## **Essential Mathematics**

2018 Subject Outline Stage 1



South Australian Board of SA Certificate of Education



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## INTRODUCTION

## SUBJECT DESCRIPTION

Essential Mathematics is a 10-credit subject or a 20-credit subject at Stage 1, and a 20-credit subject at Stage 2.

Essential Mathematics offers senior secondary students the opportunity to extend their mathematical skills in ways that apply to practical problem-solving in everyday and workplace contexts. Students apply their mathematics to diverse settings, including everyday calculations, financial management, business applications, measurement and geometry, and statistics in social contexts.

In Essential Mathematics there is an emphasis on developing students' computational skills and expanding their ability to apply their mathematical skills in flexible and resourceful ways.

This subject is intended for students planning to pursue a career in a range of trades or vocations.

## **MATHEMATICAL OPTIONS**

The diagram below represents the possible mathematical options that students might study at Stage 1 and Stage 2.



#### Notes:

Although it is advantageous for students to study Australian Curriculum 10 and 10A in Year 10, the 10A curriculum per se is not a prerequisite for the study of Specialist Mathematics and Mathematical Methods. The essential aspects of 10A are included in the curriculum for Specialist Mathematics and Mathematical Methods.

Mathematical Methods can be studied as a single subject; however, Specialist Mathematics is designed to be studied together with Mathematical Methods.

## CAPABILITIES

The capabilities connect student learning within and across subjects in a range of contexts. They include essential knowledge and skills that enable people to act in effective and successful ways.

The SACE identifies seven capabilities. They are:

- literacy
- numeracy
- information and communication technology (ICT) capability
- critical and creative thinking
- personal and social capability
- · ethical understanding
- intercultural understanding.

## Literacy

In this subject students develop their literacy capability by, for example:

- communicating mathematical reasoning and ideas for different purposes, using appropriate language and representations, such as symbols, equations, tables, and graphs
- interpreting and responding to appropriate mathematical language and representations
- · analysing information and explaining mathematical results.

Mathematics provides a specialised language to describe and analyse phenomena. It provides a rich context for students to extend their ability to read, write, visualise, and talk about situations that involve investigating and solving problems.

Students apply and extend their literacy skills and strategies by using verbal, graphical, numerical, and symbolic forms of representing problems and displaying statistical information. Students learn to communicate their findings in different ways, using different systems of representation.

## Numeracy

Being numerate is essential for participating in contemporary society. Students need to reason, calculate, and communicate to solve problems. Through the study of mathematics, they understand and use skills, concepts, and technologies in a range of contexts that can be applied to:

- using measurement in this physical world
- gathering, representing, interpreting, and analysing data
- · using spatial sense and geometric reasoning
- investigating chance processes
- using number, number patterns, and relationships between numbers
- working with graphical, statistical and algebraic representations, and other mathematical models.

## Information and communication technology (ICT) capability

In this subject students develop their information and communication technology capability by, for example:

- understanding the role of electronic technology when using mathematics
- · making informed decisions about the use of electronic technology
- understanding the mathematics involved in computations carried out using technologies, so that reasonable interpretations can be made of the results.

Students extend their skills in using technology effectively and processing large amounts of quantitative information.

Students use ICT to extend their theoretical mathematical understanding and apply mathematical knowledge to a range of problems. They use software relevant for study and/or workplace contexts. This may include tools 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, address problems, and operate systems in particular situations.

## Critical and creative thinking

In this subject students develop critical and creative thinking by, for example:

- building confidence in applying knowledge and problem-solving skills in a range of mathematical contexts
- · developing mathematical reasoning skills to think logically and make sense of the world
- · understanding how to make and test projections from mathematical models
- · interpreting results and drawing appropriate conclusions
- reflecting on the effectiveness of mathematical models, including the recognition of assumptions, strengths, and limitations
- using mathematics to solve practical problems and as a tool for learning
- making connections between concrete, pictorial, symbolic, verbal, written, and mental representations of mathematical ideas
- thinking abstractly, making and testing conjectures, and explaining processes.

Problem-solving in mathematics builds students' depth of conceptual understanding and supports development of critical and creative thinking. Learning through problem-solving helps students when they encounter new situations. They develop their creative and critical thinking capability by listening, discussing, conjecturing, and testing different strategies. They learn the importance of self-correction in building their conceptual understanding and mathematical skills.

## Personal and social capability

In this subject students develop their personal and social capability by, for example:

- arriving at a sense of self as a capable and confident user of mathematics through expressing and presenting ideas in a variety of ways
- appreciating the usefulness of mathematical skills for life and career opportunities and achievements
- understanding the contribution of mathematics and mathematicians to society.

The elements of personal and social competence relevant to mathematics include the application of mathematical skills for informed decision-making, active citizenship, and effective self-management. Students build their personal and social competence in mathematics through setting and monitoring personal and academic goals, taking initiative, and building adaptability, communication, and teamwork.

Students use mathematics as a tool to solve problems they encounter in their personal and working lives. They acquire a repertoire of strategies and build the confidence needed to:

- meet the challenges and innovations of a changing world
- be the designers and innovators of the future, and leaders in their fields.

## **Ethical understanding**

In this subject students develop their ethical understanding by, for example:

- gaining knowledge and understanding of ways in which mathematics can be used to support an argument or point of view
- examining critically ways in which the media present particular information and perspectives
- sharing their learning and valuing the skills of others
- considering the social consequences of making decisions based on mathematical results
- acknowledging and learning from errors rather than denying findings and/or evidence.

Areas of ethical understanding relevant to mathematics include issues associated with ethical decision-making and working collaboratively as part of students' mathematically related explorations. They develop ethical understanding in mathematics through considering social responsibility in ethical dilemmas that may arise when solving problems in personal, social, community, and/or workplace contexts.

## Intercultural understanding

In this subject students develop their intercultural understanding by, for example:

- understanding mathematics as a body of knowledge that uses universal symbols that have their origins in many cultures
- understanding how mathematics assists individuals, groups, and societies to operate successfully across cultures in the global, knowledge-based economy.

Mathematics is a shared language that crosses borders and cultures, and is understood and used globally.

Students read about, represent, view, listen to, and discuss mathematical ideas. They become aware of the historical threads from different cultures that have led to the current bodies of mathematical knowledge. These opportunities allow students to create links between their own language and ideas and the formal language and symbols of mathematics.

# ABORIGINAL AND TORRES STRAIT ISLANDER KNOWLEDGE, CULTURES, AND PERSPECTIVES

In partnership with Aboriginal and Torres Strait Islander communities, and schools and school sectors, the SACE Board of South Australia supports the development of highquality learning and assessment design that respects the diverse knowledge, cultures, and perspectives of Indigenous Australians.

The SACE Board encourages teachers to include Aboriginal and Torres Strait Islander knowledge and perspectives in the design, delivery, and assessment of teaching and learning programs by:

- providing opportunities in SACE subjects for students to learn about Aboriginal and Torres Strait Islander histories, cultures, and contemporary experiences
- recognising and respecting the significant contribution of Aboriginal and Torres Strait Islander peoples to Australian society
- drawing students' attention to the value of Aboriginal and Torres Strait Islander knowledge and perspectives from the past and the present
- promoting the use of culturally appropriate protocols when engaging with and learning from Aboriginal and Torres Strait Islander peoples and communities.

