DEPARTMENT OF EDUCATION
learners first

Personal futures

Mathematics

Essential Mathematics - Personal 2

Course document

independent schools tasmania

Catholic Education Tasmania

Years 9-12 Learning

Tasmanian Government

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Essential Mathematics – Personal, 150 hours – Level 2

Focus area – Personal futures

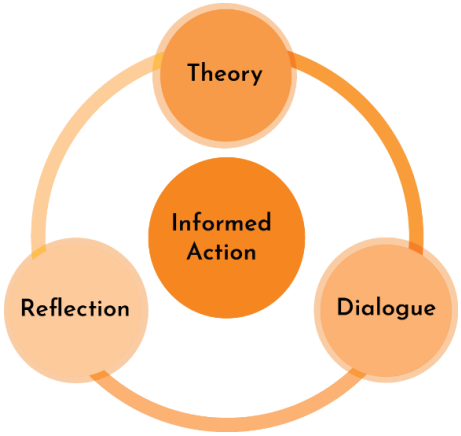
Courses aligned to the Years 9 to 12 Curriculum Framework belong to one of the five focus areas of Discipline-based study, Transdisciplinary projects, Professional studies, Work-based learning and Personal futures.

Essential Mathematics - Personal Level 2 is a Personal futures course.

Personal futures courses prepare learners to be independent young adults, able to lead healthy, fulfilled and balanced lives. Learning is highly personalised. Learners develop strategies to optimise learning, make decisions, solve problems, set career and life goals, and pursue areas of strong personal interest. Personal futures supports learners to develop the required knowledge, skills and understandings to make informed choices that enhance their own and others' health and wellbeing. The inclusion of Personal futures as a focus area responds to a range of contemporary research findings highlighting the importance of learners having broad educational goals that include individual and collective wellbeing and opportunities for student agency as they navigate a complex and uncertain world.

Personal futures courses have three key features that guide teaching and learning:

- theory and dialogue
- informed action
- reflection and dialogue.



In this course learners will do this by:

- engaging with theory and concepts to build the theoretical understanding, background knowledge, rules and conventions of mathematics
- interacting and working with other people and engaging in mathematical discourse to explore ideas, reasoning and approaches
- identifying challenges and problems and using problem solving and mathematical reasoning to test and refine ideas take informed action and compare solutions
- reflecting on their own understanding, integrating prior knowledge and sharing solutions with others.

Rationale

Essential Mathematics – Personal Level 2 is offered alongside *Essential Mathematics – Workplace* Level 2. The two courses provide learners with different topics and together they provide breadth rather than progression of complexity. Consequently, there is no defined order for undertaking these courses and learners may choose to do either one or both according to their personal interest and needs.

In *Essential Mathematics – Personal* Level 2 learners develop their understanding of concepts and techniques drawn from proportion and finance, collection and handling of data, measurement of time, motion, energy and mass.

This will assist them in making informed decisions in relation to their use of mathematics. By undertaking this course, learners will develop their ability to identify and solve problems in real contexts, and in a range of personal, further learning, everyday and community settings.

Learners will work collaboratively to generate ideas and find innovative approaches to engaging with mathematics. Learners will reflect on their ability to interpret, understand and apply these concepts and techniques.

This course will enable learners to develop their mathematical proficiency to the standard required to enter the workforce and participate effectively. This is a key factor in ensuring Tasmania and Australia's current and emerging needs are met. The nation's ability to compete globally requires a substantial number of proficient workers able to learn, adapt, create, interpret, analyse and apply mathematical information.

The purpose of Years 9 to 12 Education is to enable all learners to achieve their potential through Years 9 to 12 and beyond in further study, training or employment.

Years 9 to 12 Education enables personal empowerment, cultural transmission, preparation for citizenship and preparation for work.

This course is built on the principles of access, agency, excellence, balance, support and achievement as part of a range of programs that enables learners to access a diverse and flexible range of learning opportunities suited to their level of readiness, interests and aspirations.

Learning outcomes

On successful completion of this course learners will be able to:

1. communicate thinking, strategies and solutions using appropriate mathematical or statistical language
2. plan, organise and manage learning in order to complete tasks and evaluate progress
3. apply numeric techniques and algebraic processes to represent situations and solve problems
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of solutions to problems
5. act as creative, critical and reflective thinkers to assess ideas and take informed action
6. apply concepts and techniques involving proportion, finance and money management
7. apply concepts and techniques involving relative frequency, and collecting and handling data
8. apply concepts and techniques involving measurement of energy and mass, and time and motion.

Integration of general capabilities and cross-curriculum priorities

The general capabilities addressed specifically in this course are:

- Critical and creative thinking
- Literacy
- Numeracy
- Personal and social capability

The cross-curriculum priorities enabled through this course are:

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

Course description

Essential Mathematics – Personal Level 2 enables learners to use Mathematics to make informed decisions effectively, efficiently, and critically.

They will study:

- percentages, rates and ratio
- data representation and interpretation
- measurement of energy and mass, and time and motion.

Learners will solve problems, explain their reasoning, and investigate, explore and model situations.

Working collaboratively, they will discuss ideas and evaluate their use of mathematics in everyday contexts.

Pathways

The *Essential Mathematics – Personal* Level 2 course enables learning continuity from Year 10 Australian Curriculum: Mathematics for learners who have achieved an "approaching the standard" rating or higher. Learners who have successfully undertaken the TASC accredited course or the *Mathematics* Level 1 course could progress into this course. Additionally, learners who have completed the *Essential Mathematics – Workplace* Level 2 and wish to broaden their essential mathematical knowledge and understanding could enrol in this course.

Essential Mathematics – Personal Level 2 will provide the foundational technical knowledge that may be sufficient for further vocational education and training courses.

Course requirements

Access

This course requires learners to collaborate with others. If they choose, learners may access this course and *Essential Mathematics – Workplace* Level 2 in the same year.

Resource requirements

Learners will require access to scientific calculators in this course. On occasion, computers and the internet will be required to enable learners' access to information and data sources.

Course structure and delivery

Structure

This course consists of three 50-hour modules.

Module 1: Application of percentages, rates and ratio, and budgeting

Module 2: Probability and statistics

Module 3: Measurement of energy and mass, and time and motion

Delivery

There is no specific recommended delivery sequence for the modules.

Course content

Module 1: Application of percentages, rates and ratio, and budgeting

This module contains two topics:

- percentages, rates and ratio
- budgeting and spreadsheets.

'Percentages, rates and ratio' enables learners to engage with applications of percentages. This will support them to calculate, compare and interpret costs associated in various practical contexts and engage with and use rates and ratios as tools for comparison to solve problems in contexts including health, personal finance and travel.

'Budgeting and spreadsheets' builds on this knowledge and requires learners to consider the personal domestic expenses associated with purchasing and maintaining a vehicle and household utilities, and to consider how they may establish a budget to account for these and other discretionary expenses from a given income.

Module 1 learning outcomes

The following learning outcomes are a focus of this module:

1. communicate thinking, strategies and solutions using appropriate mathematical or statistical language
2. plan, organise and manage learning in order to complete tasks and evaluate progress
3. apply numeric techniques and algebraic processes to represent situations and solve problems
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of solutions to problems
5. act as creative, critical and reflective thinkers to assess ideas and take informed action
6. apply concepts and techniques involving proportion, finance and money management.

