visual evidence (still photos or video).

The photographic evidence submitted must be drawn from practical skills performed as part of the assessment process.

Teachers should consult the BSSS website for current information regarding all moderation requirements including subject specific and photographic evidence.

## Appendix B – Course Developers

<b>Name</b>	<b>College</b>
Jacob Woolley	Canberra College
Gary Pocock	Canberra Institute of Technology
Susan Warner	Gungahlin College
Gavin Scales	Gungahlin College
Marion McIntosh	Melba Copland Secondary School
Wayne Semmens	Melba Copland Secondary School
Jennifer Missen	Merici College
Nicole Burg	Narrabundah College
Rebecca Guinane	Narrabundah College
Andrew Trost	Narrabundah College

## Appendix C – 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 D – 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
Critically analyse	Analysis that engages with criticism and existing debate on the issue
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	Planning, inquiry into and drawing conclusions about
Justify	Show how argument or conclusion is right or reasonable
Manipulate	Adapt or change
Plan	Strategize, 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

## Appendix E – Glossary for ACT Senior Secondary Curriculum

Courses will detail what teachers are expected to teach and students are expected to learn for year 11 and 12. They will describe the knowledge, understanding and skills that students will be expected to develop for each learning area across the years of schooling.

**Learning areas** are broad areas of the curriculum, including English, mathematics, science, the arts, languages, health and physical education.

A **subject** is a discrete area of study that is part of a learning area. There may be one or more subjects in a single learning area.

**Frameworks** are system documents for Years 11 and 12 which provide the basis for the development and accreditation of any course within a designated learning area. In addition, frameworks provide a common basis for assessment, moderation and reporting of student outcomes in courses based on the framework.

The **course** sets out the requirements for the implementation of a subject. Key elements of a course include the rationale, goals, content descriptions, assessment, and achievement standards as designated by the framework.

BSSS courses will be organised into units. A unit is a distinct focus of study within a course. A standard 1.0 unit is delivered for a minimum of 55 hours generally over one semester.

**Core** units are foundational units that provide students with the breadth of the subject.

**Additional** units are avenues of learning that cannot be provided for within the four core 1.0 standard units by an adjustment to the program of learning.

An **Independent Study unit** is a pedagogical approach that empowers students to make decisions about their own learning. Independent Study units can be proposed by a student and negotiated with their teacher but must meet the specific unit goals and content descriptions as they appear in the course.

An **elective** is a lens for demonstrating the content descriptions within a standard 1.0 or half standard 0.5 unit.

A **lens** is a particular focus or viewpoint within a broader study.

**Content descriptions** refer to the subject-based knowledge, understanding and skills to be taught and learned.

A **program of learning** is what a college develops to implement the course for a subject and to ensure that the content descriptions are taught and learned.

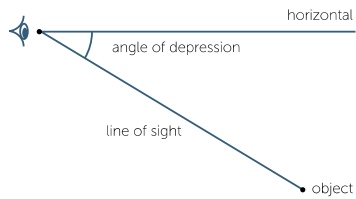
**Achievement standards** provide an indication of typical performance at five different levels (corresponding to grades A to E) following completion of study of senior secondary course content for units in a subject.

ACT senior secondary system **curriculum** comprises all BSSS approved courses of study.

## Appendix F – Essential Mathematics Glossary

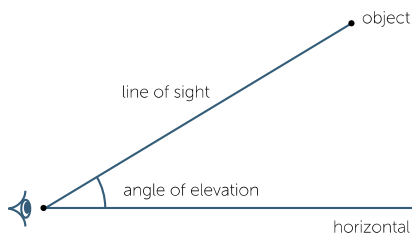
### Angle of depression

When an observer looks at an object that is lower than ‘the eye of’ the observer’, the angle between the line of sight and the horizontal is called the angle of depression.



### Angle of elevation

When an observer looks at an object that is higher than ‘the eye of’ the observer’, the angle between the line of sight and the horizontal is called the angle of elevation.



### Average speed

Average speed is the total distance travelled divided by the total time taken.

### Back-to-back stem plots

A back-to-back stem-and-leaf plot is a method for comparing two data distributions by attaching two sets of ‘leaves’ to the same ‘stem’ in a stem-and-leaf plot.