## SACE NUMERACY REQUIREMENT

Completion of 10 or 20 credits of Stage 1 Essential Mathematics with a C grade or better, or 20 credits of Stage 2 Essential Mathematics with a C- grade or better, will meet the numeracy requirement of the SACE.

## LEARNING SCOPE AND REQUIREMENTS

## LEARNING REQUIREMENTS

The learning requirements summarise the knowledge, skills, and understanding that students are expected to develop and demonstrate through learning in Stage 1 Essential Mathematics.

In this subject, students are expected to:

- 1. understand mathematical information and concepts
- 2. apply mathematical skills and techniques to solve practical problems in everyday contexts
- develop skills in gathering, representing, and interpreting data relevant to everyday contexts
- 4. interpret results and use mathematical reasoning to draw conclusions and consider the appropriateness of solutions
- 5. make discerning use of electronic technology
- 6. communicate mathematically and present mathematical information in a variety of ways.

## CONTENT

Stage 1 Essential Mathematics is a 10-credit subject or a 20-credit subject.

Students extend their mathematical skills in ways that apply to practical problem-solving in everyday and workplace contexts. A problem-based approach is integral to the development of mathematical skills and associated key ideas in this subject.

Topics studied cover a range of applications of mathematics, including general calculation, measurement and geometry, money management, and statistics. In this subject there is an emphasis on extending students' computational skills and expanding their ability to apply their mathematical skills in flexible and resourceful ways.

Stage 1 Essential Mathematics consists of the following seven topics:

- Topic 1: Calculations, time, and ratio
- Topic 2: Earning and spending
- Topic 3: Geometry
- Topic 4: Data in context
- Topic 5: Measurement
- Topic 6: Investing
- Topic 7: Open topic.

## Programming

Programs for a 10-credit subject must be made up of a selection of subtopics from at least three topics. Topics can be studied in their entirety or in part, taking into account student interests, and preparation for pathways into the future study of mathematics.

Programs for a 20-credit subject must be made up of a selection of subtopics from at least six topics from the list.

The topics selected can be sequenced and structured to suit individual cohorts of students. The suggested order of the topics provided in the list is a guide only.

Topics 1 to 6 consist of a number of subtopics. These are presented in the subject outline in two columns as a series of key questions and key concepts, side by side with considerations for developing teaching and learning strategies.

Where a school chooses to undertake Topic 7: Open topic, the key questions and key concepts, considerations for developing teaching and learning strategies, and any subtopics will need to be developed.

The key questions and key concepts cover the content for teaching, learning, and assessment in this subject. The considerations for developing teaching and learning strategies are provided as a guide only.

A problem-based approach is integral to the development of the computational models and associated key concepts in each topic. Through key questions, students deepen their understanding of concepts and processes that relate to the mathematical models required to address the problems posed.

The considerations for developing teaching and learning strategies present guidelines for sequencing the development of ideas. They also give an indication of the depth of treatment and emphases required.

In the considerations for developing teaching and learning strategies, the term 'trade' is used to suggest a context in a generic sense to cover a range of industry areas and occupations such as automotive, building and construction, electrical, hairdressing, hospitality, nursing and community services, plumbing, and retail.

## Topic 1: Calculations, time, and ratio

Students extend their proficiency with calculations required for everyday living. Computational skills are practised within contexts that are relevant to the students' interests. To develop a better understanding of the mathematical processes involved, the initial focus of the learning in this topic is the performance of calculations by hand. The discerning use of electronic technology is introduced to enable more complex problems to be solved efficiently.

#### Subtopic 1.1: Calculations

#### Key questions and key concepts

How can basic mathematics skills help us in our everyday lives?

- Solve practical problems requiring basic number operations
- Apply arithmetic operations according to their correct order

How can you determine the reasonableness of your calculations?

- Use leading-digit approximation to obtain estimates of calculations
- Apply approximation strategies
- Ascertain the reasonableness of answers to arithmetic calculations
- · Check results of calculations for accuracy

How can a calculator be used to carry out multistep calculations?

### Considerations for developing teaching and learning strategies

In everyday contexts, students solve a range of problems using addition, subtraction, multiplication, and division. These problems include fractions, decimals, finding the square root of positive whole numbers that are perfect squares, and writing numbers in index form and expanding indices to find the basic numeral. The focus is on carrying out these computations without the use of electronic technology. For certain trades, students need to be familiar with the use of long division. Problems could include checking the calculations for an electricity bill, determining the cost of a shopping list, or building an object. It may be useful to revise the order of operations for solving problems when more than one mathematical procedure is involved in the solution.

Discuss the importance of questioning, and detecting answers that are not reasonable. Investigate strategies that enable appropriate approximations for answers to arithmetic calculations. Use leading-digit approximations (e.g.  $41 \times 21$  is approximately  $40 \times 20$ ), sensible rounding of figures (e.g. estimate a shopping bill where the cost of a number of individual items purchased is rounded to the nearest \$5 or \$10 figure or grouped into approximately these sums) or using the distributive law  $(23 \times 7 = 20 \times 7 + 3 \times 7)$ . Students become discerning about the reasonableness of their answer in the context of the problem.

Discuss the discerning use of technology. Students become familiar with using their calculator to enter and calculate multi-step arithmetic problems. These calculations include the use of technology to solve problems involving fractions, decimals, finding the square root of positive whole numbers, and carrying out computations with indices.

## Key questions and key concepts

How many decimal places are appropriate in an answer?

- Recognise the significance of place value after the decimal point
- Evaluate decimal fractions to the required number of decimal places
- Round up or round down numbers to the required number of decimal places
- Use scientific notation to display small and large numbers
- Multiply and divide by multiples of 10

### Considerations for developing teaching and learning strategies

Consider the place value of figures after a decimal point. Use technology to convert fractions to decimals, and to round to a required number of decimal places.

Emphasise the rules for rounding numbers both up and down, including to tens, tenths, and hundredths. Provide practical examples to reinforce the need for rounding of values to specified decimal places. Review the use of scientific notation to display very small and very large numbers, and multiplication and division by multiples of ten.

#### Subtopic 1.2: Time and rates

#### Key questions and key concepts

Estimate and calculate time:

- Use units of time conversions between units, and fractional, digital, and decimal representations
- Represent time using 12-hour and 24-hour clocks
- Calculate time intervals (e.g. time between, time ahead, time behind)

#### Considerations for developing teaching and learning strategies

Discuss units of time (why is a metric system not used for time?) and the different representations of time including fractional, digital, and decimal. Carry out conversions between a 12-hour clock and a 24-hour clock, and use practical examples to calculate time intervals between a start and finish time (e.g. bus or train timetables). Using timetables and electronic technologies, students plan and compare the time taken to travel a specific distance with various modes of transport to determine the most time-efficient routes. Contexts could include planning the journey to a job location some distance from home, or planning a family holiday travelling interstate or overseas, which would allow for the investigation and use of time zones in time calculations.

In other contexts, for example, in schools with a fishing or horticultural focus, students could interpret more complex timetables, such as tide charts, sunrise charts, and moon phases for fishing or planting crops.

### Key questions and key concepts

How can you use rates to make comparisons?