Module 1 content

Key knowledge and skills

Topic 1 – percentages, rates and ratio

- calculate a percentage of a given amount
- determine one amount expressed as a percentage of another
- apply percentage increase or decrease in various contexts; for example, calculating the goods and services tax, GST, payable on a range of goods and services, and calculating profit or loss in absolute and percentage terms
- identify common usage of rates; for example, kilometres per hour as a rate to describe speed, beats per minute as a rate to describe pulse
- convert units of rates occurring in practical situations to solve problems
- use rates to make comparisons; for example, using unit prices to compare best buys, comparing heart rates after exercise
- determine the overall change in a quantity following repeated percentage changes; for example, an increase of 10% followed by a decrease of 10%
- use, simplify and convert between units of rates; for example, kilometres per hour and metres per second, millilitres per minute and litres per hour
- use rates to solve and describe practical work-based problems
  - use rates to make comparisons; for example, using unit prices to compare best buys, working with speed, comparing heart rates after exercise and considering target heart rate ranges during training
  - use rates to determine costs; for example, calculating the cost of a trade professional using rates per hour and call-out fees
  - work with speed as a rate, including interpreting distance-time graphs, travel graphs, and use them to solve problems related to speed, distance and time
  - calculate the amount of fuel used on a trip, given the fuel consumption rate, and compare fuel consumption statistics for various vehicles.
- solve problems involving measurement of heart rates and blood pressure
  - describe heart rate as a rate expressed in beats per minute
  - measure and graph a person's heart rate over time under different conditions and identify mathematical trends
  - calculate target heart rate ranges during training
  - express blood pressure using measures of systolic pressure and diastolic pressure
  - measure blood pressure over time and under different conditions
  - use a blood pressure chart and interpret the 'healthiness' of a reading.
- solve practical problems involving expressing a ratio in simplest form, finding the ratio of two quantities and dividing a quantity in a given ratio
  - calculating mixtures for building materials or cost per item
  - scaling recipes for use in a commercial setting.

Topic 2 – budgeting and spreadsheets

- interpret and use information about a household's electricity, water or gas usage and related charges and costs from household bills
- plan for the purchase of a car
  - investigate on-road costs for new and used vehicles, including sale price, or loan repayments, registration, insurance and stamp duty at current rates
  - consider sustainability when choosing a vehicle to purchase; for example, fuel consumption rates

  - calculate and compare the cost of purchasing different vehicles using a spreadsheet.
- plan for the running and maintenance of a car
  - describe the different types of insurance available, including compulsory and non-compulsory third-party insurance and comprehensive insurance
  - investigate other running costs associated with ownership of a vehicle; for example, cost of servicing, repairs and tyres
  - calculate and compare the cost of running different vehicles using a spreadsheet.
- prepare a personal budget for a given income, taking into account fixed and discretionary spending.

Module 1 work requirements

This module includes the following work requirement:

- a connected series of short responses relating to percentages, rates and ratio, finance and money management.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 1 assessment

This module has a focus on criteria 1, 2, 3, 4, 5 and 6.

Module 2: Probability and statistics

This module contains three topics:

- graphs and modelling
- data collection and analysis
- probability and relative frequency.

'Graphs and modelling' extends learners' capacity to model and analyse practical situations on the Cartesian plane. Example contexts that may be represented include situations relating to business and travel, utility rates, contract plans, taxi fares, and health, BMI and medication dosage, amongst others.

'Data collection' enables learners to explore and apply different procedures for conducting data collection and to understand the constraints and limitations in a variety of contexts. Learners will represent and analyse data as a tool for interpreting situations and making informed recommendations.

'Probability and relative frequency' enables learners to perform and interpret simulations of chance events and to represent the outcomes of events using a variety of techniques. Probability concepts have a wide application in taking informed action in life, including identifying risk and reward, recognising implications on decision-making and understanding the impact and perceived chance of events disrupting or affecting organised plans, including; for example, weather events, traffic flow and the introduction of competitors in a workplace context.

Module 2 learning outcomes

The following learning outcomes are a focus of this module:

1. communicate thinking, strategies and solutions using appropriate mathematical or statistical language
2. plan, organise and manage learning in order to complete tasks and evaluate progress
3. apply numeric techniques and algebraic processes to represent situations and solve problems
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of solutions to problems
5. act as creative, critical and reflective thinkers to assess ideas and take informed action

7. apply concepts and techniques involving relative frequency and collecting and handling data.

Module 2 content

Key knowledge and skills

Topic 1 – graphs and modelling

- demonstrate familiarity with Cartesian coordinates in two dimensions by plotting points on the Cartesian plane
- generate tables of values for linear functions, including for negative values of x
- graph linear functions for all values of x with pencil and paper and with graphing software
- determine the slope and intercepts of a straight-line graph from both its equation and its plot
- develop a linear formula from a word description
- interpret and use graphs in practical situations, including travel graphs and conversion graphs
- draw graphs from given data to represent practical situations
- 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
- interpret, in context, the gradient and intercept of a straight-line graph used to model and analyse a practical situation
- construct and analyse a straight-line graph to model a given linear relationship; for example, modelling the cost of a taxi trip from the airport to a hotel.

Topic 2 – data collection and analysis

This topic contains three subtopics:

- census and sampling
- sources of bias
- data analysis.

Census and sampling

- investigate the procedure for conducting a census
- investigate the advantages and disadvantages of conducting a census
- understand the purpose of sampling: to provide an estimate of population values when a census is not used
- investigate the different kinds of samples; for example, systematic samples, self-selected samples, simple random samples
- investigate the advantages and disadvantages of these kinds of samples; for example, comparing simple random samples with self-selected samples
- identify the target population to be surveyed
- investigate questionnaire design principles; for example, simple language, unambiguous questions, consideration of number of choices, issues of privacy and ethics, and freedom from bias.

Sources of bias

- describe the faults in the collection of data process
- describe sources of error in surveys; for example, sampling error and measurement error
- 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
- investigate errors and misrepresentation in surveys, including examples of media misrepresentations of surveys.

Data analysis

- describe the patterns and features of bivariate data
- describe the association between two numerical variables in terms of direction:
  - positive or negative
  - form: linear or non-linear
  - strength: strong or moderate or weak.
- identify the dependent and independent variable
- find the line of best fit by eye
- use technology to find the line of best fit
- interpret relationships in terms of the variables
- use technology to find the correlation coefficient, an indicator of the strength of linear association
- use the line of best fit to make predictions, both by interpolation and extrapolation
- recognise the dangers of extrapolation
- distinguish between causality and correlation through examples.

Topic 3 – probability and relative frequency

- interpret commonly used probability statements, including 'possible', 'probable', 'likely', 'certain'
- describe ways of expressing probabilities formally using fractions, decimals, ratios and percentages
- perform simulations of experiments using technology
- recognise that the repetition of chance events is likely to produce different results
- identify relative frequency as probability
- identify factors that could complicate the simulation of real-world events
- construct a sample space for an experiment
- use a sample space to determine the probability of outcomes for an experiment
- use arrays or tree diagrams to determine the outcomes of and the probabilities for experiments
- determine the probabilities associated with simple games
- determine the probabilities of occurrence of simple traffic-light problems.