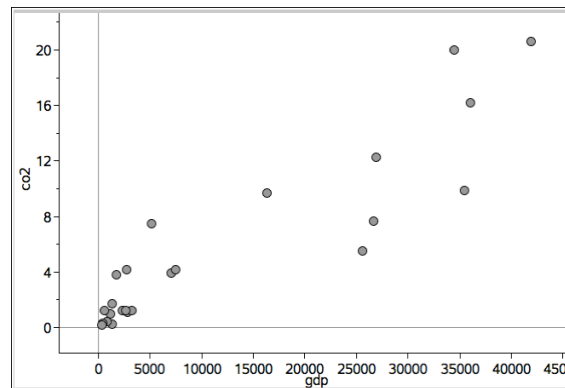
For example, the stem-and-leaf plot below displays the distribution of pulse rates of 19 students before and after gentle exercise.

pulse rate		
before	after	
9 8 8 8	6	
8 6 6 4 1 1	7	
8 8 6 2	8	6 7 8 8
6 0	9	0 2 2 4 5 8 9 9
4	10	0 4 4
0	11	8
	12	4 4
	13	

### Bivariate data scatter plot

A two-dimensional data plot using Cartesian co-ordinates to display the values of two variables in a bivariate data set.

For example the scatterplot below displays the CO<sub>2</sub> emissions in tonnes per person (*co2*) plotted against Gross Domestic Product per person in \$US (*gdp*) for a sample of 24 countries in 2004. In constructing this scatterplot, *gdp* has been used as the explanatory variable.



### Categorical data

Data associated with a categorical variable is called categorical data.

### Categorical variable

A categorical variable is a variable whose values are categories.

Examples include blood group (A, B, AB or O) or house construction type (brick, concrete, timber, steel, other).

Categories may have numerical labels, eg. the numbers worn by player in a sporting team, but these labels have no numerical significance, they merely serve as labels.

### Census

A population is the complete set of individuals, objects, places, etc, that we want information about.

A census is an attempt to collect information about the whole population.

### Compound interest

The interest earned by investing a sum of money (the principal) is compound interest if each successive interest payment is added to the principal for the purpose of calculating the next interest payment.

For example, if the principal  $P$  earns compound interest at the rate of  $i\%$  per period, then after  $n$  periods the total amount accrued is  $P\left(1 + \frac{i}{100}\right)^n$

### Correlation

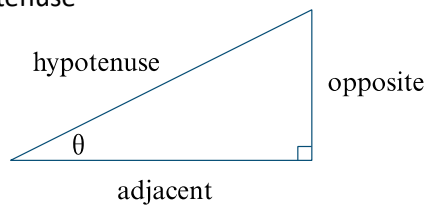
**Correlation** is a measure of the strength of the linear relationship between two variables.



### Cosine ratio

In any right-angled triangle,

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} \quad \text{where } 0^\circ < \theta < 90^\circ$$



### Correlation coefficient ( $r$ )

The correlation coefficient ( $r$ ) is a measure of the strength of the linear relationship between a pair of variables. The formula for calculating  $r$  is given below.

For variables  $x$  and  $y$ , and computed for  $n$  cases, the formula for  $r$  is:

$$r = \frac{1}{n-1} \sum \left( \frac{x_i - \bar{x}}{s_x} \right) \left( \frac{y_i - \bar{y}}{s_y} \right)$$

### Extrapolation

In the context of fitting a linear relationship between two variables, extrapolation occurs when the fitted model is used to make predictions using values of the explanatory variable that are outside the range of the original data. Extrapolation is a dangerous process as it can sometimes lead to quite erroneous predictions.

### Five-number summary

A five-number summary is a method of summarising a set of data using the minimum value, the lower or first-quartile ( $Q_1$ ), the median, the upper or third-quartile ( $Q_3$ ) and the maximum value. Forms the basis for a boxplot.

### Frieds' formula Young's formula Clarks formula Drip rates

#### Frieds' formula

Dosage for children 1-2 years = (age (in months) x adult dosage) /150

#### Young's formula

Dosage for Children 1-12 years = (weight in kg x adult dosage)/ (age of child (in years) + 12)

#### Clarks formula

Dosage for children (general formula) = (weight in kg x adult dosage) /70

### GST

The GST (Goods and Services Tax) is a broad sales tax of 10% on most goods and services transactions in Australia.