- Identify common usage of rates (e.g. km/h as a rate to describe speed, beats/minute as a rate to describe pulse)
- Convert units of rates occurring in practical situations to solve problems, including km/h to m/s, mL/min to L/h
- Use rates to make comparisons and to solve problems
- Interpret rate graphs

## Considerations for developing teaching and learning strategies

The extension of time into combining time with other measurements will introduce the concept of rates. Class discussion could include questions such as:

- · How fast can you walk or run?
- How could this be measured so that it can be compared with the speed of a car?
- Which is faster 60 kilometres an hour or 15 metres a second?

Identify appropriate units and conversions for different activities (e.g. walking, running, driving, water flow rates, petrol consumption).

Determine distances and speed, or other types of combined measurements using rates (e.g. water loss from a dripping tap over a given time, heart rate, petrol usage).

Make comparisons using rates, for example, using unit prices to compare best buys or comparing heart rates before and after exercise.

Interpret rate graphs such as distance versus time, cost versus time, or car stopping distances at varying speeds. An extension to this subtopic can be made through use of formulae to determine speed, distance, or time (i.e. speed = distance/time). Alternatively, rates can be used to determine a tradesperson's costs to complete a job; for example, calculating the cost of a plumber using rates per hour with a call-out fee included.

### Subtopic 1.3: Ratio and scale

### Key questions and key concepts

What is a ratio and how are they used to solve problems?

- The relationship between fractions and ratio
- Express a ratio in simplest form
- Find the ratio of two quantities
- Divide a quantity in a given ratio

How does a scale factor work?

- Scale factor
- Scale diagrams
- · Calculation of actual and scale distances

#### Considerations for developing teaching and learning strategies

Consideration of ratios and their expression in their simplest form will lead to problem-solving, including finding the ratio of two or more quantities; expressing a ratio in its simplest form; or dividing a quantity in a given ratio. Use everyday examples such as:

- preparing cordial where water and syrup are combined in a ratio
- adjusting a recipe to cater for a larger number of guests
- preparing 2-stroke fuel by mixing petrol and oil in ratio
- calculating dosages of medicines (e.g. if a vial of medicine states 5 mg per cm<sup>3</sup>, how many cm<sup>3</sup> will be needed for a patient requiring 7.5 mg of medicine?).

Discuss how large distances or spaces can be represented on a diagram. This leads to a discussion of the use of scale factor on maps and plans. Investigate the use of different scales (e.g. a scale on a house plan compared to the scale used on a road map covering a large area) and use the given scale to calculate actual lengths or distances.

Construct simple maps or plans where a scale is chosen by the student (e.g. a scale plan of the school for students new to the school). Use electronic technology, such as a drawing software package, where appropriate. Place emphasis on the conventions of construction of scale diagrams, such as:

- · scales in ratio
- indications of dimensions
- labelling.

Calculate time and costs for a journey from distances estimated from maps.

## **Topic 2: Earning and spending**

This topic examines basic financial calculations in the context of the students' personal experiences and intended pathways (e.g. living independently, working, pursuing a hobby). Students understand the different ways of being paid for work and the impact of taxation on their income. They learn to manage the spending of their earnings through budgeting. Much of the learning in this topic is undertaken through investigations in which individuals or groups of students budget for buying a major item (such as a car) or plan for a major event (such as a holiday).

### Subtopic 2.1: Earning

#### Key questions and key concepts

In which different ways can income be earned and received?

- Work: full-time, part-time, casual, selfemployed, work on commission, contract
- Salary
- Wages
- Hourly paid
- Commission
- Piecework
- Additional bonuses, entitlements, allowances, overtime, or rewards

How can you calculate a weekly, fortnightly, monthly, or annual income?

- · Gross income (salaries, wages)
- Commissions
- Contracts

How much personal taxation will you pay?

- Personal taxation
- Medicare levy
- Other deductions

#### Considerations for developing teaching and learning strategies

Discuss the various ways of earning an income. These could be grouped in remuneration categories (e.g. salary, hourly paid, contract, commission) and as full-time, part-time, or casual work; shift work; commission; or piecework.

Discussion of leave loadings; overtime; allowances for uniforms, training, and tools; sick leave or carer's leave; payments in shares or bonuses; and areas of employment in which these might apply.

Students carry out a variety of pay calculations including maintaining a timesheet; calculating various weekly, fortnightly, monthly, and annual gross incomes for salaries, wages, commissions, contracts; and so on. Include allowances, loadings, and bonuses. Use technology where appropriate. The use of spreadsheets is encouraged.

After calculating gross incomes, calculate personal income tax, the Medicare levy, and other deductions (e.g. superannuation, union fees, and private health cover) and the amount deducted to find net income. Students use the taxation tables on the Australian Taxation Office website.

Explore examples to investigate the impact of changes in the amount of time worked and how that affects the tax paid, and hence the net income.

#### Subtopic 2.2: Spending

Key questions and key concepts	Considerations for developing teaching and learning strategies
How, and on what, do you spend your money?	Explore the different ways in which students spend their money, and what their expenses might be in the near future. Pose questions, such as: 'What would you like to buy?', 'How much money will you need?', 'How will you know if you have a bargain and have spent your money wisely?'.
What is a percentage?	Discuss the term 'percentage' to elicit students' understanding of the term and its uses in everyday life. Use of visual diagrams may assist.
How can a percentage be expressed as a decimal or fraction?	Convert a percentage to both a fraction in its simplest form and to a decimal. This should include the use of commonly used percentages (e.g. 5%, 10%, 25%).
<ul><li>How can the calculation of a percentage provide us with information?</li><li>Finding a percentage of a given amount</li><li>Determining one amount expressed as a percentage of another</li></ul>	Discussion of the relevance of percentages in practical situations will lead to calculations that require finding a percentage of an amount, or describing one amount as a percentage of another. Examples include distribution of money (for a job completed), working on commission, trade discounts, or investigation of what percentage of the household money is spent on various expenses.

What impact do percentage increases and decreases have on the price of goods and services?

- percentage increases and decreases
- calculations involving mark-ups, discounts, goods and services tax (GST)

percentage discounts. Estimating discounts and sale prices from advertised percentage discounts for commonly used percentages (e.g. 5%, 10%, 50%) should be practised without the use of technology. Discussion of where GST is applied to the cost of individual goods and services. Students calculate the impact of GST on the total cost of

Advertisements in the media, catalogues, and

or sales. Students collect examples of such advertisements to calculate and check the

accuracy of the advertised savings including

investigation of sale prices, original prices, and

stores provide examples of discounts, specials,

calculate the impact of GST on the total cost of goods purchased and the services required where GST is applied in everyday life (e.g. investigate grocery shopping dockets, painting bill).

### Key questions and key concepts

How do you determine the overall change in a quantity following repeated percentage changes?

What are the real costs and actual charges when purchasing goods?

### Considerations for developing teaching and learning strategies

Students may investigate the effect of a number of percentage changes to a given figure:

- volume discount followed by a trade discount based on payment terms (e.g. 7/10, 5.5/21, *n*/30)
- series discount of two or more percentage reductions (e.g. trade, cash, end of season, markdowns, end-of-line clearance).

Investigate the costs associated with different ways in which money is spent (e.g. debit or credit card or app, cash, lay-by, direct debit). Assess the advantages and disadvantages of one or more payment methods.