Module 2 work requirements

This module includes the following work requirement:

- one extended response: investigating a simple game.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 2 assessment

This module has a focus on criteria 1, 2, 3, 4, 5 and 7.

Module 3: Measurement of energy and mass, and time and motion

This module consists of two topics which will be taught concurrently:

- practicalities of measurement
- measurement of energy and mass, and time and motion.

'Practicalities of measurement' provides learners opportunities to conduct measurements in practical situations and to calculate, compare and solve problems relating to these measurements. The practicalities of measurement including estimation, precision and accuracy will be investigated and analysed.

'Measurement of energy and mass, and time and motion' enables learners to use units of measure to describe, compare and calculate energy, mass, time, speed and distance, and to interpret information in practical situations including these measurements. They will use appropriate units, convert between units and investigate or compare alternative possibilities, and discuss implications of human error involved in measurements.

Module 3 learning outcomes

The following learning outcomes are a focus of this module:

1. communicate thinking, strategies and solutions using appropriate mathematical or statistical language
2. plan, organise and manage learning in order to complete tasks and evaluate progress
3. apply numeric techniques and algebraic processes to represent situations and solve problems
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of solutions to problems
5. act as creative, critical and reflective thinkers to assess ideas and take informed action
8. apply concepts and techniques involving measurement of energy and mass, and time and motion.

Module 3 content

Key knowledge and skills

Topic 1 – practicalities of measurement

- review the use of different metric units of measurement including units of area
- take measurements, and calculate conversions between common units of measurement; for example, kilometres to metres or litres to millilitres
- calculate the absolute error of a reported measurement using: $\text{absolute error} = \frac{1}{2} \times \text{precision}$ and state the corresponding limits of accuracy
- find the limits of accuracy as given by:
  $$\text{upper bound} = \text{measurement} + \text{absolute error}$$
  $$\text{lower bound} = \text{measurement} - \text{absolute error}$$
- investigate types of errors; for example, human error or device limitations
- calculate the percentage error of a reported measurement using:
  $$\text{percentage error} = \frac{\text{absolute error}}{\text{measurement}} \times 100\%$$
- use standard form and standard metric prefixes in the context of measurement, with and without a required number of significant figures
  - standard prefixes include nano-, micro-, milli-, centi-, kilo-, mega-, giga- and tera-
- explore implications of human error and device limitations.

Topic 2 – measurement of energy and mass, and time and motion

This topic has two subtopics:

- units of energy and mass
- time and motion.

Units of energy and mass

- use units of energy to describe consumption of electricity, such as kilowatt hours
- use units of energy used for foods, including calories
- use units of energy to describe the amount of energy in activity, such as kilojoules
- convert from one unit of energy to another
- use metric units of mass, their abbreviations, conversions between them and appropriate choices of units including consideration of the importance of accuracy
- estimate and measure the mass of different objects
- solve problems involving household energy running costs and efficiency ratings
  - know that a watt: W, is the International System of Units, SI, derived unit of power and is equal to one joule per second
  - interpret the energy rating of household appliances and compare running costs of different models of the same type of appliance, considering costs of domestic electricity; for example, calculate the cost of running a 200-watt television for six hours if the average peak rate for domestic electricity is $0.15 per kWh
  - investigate local council requirements for energy-efficient housing.

Time and motion

- use units of time including conversion between units and fractional, digital and decimal representations
- represent time using 12-hour and 24-hour clocks
- calculate time intervals, such as time between, time ahead, time behind
- interpret timetables, such as bus, train and ferry timetables
- use several timetables and electronic technologies to plan the most time-efficient routes
- interpret complex timetables, such as tide charts, sunrise charts and moon phases
- compare the time taken to travel a specific distance with various modes of transport
- use scales to find distances, such as on maps; for example, road maps, street maps, bushwalking maps, online maps and cadastral maps
- optimise distances through trial-and-error and systematic methods; for example, shortest path, routes to visit all towns, and routes to use all roads
- identify the appropriate units for different activities, such as walking, running, swimming and flying
- calculate speed, distance or time using the formula
  $\text{speed} = \frac{\text{distance}}{\text{time}}$
- calculate the time or costs for a journey from distances estimated from maps
- interpret distance-versus-time graphs
- calculate and interpret average speed; for example, a 4-hour trip covering 250 km.

Module 3 work requirements

This module includes the following work requirement:

- a connected series of short responses applying applications of measurement.

See Appendix 3 for the full specifications of the work requirements of this course.

Module 3 assessment

This module has a focus on criteria 1, 2, 3, 4, 5 and 8.

Assessment

Criterion-based assessment is a form of outcomes assessment that identifies the extent of learner achievement at an appropriate endpoint of study. Although assessment as part of the learning program is continuous, much of it is formative and is done to help learners identify what they need to do to attain the maximum benefit from their study of the course. Therefore, assessment for summative reporting to TASC will focus on what both teacher and learner understand to reflect endpoint achievement.

The standard of achievement each learner attains on each criterion is recorded as a rating 'A', 'B', or 'C', according to the outcomes specified in the standards section of the course.

A 't' notation must be used where a learner demonstrates any achievement against a criterion less than the standard specified for the 'C' rating.

A 'z' notation is to be used where a learner provides no evidence of achievement at all.

Internal assessment of all criteria will be made by the provider. Providers will report the learner's rating for each criterion to TASC.

Criteria

The assessment for *Essential Mathematics – Personal* Level 2 will be based on the degree to which the learner can:

1. communicate mathematical ideas and information and apply mathematical conventions
2. manage and take responsibility for learning and evaluate mathematical development
3. apply numeric and algebraic techniques and processes to investigate and represent real-world situations and solve problems
4. apply mathematical reasoning to interpret information, justify chosen approaches and explain the reasonableness of solutions
5. create, apply and reflect on mathematical strategies to solve problems, refine personal decisions and take informed action
6. interpret concepts and apply mathematical techniques to solve problems involving proportion, finance and money management
7. interpret concepts and apply mathematical techniques to solve problems involving probability and statistics
8. interpret concepts and apply mathematical techniques to solve problems involving measurement of energy and mass, and time and motion.

	Module 1	Module 2	Module 3
Criteria focus	1,2,3,4,5,6	1,2,3,4,5,7	1,2,3,4,5,8

Standards

Criterion 1: communicate mathematical ideas and information and apply mathematical conventions

Criterion elements	Rating A	Rating B	Rating C
E1 - Communicates observations and judgements	communicates clear and reasoned observations and judgements using appropriate mathematical and statistical terminology and language	communicates clear observations and judgements using appropriate mathematical and statistical terminology and language	communicates observations and judgements using appropriate mathematical and statistical terminology and language
E2 - Uses conventions	uses mathematical conventions, systems and constructs including manipulation and use of symbolic expressions, rules and formal systems accurately and purposefully	uses mathematical conventions, systems and constructs including manipulation and use of symbolic expressions and rules appropriately on most occasions	uses mathematical conventions, systems and constructs based on definitions and rules when prompted
E3 - Uses units and notation	presents work with correct use of units and notation throughout calculations to convey mathematical information	presents the final answer with correct use of units and notation as required	uses correct units and notation when prompted
E4 - Identifies solutions	presents work with the final answer clearly identified and articulated in terms of the questions where necessary.	presents work with the final answer clearly identified.	presents work with the final answer apparent.