### Interquartile range

The interquartile range (IQR) is a measure of the spread within a numerical data set. It is equal to the upper quartile ( $Q_3$ ) minus the lower quartiles ( $Q_1$ ); that is,  $IQR = Q_3 - Q_1$

The IQR is the width of an interval that contains the middle 50% (approximately) of the data values. To be exactly 50%, the sample size must be a multiple of four.

### kWh (kilowatt hour)

The kilowatt hour, or kilowatt-hour, is a unit of energy equal to 1000 watt hours or 3.6 megajoules. The kilowatt hour is most commonly known as a billing unit for energy delivered to consumers by electric utilities.

### MJ (Megajoule)

A joule is the SI unit of work. The megajoule (MJ) is equal to one million joules

### Mean

The arithmetic mean of a list of numbers is the sum of the data values divided by the number of values in the list.

In everyday language, the arithmetic mean is commonly called the average.

For example, for the following list of five numbers 2, 3, 3, 6, 8 the mean equals

$$\frac{2 + 3 + 3 + 6 + 8}{5} = \frac{22}{5} = 4.4$$

In more general language, the mean of  $n$  observations  $x_1, x_2, \dots, x_n$  is

$$\bar{x} = \frac{\sum x_i}{n}$$

### Median

The median is the value in a set of ordered set of data values that divides the data into two parts of equal size. When there are an odd number of data values, the median is the middle value. When there is an even number of data values, the median is the average of the two central values.

### Mode

The mode is the most frequently occurring value in a data set.

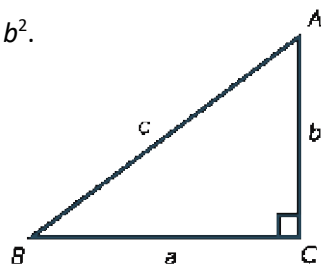
### Outlier

An outlier in a set of data is an observation that appears to be inconsistent with the remainder of that set of data. An outlier is a surprising observation.

### Pythagoras' theorem

The square of the hypotenuse of a right-angled triangle equals the sum of the squares of the lengths of the other two sides.

In symbols,  $c^2 = a^2 + b^2$ .



### The converse

If  $c^2 = a^2 + b^2$  in a triangle  $ABC$ , then  $\angle C$  is a right angle.

### Range

The range is the difference between the largest and smallest observations in a data set.

The range can be used as a measure of spread in a data set, but it is extremely sensitive to the presence of outliers and should only be used with care.

### Reaction time

The time a person takes to react to a situation (pressing the brake) requiring them to stop

### Simple interest

Simple interest is the interest accumulated when the interest payment in each period is a fixed fraction of the principal. For example, if the principle  $P$  earns simple interest at the rate of  $i$  % per period, then after  $n$  periods the accumulated simple interest is  $\frac{Pni}{100}$ .

### Stopping distances

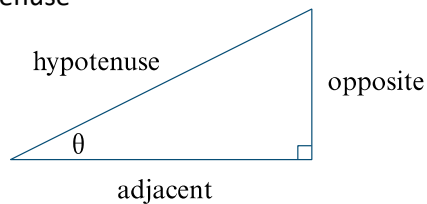
The distance a car travels after the driver has applied the brake given speed of the vehicle and/or conditions of the road which can be found using formula or tables.

Stopping distance = braking distance + reaction time(secs) X speed

### Sine ratio

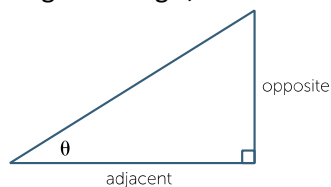
In any right-angled triangle,

$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}}, \text{ where } 0^\circ < \theta < 90^\circ$$



### Tangent ratio

In any right-angled triangle,



$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}}, \text{ where } 0^\circ < \theta < 90^\circ.$$

## Appendix G – Course Adoption

### Conditions of Adoption

The course and units of this course are consistent with the philosophy and goals of the college and the adopting college has the human and physical resources to implement the course.

### Adoption Process

Course adoption must be initiated electronically by an email from the principal or their nominated delegate to [bssscertification@ed.act.edu.au](mailto:bssscertification@ed.act.edu.au). A nominated delegate must CC the principal.

The email will include the **Conditions of Adoption** statement above, and the table below adding the **College** name, and circling the **Classification/s** required.

<b>College:</b>	
<b>Course Title:</b>	<b>Essential Mathematics</b>
<b>Classification/s:</b>	<b>A    M</b>
<b>Accredited from:</b>	2014
<b>Framework:</b>	Mathematics 2020