## Subtopic 2.3: Budgeting

Key questions and key concepts	Considerations for developing teaching and learning strategies
How do you plan to spend your money?	Explore the kinds of items that students plan to spend their money on, and what their expenses might be in the near future. Pose questions such as: 'What do you want to save up for?', 'How much money will you need?'.
How do you balance your personal budget?	Using a spreadsheet, students list the income that they receive or earn over a period of time, and their likely expenses, and determine if they will be in credit or debt. They extrapolate this information to determine proposed savings over an extended period of time such as a month or year. This could lead to investigation of possible changes to their spending practices that allow them to save for an event or item.
How can budgeting be applied to a business?	Discuss the importance to a business entity of knowing what the income and expenses need to be in order to stay profitable. This could lead to discussions of various expenses that may be applicable to a business (e.g. rent, electricity, wages, insurance). Students use these ideas in designing a fundraising activity to raise money for a charity.

## **Topic 3: Geometry**

The earliest geometry involved observing the properties of plane shapes such as triangles and quadrilaterals and their use in construction. Students name a variety of common two-dimensional and three-dimensional (2D and 3D) figures and classify them according to their geometric properties. They learn to measure and classify angles, and use instruments (e.g. a pair of compasses and a straight edge) to construct geometrical figures. They identify the geometry involved in structures in the built environment and landscapes.

### Subtopic 3.1: Shapes

#### Key questions and key concepts

How are different 2D shapes identified and classified?

- · Naming of 2D shapes
- Classification of shape as regular or irregular
- Classification and naming of different triangles (e.g. equilateral, isosceles, scalene, rightangled)
- Naming of different representations of circles (e.g. semicircle and sector)

How are different 3D shapes identified and classified?

- Naming of 3D shapes
- Classification of 3D shapes (e.g. prisms, pyramids, sphere, cone)
- · Properties of prisms
- Properties of pyramids
- 3D nets

## Considerations for developing teaching and learning strategies

Consider the names of 2D shapes such as square, rectangle, rhombus, parallelogram, trapezium, circle, and triangle. These include naming polygons up to 12-sided figures. Further classify shapes as regular or irregular. Students classify triangles by the length of their sides, and know the appropriate name. Students identify right-angled triangles and different representations of circles, such as a semicircle and sector.

Students identify 2D shapes in a range of everyday or trade contexts (e.g. different shapes in tiles, paving, buildings, and landscape designs).

Consider the names of 3D shapes such as cube, sphere, cylinder, and cone. Discuss the properties of a prism, leading to students naming a variety of prisms (e.g. cube, cone, rectangular prism, and triangular prism). Discuss the properties of a pyramid, leading to the students being able to distinguish between a square-based pyramid and a triangular-based pyramid.

Students identify these shapes in a range of everyday or trade contexts (e.g. commercial packaging, cylinders in car engines, retaining walls). Students investigate a range of nets used to construct 3D solids (e.g. cubes, spheres, prisms, pyramids, cylinders, and cones). Students recognise the 2D shapes that form the faces of the 3D solids. Students name the 3D shape from a net as well as draw a net for a given 3D solid.

### Subtopic 3.2: Angle geometry

### Key questions and key concepts

How are angles classified and measured?

• Classification of angles as acute, right, obtuse, straight, reflex, revolution

## Considerations for developing teaching and learning strategies

Consider the properties of the various angles and recognise these in everyday shapes and structures. When given a range of diagrams depicting various angles, students estimate the size of the angles and then measure the angles using appropriate equipment such as a geoliner or protractor. Useful contexts for problems are found by applying this knowledge to everyday situations such as taking measurements in the building industry or constructing scale diagrams (e.g. investigation of the angles required in the different types of roof trusses or laying out a formal garden design).

Students learn the properties of complementary and supplementary angles, and use these to find unknown angles.

The understanding of parallel lines and their representation is followed by the introduction of the range of rules that can be used to determine the size of angles created when a transverse line cuts two or more parallel lines. These rules are used to determine missing angles in simple questions involving parallel lines.

How can unknown angles be determined?

- Complementary angles
- Supplementary angles

How can angles be determined when lines are parallel?

- Corresponding angles
- Alternate angles
- · Vertically opposite angles
- Co-interior angles

### Subtopic 3.3: Geometry and construction

#### Key questions and key concepts

How can you use mathematical equipment to construct geometrical figures?

- Construction techniques for lines
- Construction techniques for angles

How can mathematical equipment be used to construct geometrical shapes?

- Construction of triangles (e.g. equilateral, isosceles, scalene, right-angled)
- Constructions involving circles
- · Construction of a variety of polygons

## Considerations for developing teaching and learning strategies

This section reinforces skills associated with the use of mathematical equipment for making accurate constructions of angles and lengths using a compass and ruler. Familiarity with other equipment (e.g. a protractor) used in the measurement of angles assists in checking the accuracy of constructions. Students practise using the equipment by carrying out a variety of construction exercises, such as:

- bisecting a line segment or angle
- · copying a line segment or angle
- constructing a range of angle sizes using a compass
- finding the perpendicular bisector of a line segment.

There is a range of resources available on the Internet (e.g. www.mathopenref.com/ constructions.html).

Students use the mathematical equipment with familiarity to construct accurate geometrical figures.

Students extend their skills in geometrical construction to a range of geometrical shapes. These include:

- the accurate construction of a range of triangular shapes, given specific side length and angle properties
- constructions involving circles (e.g. constructing a circle given three points, finding the centre of a given circle, finding a tangent to a point on a circle)
- construction of a variety of polygons (e.g. squares and hexagons, given one side; a parallelogram, given the two side lengths and an included angle).

Students investigate practical applications of these techniques, for example in pegging out a building site or landscape design.

## Topic 4: Data in context

Information, in the form of data, is prevalent and influential in daily life. Data can be presented in a variety of ways and for many purposes. In this topic students learn to read and critically interpret data presented to them in various forms. They collect, organise, analyse, and interpret data to make informed decisions and predictions, or support a logical argument. Students learn to use various statistical tools and techniques for working with data. They manipulate and represent data in ways that enable them to make sound statistical arguments.

## Subtopic 4.1: Classifying data

### Key questions and key concepts

Why do we collect data?

#### What type of data is categorical?

- Nominal
- Ordinal

#### What type of data is numerical?

- Discrete
- Continuous

## Considerations for developing teaching and learning strategies

Discuss the reasons for collecting data, for example, to answer a question that has been posed or to solve a problem. Students develop an understanding of the strengths and limitations of the use of statistical data to explain everyday and other phenomena.

Discuss the classification of data that is categorical (i.e. sorted by categories). There are two types of categorical data:

- nominal, which has no associated order (items or subjects that do not have a specific order such as colour or gender)
- ordinal, in which the data collected has a qualitative scale associated with it (e.g. strongly disagree, disagree, no opinion, agree, strongly agree).

Students classify types of data. Examples of categorical data may be collected from the class, both nominal data (e.g. mobile phone brands, favourite sport) and ordinal data (e.g. students' opinions of healthy food where a qualitative scale has been used in the collection of the data).