Criterion 2: manage and take responsibility for learning and evaluate mathematical development

Criterion elements	Rating A	Rating B	Rating C
E1 - Reflects on performance	analyses learning strengths and weaknesses in order to establish processes to plan, monitor and assess understanding and performance	recognises learning strengths and weaknesses and establishes processes to plan, monitor and assess understanding and performance	identifies personal traits that promote or inhibit learning performance and understanding
E2 - Manages time	monitors and analyses progress towards meeting goals and timelines	sets goals and timelines, and monitors progress	sets goals and timelines, and monitors with support
E3 - Plans and organises	selects and applies effective organisational, planning and self-management skills to manage resources and complete all learning tasks	applies organisational, planning and self-management skills to manage resources and consistently complete tasks	with support, uses some tools to organise and plan to manage resources and complete set tasks
E4 - Works individually and collaboratively	performs tasks, demonstrates initiative, and guides others in their contribution to the completion of individual and collaborative activities	performs tasks and demonstrates initiative when contributing to the completion of individual and collaborative activities	performs tasks as directed to contribute to the completion of individual and collaborative activities
E5 - Monitors task contributions	explains own and other learners' contributions to completion of collaborative activities.	describes own contribution to completion of collaborative activities.	identifies own contribution to completion of collaborative activities.

Criterion 3: apply numeric and algebraic techniques and processes to represent real-world situations and solve problems

Criterion elements	Rating A	Rating B	Rating C
E1 - Represents real-world situations	interprets complex familiar and non-familiar real-world situations and frames them in mathematical terms	interprets complex familiar real-world situations and frames them in mathematical terms	explores simple familiar real-world situations and frames them in mathematical terms
E2 - Represents numbers and applies numeric techniques	converts flexibly between representations of fractions, decimals, percentages and ratios, and uses them accurately in complex unfamiliar calculations	converts between fractions, decimals, percentages and ratios, and uses them accurately in complex familiar calculations	identifies fractions, decimals, percentages and ratios and the relationships between them, and uses them accurately in simple calculations
E3 - Uses standard algorithms and algebraic techniques to solve problems	applies order of operations correctly, and accurately substitutes variables into complex familiar equations to find an unknown that is not the subject of the equation by transposition.	applies order of operations correctly, and accurately substitutes variables into complex familiar equations to find an unknown that is the subject of the equation.	uses standard algorithms for the four basic number operations correctly, and accurately substitutes variables into simple familiar equations to find an unknown that is the subject of the equation.

Criterion 4: apply mathematical reasoning to interpret information, justify chosen approaches and explain the reasonableness of solutions

Criterion elements	Rating A	Rating B	Rating C
E1 - Makes inferences	explores and links elements of problems to make logical inferences that can be tested mathematically	identifies and explains elements of problems to make informed inferences that can be tested mathematically	identifies elements of problems and makes inferences that may be able to be tested mathematically
E2 - Analyses results	relates experimental findings to real-world phenomena, describing differences and analysing possible reasons for these differences	relates experimental findings to real-world phenomena, noting differences and identifying possible reasons for these differences	compares experimental findings to expected results in familiar contexts, and identifies possible reasons for differences

Criterion elements	Rating A	Rating B	Rating C
E3 - Justifies chosen approaches	justifies why the mathematical applications and processes used were appropriate for the context	describes and explains how the mathematical applications and processes used were appropriate for the context	describes the mathematical applications and processes used to solve problems
E4 - Explains reasonableness of solutions	evaluates and explains the reasonableness of the results and solutions to routine and non-routine problems in a variety of contexts.	explains the reasonableness of the results and solutions to routine and non-routine problems.	describes the reasonableness of the results and solutions to routine problems.

Criterion 5: create, apply and reflect on mathematical strategies to solve problems, refine personal decisions and take informed action

Criterion elements	Rating A	Rating B	Rating C
E1 - Creates mathematical strategies	generates ideas and refines and tests chosen approaches to solve problems	generates ideas and tests chosen approaches to solve problems	generates ideas and approaches to solve problems
E2 - Reflects and builds understanding	uses reflective thinking strategies to assess ideas or opinions and responds to clarifying questions to build understanding about situations	uses reflective thinking strategies to identify other ideas or opinions and asks clarifying questions to build understanding about situations	uses reflective thinking strategies to describe their understanding of a situation in mathematical terms
E3 - Reflects and refines personal thinking	evaluates why their thinking has changed over time	explains how their thinking has changed over time	describes when their thinking has changed
E4 - Plans and takes informed action	plans and takes informed action effectively in given and chosen contexts.	plans and takes informed action in given contexts.	plans and takes informed action in a given context.

Criterion 6: interpret concepts and apply mathematical techniques to solve problems involving proportion, finance and money management

Criterion elements	Rating A	Rating B	Rating C
E1 - Calculate using percentages	determines the overall change in a quantity following multiple percentage increases and decreases to solve complex unfamiliar problems	determines the overall change in a quantity following multiple percentage increases and decreases to solve complex familiar problems	calculates percentages of a given amount and determines one amount expressed as a percentage of another
E2 - Use rates and ratios to solve practical problems	uses rates and ratios to calculate and solve complex familiar problems and makes comparisons between different quantities	uses rates and ratios to calculate and solve simple familiar problems including, where relevant, converting between different forms	uses rates to make comparisons and identifies and converts between units of rates to solve simple familiar problems
E3 - Investigate personal domestic expenses†	prepares a personal budget for a given income and describes how personal domestic expenses will be made, accounting for savings and discretionary spending.	compares and calculates upfront and ongoing personal domestic expenses by investigating different products and ways of purchasing.	calculates income from salary or wages and identifies and calculates upfront and ongoing personal domestic expenses in a chosen or given situation.

† Personal domestic expenses in this course include household electricity, water or gas usage, and costs from household bills and purchases, running and ongoing maintenance costs of a vehicle.

Criterion 7: interpret concepts and apply mathematical techniques to solve problems involving probability and statistics

Criterion elements	Rating A	Rating B	Rating C
E1 - Collect data	selects purposefully and justifies conducting a census or sampling type based on the target population to be surveyed and the statistical question being asked	describes the advantages and disadvantages of conducting a census and different types of sampling	identifies the procedure for conducting a census and different types of sampling

Criterion elements	Rating A	Rating B	Rating C
E2 – Interpret sources of bias	analyses survey findings and presents evidence to interrogate the reliability or misrepresentation of findings	describes errors in data collection and misrepresentations in survey findings	identifies errors in data collection and misrepresentations in survey findings
E3 - Interpret bivariate data	interprets relationships between variables including finding the correlation coefficient, makes predictions by interpolation and extrapolation	interprets key features of graphs, describes relationships between variables, finds line of best fit with and without the aid of technology, and makes predictions by interpolation and extrapolation	identifies the key features of graphs, describes patterns in data and recognises relationships between variables
E4 - Express probability	expresses probability formally using fractions, decimals, ratios and percentages, describes likelihood of chance events, and explains why repeated trials are likely to produce different results	expresses probability formally using fractions, decimals, ratios and percentages, and describes likelihood of chance events	describes chance events using common probability statements and routine fractions
E5 - Calculate and compare probability	determines the theoretical probabilities associated with simple games and problems, and – through the use of arrays or tree diagrams in multi-step events – explains differences obtained through experimentation.	calculates and compares probability of events using theoretical expectation and relative frequency from repeated trials.	identifies relative frequency as probability and use sample spaces to determine the probability of outcomes for an experiment.

Criterion 8: interpret concepts and apply mathematical techniques to solve problems involving measurement of energy and mass, and time and motion

Criterion elements	Rating A	Rating B	Rating C
E1 – Interpret practicalities of measurement	describes possible implications of error in measurements and explains what level of error is acceptable or not, in a given context	investigates types of errors, calculates errors in measurements as a percentage and identifies what percentage error is acceptable in a given context	calculates the absolute error of reported measurements and identifies possible causes of error
E2 - Use and convert between units	uses and converts between units of energy, time and speed, and metric units of mass to solve complex familiar problems	uses and converts between units of energy, time and speed, and metric units of mass to solve simple problems	uses units of time, distance, speed, energy, and mass to describe and represent situations
E3 - Interpret and use timetables, graphs and charts	interprets timetables, maps, graphs and charts to solve complex familiar problems, including comparison and optimisation in situations involving consumption of energy or travel	interprets timetables, maps, graphs and charts to solve complex familiar problems, including calculating cost of energy consumption or travel	interprets timetables and maps to solve simple problems in situations, involving energy or time and motion
E4 - Use scales to interpret and use maps	uses scales and systematic methods to calculate distance, speed and time taken, to solve complex familiar problems involving comparison and optimisation of travel.	use scales and analyses key features of maps to calculate and compare distance of multiple routes and solve complex familiar problems involving cost or speed of travel.	uses scales and identifies key features of maps to calculate distance and solve simple problems involving cost or speed of travel.

Quality assurance

Each provider will submit bodies of learners' work sufficient to allow an assessment against a nominated range of criteria and the overall award to an annual review meeting organised by TASC. The work, while not necessarily be fully resolved, will be assessed by the provider against the range of nominated assessment criteria and the overall award. TASC will give each provider guidance regarding the selection of learners and the nominated criteria.

Each body of work that providers submit to the meeting will include sufficient and appropriate material for judgements to be made about the learner's standard of numeracy. The review meeting will give advice regarding the provider's interpretation and application of the selected criteria's standards to the evidence of student work. Providers are expected to act on this advice.

TASC may require providers to supply further samples of individual learners' work to determine that standards have been applied appropriately and/or undertake audits. The nature and scope of such requirements will be risk-based.

Qualifications and award requirements

The final award will be determined by the Office of Tasmanian Assessment, Standards and Certification from 8 ratings.

The minimum requirements for an award in this course are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)
6 'A' ratings, 2 'B' ratings

HIGH ACHIEVEMENT (HA)
3 'A' ratings, 4 'B' ratings, 1 'C' rating

COMMENDABLE ACHIEVEMENT (CA)
4 'B' ratings, 3 'C' ratings

SATISFACTORY ACHIEVEMENT (SA)
6 'C' ratings

PRELIMINARY ACHIEVEMENT (PA)
4 'C' ratings

A learner who otherwise achieves the rating for a CA (Commendable Achievement) or SA (Satisfactory Achievement) award but who fails to show any evidence of achievement in one or more criteria ('z' notation) will be issued with a PA (Preliminary Achievement) award.

Course evaluation

Years 9-12 Learning will develop and regularly review and revise the curriculum. Course evaluation is informed by the experience of the course's implementation, delivery and assessment. More information about course evaluation can be found on the Years 11 and 12 website.

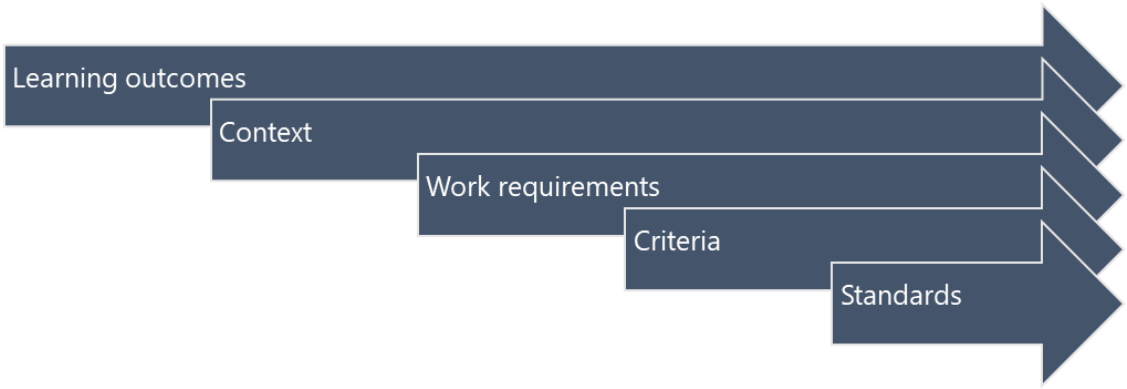
Course developer

This course has been developed by the Department of Education's Years 9-12 Learning Unit in collaboration with Catholic Education Tasmania and Independent Schools Tasmania.

Accreditation and version history

Version 1. Accredited on 14 April 2022 for use from 1 January 2023 to 21 December 2027.

Appendix 1 – Line of sight



Learning outcomes	Course content: module	Work requirements: module	Criterion	Criterion elements	General capabilities
1. communicate thinking, strategies and solutions using appropriate mathematical or statistical language	1, 2, 3	1, 2, 3	1	1, 2, 3, 4	
2. plan, organise and manage learning in order to complete tasks and evaluate progress	1, 2, 3	1, 2, 3	2	1, 2, 3, 4, 5	
3. apply numeric techniques and algebraic processes to represent situations and solve problems	1, 2, 3	1, 2, 3	3	1, 2, 3	
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of solutions to problems	1, 2, 3	1, 2, 3	4	1, 2, 3, 4	
5. act as creative, critical and reflective thinkers to assess ideas and take informed action	1, 2, 3	1, 2, 3	5	1, 2, 3, 4	
6. apply concepts and techniques involving proportion, finance and money management	1	1	6	1, 2, 3	
7. apply concepts and techniques involving relative frequency, and collecting and handling data	2	2	7	1, 2, 3, 4, 5	
8. apply concepts and techniques involving measurement of energy and mass, and time and motion	3	3	8	1, 2, 3, 4	

Appendix 2 – Alignment to curriculum frameworks

Links to Australian Curriculum 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 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.

Alignment to Australian Curriculum Senior Secondary Framework

Almost all content in this course is drawn from the Australian Curriculum Senior Secondary Framework: Essential Mathematics. The content selected for this course comes from Units 1 to 4 and in most cases content descriptors are used verbatim. The content covered in the subtopic 'Calculations' from Essential Mathematics Unit 1 Topic 1 and 'Algebra' in Essential Mathematics Unit 1 Topic 3 is embedded throughout the course and is assessed across the course content under Criterion 3.

Additional content on the topic of 'Practicalities of measurement' has been included as it provides important knowledge and techniques that build a more conceptual understanding of measurement as a tool to be used in many aspects of life.