Discuss the classification of data that is:

- numerical and can be further classified into discrete numerical data; that is, the data has a specific value (e.g. the number of mobile phones in a home, number of children in a family)
- continuous numerical; that is, the data may take any value within a range (e.g. the temperature recorded hourly for a particular location, other forms of measurement).

Students classify types of numerical data.

### Subtopic 4.2: Reading and interpreting graphs

How is information presented in tables and graphs?

- Line graph, step graph, column graph, picture graph, pie graph
- · Two-way tables

How do the media and different texts display information in graphs?

Why are some methods of presenting data more suitable than others?

## Considerations for developing teaching and learning strategies

Consider the ways in which information can be represented graphically and what qualities are important in presenting information (e.g. clear labelling, appropriate scales). Investigate information presented in two-way tables as a further method of presenting information. Expose students to a range of graphs or tables from which they can extract information (e.g. body mass index or BMI for age, stopping distances for vehicles, height and weight charts for babies).

Investigate the variety of places in which graphs are used to display information. Discuss and interpret how the way in which information is presented in these graphs supports understanding. Investigate or refer to examples of charts (e.g. in magazines, in newspapers, on television) displaying a variety of information (e.g. political polls, indexes, share market information).

Students look for data presented in the media or other publications in everyday contexts and discuss how appropriately they have been presented.

## Subtopic 4.3: Drawing graphs

Key questions and key concepts	Considerations for developing teaching and learning strategies
What type of graph is best used to display a dataset?	Discuss the type of information that is best displayed on different types of graphs. For example, pie graphs show how something is divided (e.g. the money in a weekly budget), line graphs show the rise or fall of one variable, and histograms can be used to compare data.
<ul><li>How can categorical data be displayed?</li><li>Tables, column graphs, picture graphs, pie charts</li></ul>	Students recognise categorical data and select an appropriate method to present it. They select categorical data that has been presented in the media and display it in a different format, or collect their own categorical data, and present the data in a range of appropriate ways. Students use appropriate labelling, scales, and titles for graphs.
<ul><li>How can numerical data be displayed?</li><li>as frequency distributions, dot plots, stem and leaf plots, and histograms</li></ul>	Students recognise numerical data and select an appropriate method to present it. They select numerical data that has been presented in the media and display it in a different format, or collect their own numerical data, and present the data in a range of appropriate ways. Students use appropriate labelling, scales, and titles for all graphs.
How can a line graph be used to represent data that demonstrates a continuous change?	Students use a variety of data that demonstrate a continuous change, to produce line graphs. This includes data such as the hourly temperature over the period of a day, the rainfall each day of a particular month, the price of particular companies' shares every month over the period of a year. Students use appropriate labelling, scales, and titles for all graphs.
How can spreadsheets be used to tabulate and graph data?	Data can be provided to or collected by students to create a range of different types of graphs using the graphing package on a spreadsheet. Students choose appropriate types of graphs to display the different types of data provided and learn to use the graphing package to include appropriate labelling, scales, and titles for all graphs.

## Subtopic 4.4: Summarising and interpreting data

Key questions and key concepts	Considerations for developing teaching and learning strategies
What is the mode?	Students develop an understanding of the mode as the statistical measure that identifies the most common score(s) within a data set. Discuss how useful it may be in describing data. Students identify the mode of a given data set.
<ul><li>What is meant by average?</li><li>Median and mean</li></ul>	Students examine sets of data with this question in mind, including median and mean, noting that measures of central location are not valid for categorical data.
<ul><li>How can the measures of central tendency be calculated?</li><li>Arithmetic mean and median</li></ul>	Students develop an understanding of calculations of the mean and median. For small data sets, students calculate these measures without technology.
How useful are the mean and median as measures of central tendency?	Students become aware that the centre, on its own, is of limited use as the descriptor of a distribution, but that it can be used to compare two sets of data or to compare a single set of data with a standard. Students investigate the suitability of mean and median in various everyday and vocational contexts. Investigation of examples of the media using these measures inappropriately would give students an understanding of the need to check the validity of information presented by different sources.
<ul><li>What effect do outliers have on measures of central tendency?</li><li>Recognition of an outlier</li><li>Effect on the measures of central tendency</li></ul>	Introduce discussion of individual data that fall well outside of the observed pattern (outliers). Examples of outliers may have been evident in data that has already been used or collected by the class. Investigate the identified outlier to determine if it is a 'real' piece of data or caused by an error in the collection process (e.g. faulty equipment, error in recording the value). Outliers should be excluded from the data set only if their existence can be shown to be the

Discuss the effect of outliers on measures of centre. Use carefully chosen examples to support the discussion of how outliers can distort the different measures of central tendency of a distribution. Students choose the measure of centre most appropriate for a given purpose and a given set of data (e.g. selling price of houses, typical daily calorie intake).

result of an error.

## Key questions and key concepts

What further statistical measures can support the investigation of data?

• Range, interquartile range, standard deviation

### Considerations for developing teaching and learning strategies

Students use the range, interquartile range, and standard deviation to obtain more information about aspects of the data. In cases where students cannot access a graphics calculator or spreadsheet package, use small data sets to support the finding of quartiles. Investigation of examples of inappropriate use of these measures by the media, or other sources, may encourage students to check the validity of information presented. Consider further investigation into the calculation and interpretation of deciles and percentiles.

Discuss the informal ways that can be used to describe the spread of data, including descriptions such as spread out/dispersed, tightly packed, clusters, gaps, more/less dense regions, and outliers.

How can data be described without using statistical measures?

### Subtopic 4.5: Comparing data sets

#### Key questions and key concepts

How can we compare two sets of related data?

- Use back-to-back stem plots
- · Calculate a five-number summary
- Construct box-and-whisker plots using a fivenumber summary
- Compare the characteristics of the shape of histograms

### Considerations for developing teaching and learning strategies

Compare the shape of two related distributions of numerical data using a variety of methods. Present two related sets of data as back-to-back stem plots, calculate five-number summaries, and produce box plots on the same scale.

Students look for differences in the characteristics of the shapes of the distributions (e.g. symmetry, skewness, bimodality). The use of technology for these comparisons is encouraged, whether through use of a graphics calculator or a spreadsheet program with a statistics package.

## **Topic 5: Measurement**

In this topic students extend their skills in estimating, measuring, and calculating in practical situations. They identify problems involving length, area, mass, volume, and capacity, and apply relevant techniques to solve them. Consider units of measurement, appropriate measuring devices, and the degree of accuracy required for finding answers in a given situation.

The consideration of units of power and energy consumption extends this topic beyond spatial measurement into another area relevant to everyday life. This is investigated through the energy ratings of household items with a focus on reducing our carbon footprint.

#### Subtopic 5.1: Linear measure

#### Key questions and key concepts

#### Why measure?

- · The metric system for linear measurements
- Other systems of measurement of linear measurement

Which metric units are appropriate for measuring linear distance in a given situation?

- For example, km, m, cm, mm
- Appropriate choice of units for linear measurement

How accurate does the measurement have to be?

- Using appropriate devices for making linear measurements
- · Consideration of errors in linear measurement

## Considerations for developing teaching and learning strategies

Consider the history and development of the metric system and other systems of measurement of linear distances. For students with an interest in a trade such as building or plumbing, learning about measurements in inches, feet, and miles should be considered.