Summary of aligned content

Module	Topics	Australian Curriculum Framework Source or otherwise
Module 1	Percentages, rates and ratio	Essential Mathematics Unit 1 Topic 1 and Essential Mathematics Unit 2 Topic 2 and 3
	Budgeting and spreadsheets[1]	NESA Mathematics Standard Stage 6 – Year 11 component‡
Module 2	Graphs and modelling	Essential Mathematics Unit 3 Topic 3
	Data collection and analysis	Essential Mathematics Unit 3 Topic 4
	Probability and relative frequency	Essential Mathematics Unit 4 Topic 1
Module 3	Practicalities of measurement[2]	NESA Mathematics Standard Stage 6 – Year 11 component
	Measurement of energy and mass, and time and motion	Essential Mathematics Unit 1 Topic 2 and Essential Mathematics Unit 2 Topic 4

[1] This material has been sourced with approval from the NSW Education Standards Authority (NESA) curriculum.
[2] Ibid.

Appendix 3 – Work requirements

The work requirements of a course are processes, products or performances that provide a significant demonstration of achievement that is measurable against the course's standards. Work requirements need not be the sole form of assessment for a module.

Module 1 Work requirements specifications

Work requirement 1 of 1

Title of work requirement: Proportion and finance
Format: connected series of short responses
Description: This series of short responses will focus on the interpretation, analysis, examination and evaluation of ideas and information in response to questions, situations or stimuli relating to percentages, rates and ratio, finance and money management.

Learners will analyse and calculate percentage changes, including Goods and Service Tax. They will identify and use rates and ratios to solve practical problems and make comparisons using different rates or ratios. To demonstrate mathematical reasoning, learners will make recommendations to address problems asked in given situations.

Learners will take informed action by applying knowledge of percentages, rates and ratio to a given context involving comparison and calculation of costs associated with upfront and ongoing personal domestic expenses.

Learners should be given opportunities to work collaboratively to generate, refine and test ideas and strategies. They must reflect on how their own thinking has changed after engaging in collaborative discussion. Learners may complete the work requirement in collaborative groups; however, in this situation they must clearly identify which work is their own.
Size: 8–10 hours of class time
Timing: Dedicated class time should be provided throughout the module at the teacher's discretion.
Relevant criteria:

- Criterion 1: E1, 2, 3, 4
- Criterion 2: E1, 2, 3, 4, 5
- Criterion 3: E1, 2, 3
- Criterion 4: E1, 3
- Criterion 5: E1, 2, 3, 4
- Criterion 6: E1, 2, 3

Module 2 Work requirements specifications

Work requirement 1 of 1

Title of work requirement: Probability investigation
Format: investigation
Description: Individually or in small groups, learners will investigate the probability associated with a simple game of their choice or other familiar contexts such as simple traffic-light problems. Within the investigation, learners must submit an experimental design for approval from the teacher. Within this design they must:

- use a sample space or arrays or tree diagrams to show the theoretical probability of all different outcomes of the context
- describe and compare the probability outcomes occurring using fractions, decimals or percentages and common language of chance

- develop a methodology to simulate or test the outcomes of multiple trials of the focus of the context and describe how they will capture and analyse results.

Once the experimental design is approved by the teacher, learners will proceed with carrying out their experiment and must:

- capture and record the results appropriately as outlined in their experiment design
- analyse the results of the experiment, identifying relative frequency as probability and identifying factors that may have affected the results obtained
- analyse the results obtained in comparison to theoretical probability and provide possible explanations for any differences.

Additionally, learners should record reflections on how their thinking was challenged, confirmed or extended through collaborative discussion and problem-solving, and in response to their results. This reflection can take any format but must be submitted as part of the work requirement for assessment.
Size: 4–6 hours of class time
Timing: dedicated class time should be provided throughout the module at the teacher's discretion.
External agencies: at the teacher's discretion
Relevant criteria:

- Criterion 1: E1, 2, 3, 4
- Criterion 2: E1, 2, 3, 4, 5
- Criterion 3: E1, 2, 3
- Criterion 4: E1, 2, 3, 4
- Criterion 5: E1, 2, 3, 4
- Criterion 7: E1, 2, 3, 4, 5

Module 3 Work requirements specifications

Work requirement 1 of 1

Title of work requirement: Applications of measurement
Format: connected series of short responses
Description: Learners will complete a series of connected short responses to investigate, interpret and use timetables, graphs and charts, and to use scales to interpret and use maps. Within the series of responses, learners will calculate, solve problems and convert between units of energy, time and speed and metric units of mass. Learners will calculate errors in measurement and use mathematical reasoning to describe the possible implications of these errors and what is acceptable or not in given contexts.
Size: 4–6 hours of class time
Timing: Dedicated class time should be provided throughout the module at the teacher's discretion.
Relevant criteria:

- Criterion 1: E1, 2, 3, 4
- Criterion 2: E1, 2, 3, 4, 5
- Criterion 3: E1, 2, 3
- Criterion 4: E1, 2, 3, 4
- Criterion 5: E1, 2, 3, 4
- Criterion 8: E1, 2, 3, 4

Appendix 4 – General capabilities and cross-curriculum priorities

Learning across the curriculum content, including the cross-curriculum priorities and general capabilities, assists students to achieve the broad learning outcomes defined in the *Alice Springs (Mparntwe) Education Declaration (December 2019).*

General capabilities:

The general capabilities play a significant role in the Australian curriculum in equipping young Australians to live and work successfully in the twenty-first century.

In the Australian curriculum, capability encompasses knowledge, skills, behaviours and dispositions. Students develop capability when they apply knowledge and skills confidently, effectively and appropriately in complex and changing circumstances, in their learning at school and in their lives outside school.

The general capabilities include:

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

Cross-curriculum priorities:

Cross-curriculum priorities enable students to develop understanding about and address the contemporary issues they face, for their own benefit and for the benefit of Australia as a whole. The priorities provide national, regional and global dimensions which will enrich the curriculum through development of considered and focused content that fits naturally within learning areas. Incorporation of the priorities will encourage conversations between students, teachers and the wider community.

The cross-curriculum priorities include:

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

Appendix 5 – Glossary

Term	Definition	Source acknowledgement
absolute error	The absolute error of a measurement is half of the smallest unit on the measuring device. The smallest unit is called the precision of the device.	NESA
accuracy	The condition or quality of being true, correct or exact; freedom from error or defect; precision or exactness; correctness; in science, the extent to which a measurement result represents the quantity it purports to measure; an accurate measurement result includes an estimate of the true value and an estimate of the uncertainty.	QCAA
algorithm	A precisely defined routine procedure that can be applied and systematically followed through to a conclusion.	ACARA
association	A general term used to describe the relationship between two, or more, variables. The term association is often used interchangeably with the term correlation. The latter tends to be used when referring to the strength of a linear relationship between two numerical variables.	ACARA
associative operations	Operations are associative if the order in which operations take place does not affect the result. For example, addition of numbers is associative, since the order in which they are added does not change their sum. The corresponding associative law is: $(a + b) + c = a + (b + c)$ for all numbers a, b and c. Multiplication is also associative, as the product of the numbers does not vary with the order of their multiplication. The corresponding associative law is: $(ab)c = a(bc)$ for all numbers a, b and c. Subtraction and division are not associative, as the order of operations changes the value of the expression.	ACARA
average speed	The total distance travelled, divided by the total time taken.	ACARA
array	An ordered collection of objects or numbers.	QCAA

Term	Definition	Source acknowledgement
back-to-back stem-and-leaf plots	A method for comparing two data distributions attaching two sets of 'leaves' to the same 'stem' in a stem and leaf plot.	ACARA
bias	Bias generally refers to a systematic favouring of certain outcomes more than others, due to unfair influence, knowingly or otherwise.	NESA
bimodality	A dataset is bimodal if it has two modes; this means that there is not a single data value that occurs with the highest frequency, but two data values have the same and highest frequency.	QCAA
break-even point	The break-even point is the point at which revenue begins to exceed the cost of production.	ACARA
calculates	Determine or find; for example, a number or answer by using mathematical processes; obtain a numerical answer showing the relevant stages in the working; ascertain or determine from given facts, figures or information.	QCAA
Cartesian plane	Two intersecting number lines are taken intersecting at right angles at their origins to form the axes of the coordinate system; the plane is divided into four quadrants by these perpendicular axes, called the x-axis, horizontal line, and the y-axis, vertical line; the position of any point in the plane can be represented by an ordered pair of numbers x, y; these ordered pairs are called the coordinates of the point; this is called the Cartesian coordinate system; the plane is called the Cartesian plane.	QCAA
categorical data	Data associated with a categorical variable is called categorical data.	ACARA
categorical variable	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; for example, the numbers worn by player in a sporting team, but these labels have no numerical significance, they merely serve as labels.	ACARA

Term	Definition	Source acknowledgement
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 entire population.	ACARA
commutative operations	Operations are commutative if the order in which terms are given does not affect the result. The commutative law for addition is: $a + b = b + a$, for all numbers a and b. For example, 3+5=5+3. The commutative law for multiplication is: $ab = ba$, for all numbers a and b. For example, 4×7=7×4. Subtraction and division are not commutative because for example 5-3≠3-5 and 12÷4≠4÷12.	ACARA
conversion	A change in the form or units of an expression.	QCAA
compound interest	The interest earned when 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 (A) at the interest rate (i) expressed as a percentage per period, then after (n) compounding periods the total amount accrued is: $$A = P(1 + i)^n$$ When plotted on a graph, the total amount accrued is shown to grow exponentially.	QCAA
correlation	A measure of the strength of the linear relationship between two variables.	ACARA
correlation coefficient	The correlation coefficient (r) is a measure of the strength of the liner relationship between a pair ofvariables.	ACARA
decile	Any of the nine values that divide a ranked dataset into ten equal parts.	QCAA

Term	Definition	Source acknowledgement
distributive law	Multiplication of numbers is said to be 'distributive over addition', because the product of one number with the sum of two others equals the sum of the products of the first number with each of the others. For example, the product of 3 with (4+5) gives the same result as the sum of 3×4 and 3×5: 3×(4+5)=3×9=27 and 3×4+3×5=12+15=27 This distributive law is expressed algebraically as follows: $a(b+c)=ab+ac$, for all numbers a, b and c.	ACARA
elevation views	Scale drawings showing what a building looks like from the front, back and sides.	NESA
equivalence	Two expressions are said to be equivalent if they are equal in value.	
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 quiteerroneous predictions.	ACARA
Face, shape	Any of the individual flat surfaces of a solid object.	mathsisfun.com
five-number summary	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.	ACARA
Goods and Services Tax, GST	The Goods and Services Tax, GST, is a broad sales tax of 10% on most goods and services and other items sold or consumed in Australia.	QCAA
gradient	The gradient of a line describes its steepness, incline or grade. Gradient is normally described by the ratio of the "rise" divided by the "run" between two points on aline.	ACARA

Term	Definition	Source acknowledgement
histogram	A statistical graph for displaying the frequency distribution of continuous data. A histogram is a graphical representation of the information contained in a frequency table. In a histogram, class frequencies are represented by the areas of rectangles centred on each class interval. The class frequency is proportional to the rectangle's height when the class intervals are all of equal width.	ACARA
integer	The integers are the "whole numbers" including those with negative sign ⋯-3, -2, -1, 0, 1, 2, 3⋯. In Latin, the word integer means "whole." The set of integers is usually denoted by Z. Integers are basic building blocks in mathematics.	ACARA
interpolation	In the context of fitting a linear relationship between two variables, interpolation occurs when the fitted model is used to make predictions using values of the explanatory variable that lie within the range of the original data.	ACARA
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 quartile (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.	ACARA
kilowatt hour, kWh	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.	ACARA
megajoule, MJ	A joule is the SI unit of work. The megajoule, MJ, is equal to one million joules.	ACARA
mean	The arithmetic mean, $\bar{x}$, 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.	ACARA

Term	Definition	Source acknowledgement
measures of central tendency	The values about which the set of data values for a particular variable are scattered. They are a measure of the centre or location of the data. The two most common measures of central tendency are the mean and the median.	NESA
measures of spread	Describes how similar or varied the set of data values are for a particular variable. Common measures of spread include the range, combinations of quantiles, deciles, quartiles, percentiles, the interquartile range, variance and standard deviation.	NESA
median	Is the value in a set of ordered set of data values that divides the data into two parts ofequal 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 arithmetic mean of the two central values.	ACARA
mode	Is the most frequently occurring value in a data set.	ACARA
order of operations	The order of performing mathematical operations: 1. evaluate brackets or grouping symbols first 2. evaluate any powers and roots 3. working left to right, evaluate any multiplication and division 4. working left to right, evaluate any addition or subtraction, may also be known as BODMAS, BIDMAS, BEDMAS, etc.	QCAA
outlier	An outlier in a set of data is an observation that appears to be inconsistent with the remainder ofthat set of data. An outlier is a surprising observation.	ACARA
parallel box plots	Are used to visually compare the five-number summaries of two or more datasets.	QCAA

Term	Definition	Source acknowledgement
partitioning	Means dividing a quantity into parts. In the early years of schooling, it commonly refers to the ability to think about numbers as made up of two parts, such as, 10 is 8 and 2. In later years it refers to dividing both continuous and discrete quantities into equal parts.	ACARA
percentage error	The percentage error of a measurement is the absolute error expressed as a percentage of the recorded measurement.	NESA
picture graph	A statistical graph for organising and displaying categorical data.	ACARA
piecework	Employment where a worker is paid a fixed rate for each item produced or action performed regardless of the time taken.	NESA
place value	Refers to the value of a digit as determined by its position in a number, relative to the ones, or units, place. For integers, the ones place is occupied by the rightmost digit in the number. The value of the next column, the first after the decimal point, represents tenths of ones and this continues with the value of each corresponding digit being representative of a value 10 times smaller than the previous. For example, in the number 2 594.6 the 4 denotes 4 ones, the 9 denotes 90 ones or 9 tens, the 5 denotes 500 ones or 5 hundreds, the 2 denotes 2000 ones or 2 thousands, and the 6 denotes $\frac{6}{10}$ of a one or 6 tenths.	ACARA
precision	Refers to how close the measured values are to each other. Precision does not account for how close the measured values are to the actual, expected, value.	mathsisfun.com
probability	The likelihood or chance of something; the relative frequency of the occurrence of an event as measured by the ratio of the number of cases or alternatives favourable to the event to the total number of cases or alternatives.	QCAA
quartile	The quartiles of a ranked set of data values are the three points that divide the dataset into four equal groups.	QCAA