Discuss the most appropriate unit for measuring linear distances, and their abbreviations. Include very large and very small measurements, and the use of powers of 10 and scientific notation. Students choose appropriate units for one dimension. Specific trade examples could be covered, such as the use of millimetres as the standard measure for building plans.

Collect or research a variety of instruments for measuring linear distances. Note the scale used for each, and discuss the reason for the fineness of the scale and the degree of accuracy of the measure. Use a variety of instruments so that students can read scales from different tools (e.g. ruler, large measuring tapes, trundle wheels). Students choose appropriate levels of accuracy for measuring and recording linear distances.

Discuss and calculate the errors caused by the measuring equipment used when taking linear measurements, with specific attention to absolute and relative errors.

Students estimate a variety of lengths and check their accuracy using an appropriate measuring device, and justify their choice of particular units (e.g. trade mathematics students pace out distances for quote estimates).

Discuss percentage error. Students consider whether the accuracy of their estimates increases or decreases with practice.

Discuss the different purposes of measurement and the level of accuracy required (e.g. building an object, determining the distance to walk to a café).

What do estimation and approximation mean?

When is it appropriate to use estimation?

## Key questions and key concepts

Why convert units of measurement?

- Converting metric units of length (e.g. 1200 mm = 1.2 m)
- Convert metric units of length to other length units (e.g. metric to imperial measurements)

How do you calculate the perimeter of regular and non-regular shapes?

- Circumference and perimeters of regular shapes (triangles, squares, rectangles and circles)
- Perimeters of non-regular shapes, including composite shapes

## Considerations for developing teaching and learning strategies

A discussion of the need to convert units (e.g. building plans indicate measurements in millimetres, but wood is often purchased per linear metre). This will lead students into practising the conversion of units.

Discuss and use some 'rule of thumb' conversions between other length units (e.g. 1 metre is approximately equal to 3 feet), and the accuracy of the rule of thumb to the accurate conversions. Construct a conversion graph manually or via a spreadsheet to assist with the conversion of metric units to non-metric units of measure.

Calculate the circumference of circles and perimeters of regular, non-regular, and composite shapes. Present problems contextually, in both written and visual format where possible. For circumference of circles, introduce students to rearranging the formula to find the radius or diameter. Cover notation on diagrams indicating equal lengths, and emphasise the appropriate conventions of constructing labelled diagrams.

#### Subtopic 5.2: Area measure

#### Key questions and key concepts

How can the area of standard and non-standard shapes be found?

The use of grids to estimate and calculate areas

Which metric units are used for area?

• For example, km<sup>2</sup>, m<sup>2</sup>, cm<sup>2</sup>, mm<sup>2</sup>

How can we convert units of measurement used for area?

- · Converting metric units of area
- Convert metric units of area to other area units (e.g. metric to imperial)

Calculations

- · Areas of regular shapes
- · Areas of composite shapes

#### Considerations for developing teaching and learning strategies

Students develop an understanding of the concept of area and use grids to estimate standard and non-standard areas. For example, students could use the grid method on graph paper to estimate the area of a hand, foot, or body length, or they could use Maple's method.

Students discuss the most appropriate unit for measuring areas, and their abbreviations. Students choose appropriate units for the area being measured.

Students carry out a range of conversions between metric units of area. Convert between different measurements of area such as square metres, square kilometres, hectares, and acres.

Students calculate areas such as squares, rectangles, triangles, and circles, both with and without electronic technology. To calculate the

area of circles, students should use  $\frac{22}{7}$  as an

approximation for  $\pi$  in non-calculator computations. Extend this to Heron's formula and calculation of composite shapes. Present the calculations of areas as contextual problems. When given the area of a regular shape, students rearrange the formula to find a missing variable. Students choose appropriate units.

## Subtopic 5.3: Mass

Key questions and key concepts	Considerations for developing teaching and learning strategies
What is the difference between mass and weight?	Students develop an understanding of the concept of mass, and the difference between mass and weight.
<ul><li>Which metric units are used for mass?</li><li>For example, tonnes, kg, gm, mg</li></ul>	Students discuss the most appropriate unit for measuring mass and their abbreviations. Students choose appropriate units for the mass being measured.
<ul><li>How can we convert units of measurement used for mass?</li><li>Converting metric units of mass</li></ul>	Students carry out conversions between tonnes, kilograms, grams, and milligrams, and select the correct units of mass for the problem posed. For students with an interest in a trade vocation such as hospitality or nursing, imperial measurements consider using pounds and ounces.
Estimate the mass of different objects.	Students estimate the mass of a variety of items and check their accuracy, using an appropriate measuring device (where appropriate), and justify their choice of particular units. For instance, students estimate weights of food for dietary requirements or cooking.

### Subtopic 5.4: Volume and capacity

### Key questions and key concepts

What is the relationship between volume and capacity?

Which metric units are used for volume?

• For example, kL, L, mL

How can we convert units of measurement used for volume?

• Converting metric units of volume

When is it appropriate to estimate?

## Considerations for developing teaching and learning strategies

Students understand the relationship between volume and capacity.

Students discuss the most appropriate unit for measuring volume, and their abbreviations. Students choose appropriate units for the volume being measured.

Students carry out a range of conversions between metric units of volume. Students convert cubic metres to litres and cubic centimetres to millilitres. These conversions will be particularly relevant for students interested in an automotive trade pathway.

Discuss the appropriateness of estimation, choosing everyday situations such as cooking, paint tinting, and taking medicine.

Students estimate the volume and capacity of a variety of containers (e.g. milk or fruit juice containers, tins of soup), check their accuracy using an appropriate measuring device where possible, and select appropriate units for the measurement being made.

How is the volume of objects calculated?

• Volume of cubes, rectangular and triangular prisms, and cylinders

Develop the link between the volume and the area of the base of a prism, multiplied by the height, and apply these formulae to a range of contextual problems (e.g. the amount of water in a swimming pool or rain water tank, the quantity of mulch required to cover a garden bed, or the volume of a cylinder in a car engine).

#### Subtopic 5.5: Power and energy

#### Key questions and key concepts

Which units are appropriate for measuring the rate at which electrical energy is used?

- Power used by electrical appliances, measured in watts and kilowatts
- Power generation in kilowatts, megawatts, and gigawatts

Which units are appropriate for measuring the energy used by electrical equipment over time?

- Energy used by electrical appliances over time (measured in kilowatt hours)
- How can we calculate the energy used by an appliance in kilowatt hours?
- Joules as an alternative unit of energy

## Considerations for developing teaching and learning strategies

Students investigate the rate at which common electrical equipment such as light bulbs and TVs use energy. Comparisons of the power used by different types of light bulbs (e.g. traditional incandescent vs. LED bulbs) or TV screens of varying sizes lead to consideration of the impact these items may have on the electricity used by a household over a year. Using an assumed usage time per day, they determine a monthly and yearly amount of power used by the items. Investigate the energy generated by power stations (e.g. Torrens Island Power station, Starfish Hill Windfarm), and domestic solar systems.

Students determine the amount of electrical energy used by an item over a specified time in kilowatt hours. To calculate the number of kilowatt hours used per day for a variety of electrical items, introduce the formula for conversion between power and energy:

$$E_{(\rm kWh)} = \frac{\left[P_{(\rm W)} \times t_{\rm (h)}\right]}{1000}$$

where:

- *E* = energy in kilowatt hours
- P = power in watts
- t = time in hours.

Energy (in joules, J ) = Power (in watts, W )  $\times$  Time (in seconds, s)

BBC1's documentary 'Bang Goes the Theory: Human Power Station' (BBC One, 2009, available on YouTube) provides an excellent starting point for investigating the connection between human energy and electrical power.

Students investigate the information provided on the ERL on household electrical appliances (e.g. TVs, refrigerators, washing machines). Using the energy consumption provided on the ERL and an appropriate electricity tariff, the annual running cost can be determined for a range of household electrical appliances. (See the Energy Rating website www.energyrating.gov.au for more information, including the average electricity tariff for each state and example energy consumption calculations.)

What information is provided on an Energy Rating Label (ERL) on electrical appliances? How can we use it?

- Star rating
- Energy consumption and its use in determining an approximate annual running cost of electrical equipment

## Key questions and key concepts

How can you calculate your household electricity costs?

- Daily supply charge
- Tariff

## Considerations for developing teaching and learning strategies

Students calculate the cost of electricity to a household and consider the charges for electricity of supply and usage. This could also be extended to solar feed-in tariffs. Investigation of different electricity suppliers and the supply charges and tariffs may lead to consideration of students' own household's electricity account, their household's average usage, and how it compares to that of other households. (Comparisons of average household electricity use can be made by postcode at the following link: https://www.energymadeeasy.gov.au/benchmark)

## **Topic 6: Investing**

Students investigate interest, term deposits, and the costs of credit, using current and relevant examples. To explore the concepts and uses of simple and compound interest, students collect and analyse materials from various financial institutions outlining their financial products. They examine the effects of changing interest rates, terms, and investment balances on interest earned, and make comparisons. Emphasis is placed on the use of technology, particularly spreadsheets and graphical packages, to enhance students' opportunities to investigate interest generated on investments.

### Subtopic 6.1: Simple interest

#### Key questions and key concepts

Why do people save?

How is simple interest calculated, and in which situations is it used?

- Use the simple interest formula to find the:
  - simple interest
  - principal
  - interest rate
  - · time invested in years

### Considerations for developing teaching and learning strategies

Discuss the reasons that people save money. Discuss the role of banks and other financial institutions in building savings.

Investigate everyday situations in which simple interest calculations are used (e.g. term deposits), to build the students' understanding of its applications. Use the formula for simple interest to explore a range of examples of simple interest calculations. Calculations should allow students to be able to solve problems with and without electronic technology. Students rearrange the simple interest formula to find all of the variables.

Investigations lead students to recognise the effects of changing the principal, interest rate, and time invested. The use of spreadsheets assists students to further investigate simple interest problems through the ability to make changes quickly and see the immediate impact of the change.

## Subtopic 6.2: Compound interest

### Key questions and key concepts

How is compound interest different from simple interest?

• The way in which interest is accrued?

How is the compound interest formula derived?

Find the

- amount accrued
- principal
- Find the
  - amount accrued
  - principal
  - interest rate
  - + time

## Considerations for developing teaching and learning strategies

Compare the differences between the way in which interest is accrued in a simple interest account and a compound interest account.

Exposure to the derivation of the formula for compound interest leads to the students carrying out basic calculations for problems in everyday contexts to determine the amount accrued and the principal, using the compound interest formula. To develop the understanding of the effect that the compounding period has on the interest earned, investigate the effect of changing the number of compounding periods per year.

Using examples collected from financial institutions, students use technology to calculate the amount accrued, principal, interest rate, and time. This leads to students investigating and recognising the effects of changing the principal, interest rate, and time. Using spreadsheets assists students to further investigate compound interest problems through the ability to make changes quickly and see the immediate impact of the change.

## Subtopic 6.3: Investing for interest

### Key questions and key concepts

Which is the better option: simple interest or compound interest?

- Graphical comparisons
- Effective rate calculations (both simple and compound interest investment rates)

## Considerations for developing teaching and learning strategies

Students investigate both simple and compound interest alternatives for a range of everyday problems to determine which option presents them with the best outcome in saving scenarios. Students use graphical presentation of the interest earned for both a simple and compound interest scenario to develop their understanding of the different ways in which the interest accrues. Using a larger simple interest rate and a smaller (annual) compound interest rate, students determine when compound interest becomes the better option.

Calculate the simple interest rate that, over a number of years, will earn the same amount as a given compound interest rate.

Study the use of effective rates to compare both simple and compound interest rate investment options.

## **Topic 7: Open topic**

Schools may choose to develop a topic that is relevant to their local context.

When developing an open topic, teachers should ensure that it:

- is introduced with an overview that provides a contextual framework, with an emphasis on application of the mathematics in the context
- includes an outline of the key questions and key concepts, with some considerations of the teaching and learning strategies that best relate to these questions and ideas
- is divided into subtopics, with key questions and key concepts, where appropriate
- enables students, together with the other topics for study, to develop the knowledge, skills, and understanding to meet the learning requirements of the subject
- emphasises the appropriate use of electronic technology in teaching, learning, and assessment
- consists of content of a standard comparable to that of other topics outlined in the Stage 1 Essential Mathematics subject outline.

The open topic should relate to the needs, interests, and context of the particular group of students for whom the topic is developed.

The topic should encourage a problem-based approach to mathematics as this is integral to the development of the mathematical models and associated key concepts in each topic. Through the statement of key questions and key concepts, teachers can develop the concepts and processes that relate to the mathematical models required to address the problems posed. The teaching and learning strategies should give an indication of the depth of treatment and emphases required.

The open topic at Stage 1 may be used to introduce and develop skills for an open topic that schools intend to teach at Stage 2.

## **ASSESSMENT SCOPE AND REQUIREMENTS**

Assessment at Stage 1 is school based.

## **EVIDENCE OF LEARNING**

The following assessment types enable students to demonstrate their learning in Stage 1 Essential Mathematics:

- Assessment Type 1: Skills and Applications Tasks
- Assessment Type 2: Folio.

For a 10-credit subject, students provide evidence of their learning through four assessments. Each assessment type should have a weighting of at least 20%.

Students undertake:

- · at least two skills and applications tasks
- at least one folio task.

For a 20-credit subject, students provide evidence of their learning through eight assessments. Each assessment type should have a weighting of at least 20%.

Students undertake:

- · at least four skills and applications tasks
- at least two folio tasks.

## ASSESSMENT DESIGN CRITERIA

The assessment design criteria are based on the learning requirements and are used by teachers to:

- · clarify for students what they need to learn
- design opportunities for students to provide evidence of their learning at the highest level of achievement.

The assessment design criteria consist of specific features that:

- · students need to demonstrate in their evidence of learning
- teachers look for as evidence that students have met the learning requirements.

For this subject, the assessment design criteria are:

- concepts and techniques
- reasoning and communication.

The specific features of these criteria are described below.

The set of assessments, as a whole, gives students opportunities to demonstrate each of the specific features by the completion of study of the subject.

## **Concepts and Techniques**

The specific features are as follows:

- CT1 Knowledge and understanding of mathematical information and concepts.
- CT2 Application of mathematical skills and techniques to find solutions to practical problems in context.
- CT3 Gathering, representation, and interpretation of data in context.
- CT4 Use of electronic technology to find solutions to practical problems.