Term	Definition	Source acknowledgement
radial survey	A radial survey can be used to measure the area of an irregular block of land. In a radial survey, a central point is chosen within the block of land and measurements are taken along intervals from this point to each vertex. The angles between these intervals at the central point are also measured and recorded.	NESA
range	The difference between the largest and smallest observations in a data set.	ACARA
rate	A particular kind of ratio in which the two quantities are measured in different units; for example, the ratio of distance to time, known as speed, is a rate because distance and time are measured in different units, such as kilometres and hours; the value of the rate depends on the units in which the quantities are expressed.	QCAA
ratio	A comparison of two quantities of the same kind; for example, if a recipe uses 2 cups of milk and 3 cups of flour, the ratio of milk to flour is 2 is to 3. This can also be written with a colon, 2:3, or as a fraction, $\frac{2}{3}$	QCAA
ray	The part of a line that starts at a point and continues in a particular direction to infinity. Rays are usually depicted with an arrowhead, which indicates the direction in which the line continues to infinity.	ACARA
reaction time	The time a person takes to react to a situation; for example, time taken for a person to press the brake when a situation requires them to stop.	ACARA
reasoned argument or conclusion	One that is sound, well-grounded, considered and thought out.	ACARA
recurrence relation	An equation that recursively defines a sequence; that is, once one or moreinitial terms are given, each further term of the sequence is defined as a function of the preceding terms.	NESA
recurring decimal	Non-terminating decimals may be recurring; that is, contain a pattern of digits that repeats indefinitely after a certain number of places.	ACARA

Term	Definition	Source acknowledgement
reducing balance loan	A compound interest loan where the loan is repaid by making regular payments and the interest paid is calculated on the amount still owing, the reducing balance of loan, after each payment is made.	NESA
reflection	To reflect the point A in an axis of reflection, a line is drawn at right angles to the axis of reflection and the point A' is marked at the same distance from the axis of reflection as A, but on the other side. The point A' is called the reflection image of A. A reflection is a transformation that moves each point to its reflection image.	ACARA
relative frequency	The number of items of a certain type divided by the number of all the items considered.	QCAA
sample	Part of a population; a subset of the population, often randomly selected for the purpose of estimating the value of a characteristic of the population as a whole.	QCAA
sample space	The sample space of a chance experiment is the set of all possible outcomes for that experiment.	NESA
sampling	The selection of a subset of data from a statistical population. Methods of sampling include: 1. systematic sampling - sample data is selected from a random starting point and using a fixed periodic interval 2. self-selecting sampling - non-probability sampling where individuals volunteer themselves to be part of a sample 3. simple random sampling - sample data is chosen at random where each member has an equal probability of being chosen 4. stratified sampling - after dividing the population into separate groups or strata, a random sample is then taken from each group or stratum in an equivalent proportion to the size of that group or strata in the population. A sample can be used to estimate the characteristics of the statistical population.	NESA
scale	A graduated line, as on a map, representing proportionate size.	QCAA

Term	Definition	Source acknowledgement
simple interest	The interest (I) accumulated when the interest payment in each period is a fixed fraction of the principal, e.g. if the principle P earns simple interest at the rate (R) expressed as a percentage per period, then after (T) periods the accumulated simple interest is: $$I = PRT$$ When plotted on a graph, the total amount accrued is shown to grow linearly.	QCAA
sketch	Execute a drawing or painting in simple form, giving essential features but not necessarily with detail or accuracy; in mathematics, represent by means of a diagram or graph; the sketch should give a general idea of the required shape or relationship and should include features.	QCAA
standard deviation	A measure of the variability or spread of a data set. It gives an indication of the degree to which the individual data values are spread around their mean. The standard deviation of n observations $x_1, x_2, \ldots, x_n$ is: $$s = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}}$$	QCAA
stopping distances	The distance a car travels before it comes to rest after the driver has applied the brake given speed of the vehicle and conditions of the road which can be found using formulas or tables. Stopping distance = braking distance + reaction time (seconds) × speed	ACARA
straight-line method of depreciation	In straight-line method of depreciation, the value of the depreciating asset decreases by the same amount during each time period. Also known as the 'Prime Cost method'.	NESA

Term	Definition	Source acknowledgement
symmetry	A plane figure f has line symmetry in a line m, if the image of f under the reflection in m is f itself. The line m is called the axis of symmetry. A plane figure f has rotational symmetry about a point O if there is a rotation such that the image of f under the rotation is f itself.	ACARA
terminating decimal	A decimal that contains a finite number of digits.	
translation	Shifting a figure in the plane without turning it is called translation. To describe a translation in the plane, it is enough to say how far left or right and how far up or down the figure is moved. A translation is a transformation that moves each point to its translation image.	
trapezoidal rule	Uses trapezia to approximate the area of an irregular shape, often with a curved boundary. The rule for a single application is: $A \approx \frac{h}{2}(x_1 + x_2)$	NESA
travel graph	Line graphs that are used to describe the motion of objects such as cars, trains, walkers and cyclists. The distance travelled is represented on the vertical axis and the time taken to travel that distance is represented on the horizontal axis.	NESA
tree diagram	A diagram that can be used to determine the outcomes of a multistep random experiment. A probability tree diagram has the probability for each stage written on the branches.	NESA
two-way table	Commonly used for displaying the two-way frequency distribution that arises when a group of individuals or objects are categorised according to two criteria.	QCAA
vertex (in shape)	A point in which edges intersect.	NESA

Appendix 6 – Degree of difficulty of problems

Acknowledgement: The following material has been sourced with approval from the Queensland Curriculum and Assessment Authority curriculum.

Within this course, the degree of difficulty of problems a learner can answer correctly is a defining feature of their understanding. Within the criteria and standards, the expected depth of knowledge is described using the following terms.

Simple familiar

Problems of this degree of difficulty require learners to demonstrate knowledge and understanding of the subject matter and application of skills in a situation where:

- relationships and interactions are obvious and have few elements, and
- all of the information to solve the problem is identifiable; that is
  - the required procedure is clear from the way the problem is posed, or
  - in a context that has been a focus of prior learning.

Complex familiar

Problems of this degree of difficulty require learners to demonstrate knowledge and understanding of the subject matter and application of skills in a situation where:

- relationships and interactions have a number of elements, such that connections are made with subject matter within and/or across the domains of mathematics; and
- all of the information to solve the problem is identifiable; that is either:
  - the required procedure is clear from the way the problem is posed, or
  - in a context that has been a focus of prior learning.

Some interpretation, clarification and analysis will be required to develop responses.

Complex unfamiliar

Problems of this degree of difficulty require learners to demonstrate knowledge and understanding of the subject matter and application of skills in a situation where:

- relationships and interactions have a number of elements, such that connections are made with subject matter within and/or across the domains of mathematics; and
- all the information to solve the problem is not immediately identifiable; that is:
  - the required procedure is not clear from the way the problem is posed, and
  - in a context in which learners have had limited prior experience.

Learners interpret, clarify and analyse problems to develop responses.