## **Reasoning and Communication**

The specific features are as follows:

- RC1 Interpretation of mathematical results.
- RC2 Use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions.
- RC3 Use of appropriate mathematical notation, representations, and terminology.
- RC4 Communication of mathematical ideas and information.

## SCHOOL ASSESSMENT

## Assessment Type 1: Skills and Applications Tasks

For a 10-credit subject, students complete at least two skills and applications tasks.

For a 20-credit subject, students complete at least four skills and applications tasks.

Students apply mathematical concepts, processes, and strategies to find solutions to questions related to the subtopics chosen.

Skills and applications tasks should consist of a range of applications that enable students to demonstrate their understanding of mathematical information and concepts, and their skills and techniques in solving practical mathematical problems in everyday contexts.

Skills and applications tasks can be presented in different formats. The assessment conditions under which students undertake the skills and applications tasks may vary and should be guided by the cohort of students that are undertaking the subject. Flexibility in the style of the skills and applications task, and the time allocated to complete the task, should be considered.

Electronic technology may aid and enhance the solution of problems. The use of electronic technology and notes in the skills and applications task assessments is at the discretion of the teacher.

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

- · concepts and techniques
- reasoning and communication.

## **Assessment Type 2: Folio**

For a 10 credit subject, students complete at least one folio task.

For a 20 credit subject, students complete at least two folio tasks.

Either individually or in a group, students undertake planning, apply their skills to gather, represent, and interpret data, and propose or develop a solution to a practical mathematical problem based in an everyday or workplace context. The subject of the problem may be derived from one or more subtopics, although it can also relate to a whole topic or across topics.

A mathematical problem may be initiated by the teacher, or by a student or group of students. Teachers should give students clear advice and instructions on setting and solving the mathematical problem, and support students' progress in arriving at a mathematical solution. Where students initiate the mathematical problem, teachers should give detailed guidelines on developing a problem based on a context, theme, or topic, and give clear direction about the appropriateness of each student's choice.

If a mathematical problem is undertaken by a group, students explore the problem and gather data together to develop a model or solution individually. Each student must submit an individual model or solution.

Students demonstrate their knowledge. They are encouraged to use a variety of mathematical and other software (e.g. statistical packages, spreadsheets, CAD, accounting packages) to solve their mathematical problem.

The folio tasks may take a variety of forms.

The format of a folio task may be written or multimodal.

The length of each folio task can vary. Some tasks may be short and others may be longer; however, no task should be more than six A4 pages if written, or the equivalent in multimodal form.

For this assessment type, students provide evidence of their learning in relation to the following assessment design criteria:

- · concepts and techniques
- reasoning and communication.

## **PERFORMANCE STANDARDS**

The performance standards describe five levels of achievement, A to E. Each level of achievement describes the knowledge, skills and understanding that teachers refer to in deciding how well students have demonstrated their learning on the basis of the evidence provided.

During the teaching and learning program the teacher gives students feedback on their learning, with reference to the performance standards.

At the student's completion of study of a subject, the teacher makes a decision about the quality of the student's learning by:

- · referring to the performance standards
- taking into account the weighting given to each assessment type
- assigning a subject grade between A and E.

## Performance Standards for Stage 1 Essential Mathematics

	Concepts and Techniques	Reasoning and Communication
A	Knowledge and understanding of mathematical information and concepts in familiar and unfamiliar contexts. Highly effective application of mathematical skills and techniques to find efficient and accurate solutions to routine and complex problems in a variety of contexts. Gathering, representation, and interpretation of a range of data in familiar and unfamiliar contexts. Appropriate and effective use of electronic technology to find accurate solutions to routine and complex problems. Knowledge and understanding of mathematical information and concepts in familiar and some unfamiliar contexts.	Accurate interpretation of mathematical results in familiar and unfamiliar contexts. Highly effective use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine and complex problems. Proficient and accurate use of appropriate mathematical notation, representations, and terminology. Clear and effective communication of mathematical ideas and information to develop logical and concise arguments. Mostly accurate interpretation of mathematical results in familiar and some unfamiliar contexts. Effective use of mathematical reasoning to draw
	Effective application of mathematical skills and techniques to find mostly accurate solutions to routine and some complex problems in a variety of contexts. Gathering, representation, and interpretation of data in familiar and some unfamiliar contexts. Mostly appropriate and effective use of electronic technology to find mostly accurate solutions to routine and some complex problems.	conclusions and consider the appropriateness of solutions to routine and some complex problems. Mostly accurate use of appropriate mathematical notation, representations, and terminology. Clear and appropriate communication of mathematical ideas and information to develop some logical arguments.
С	Knowledge and understanding of simple mathematical information and concepts in familiar contexts. Application of some mathematical skills and techniques to find solutions to routine problems in familiar contexts. Gathering, representation, and interpretation of data in familiar contexts. Generally appropriate and some effective use of electronic technology to find solutions to routine problems.	Generally accurate interpretation of mathematical results in familiar contexts. Appropriate use of mathematical reasoning to draw conclusions and consider the appropriateness of solutions to routine problems. Generally appropriate use of familiar mathematical notation, representations, and terminology. Appropriate communication of mathematical ideas and information.
D	Basic knowledge and some understanding of simple mathematical information and concepts in some familiar contexts. Application of basic mathematical skills and techniques to find partial solutions to routine problems in some contexts. Some gathering, representation, and basic interpretation of simple data in familiar contexts. Some appropriate use of electronic technology to find solutions to routine problems.	Some interpretation of mathematical results in some familiar contexts. Attempted use of mathematical reasoning to consider the appropriateness of solutions to routine problems. Some use of familiar mathematical notation, representations, and terminology. Attempted communication of simple mathematical ideas and information.
E	Limited knowledge or understanding of mathematical information or concepts. Attempted application of basic mathematical skills or techniques, with limited accuracy in solving routine problems. Some gathering and attempted representation of simple data in a familiar context. Attempted use of electronic technology to find a solution to a routine problem.	Limited interpretation of mathematical results. Limited awareness of the use of mathematical reasoning in solving a problem. Limited use of mathematical notation, representations, or terminology. Attempted communication of an aspect of mathematical information.

## **ASSESSMENT INTEGRITY**

The SACE Assuring Assessment Integrity Policy outlines the principles and processes that teachers and assessors follow to assure the integrity of student assessments. This policy is available on the SACE website (www.sace.sa.edu.au) as part of the SACE Policy Framework.

The SACE Board uses a range of quality assurance processes so that the grades awarded for student achievement in the school assessment are applied consistently and fairly against the performance standards for a subject, and are comparable across all schools.

Information and guidelines on quality assurance in assessment at Stage 1 are available on the SACE website (www.sace.sa.edu.au).

## SUPPORT MATERIALS

## SUBJECT-SPECIFIC ADVICE

Online support materials are provided for each subject and updated regularly on the SACE website (www.sace.sa.edu.au). Examples of support materials are sample learning and assessment plans, annotated assessment tasks, annotated student responses, and recommended resource materials.

## ADVICE ON ETHICAL STUDY AND RESEARCH

Advice for students and teachers on ethical study and research practices is available in the guidelines on the ethical conduct of research in the SACE on the SACE website (www.sace.sa.edu.au).