DEPARTMENT OF EDUCATION
learners first

Personal Futures

Mathematics

Essential Mathematics 2B

COURSE DOCUMENT

PHASE 4

DRAFT FOR CONSULTATION

Catholic Education Tasmania

INDEPENDENT SCHOOLS TASMANIA

Years 9 to 12 Learning

Tasmanian Government

Table of Contents

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Essential Mathematics, 150 hours – Level 2B

This course is a Level 2 component of the proposed Essential Mathematics suite.

Focus Area – Personal Futures

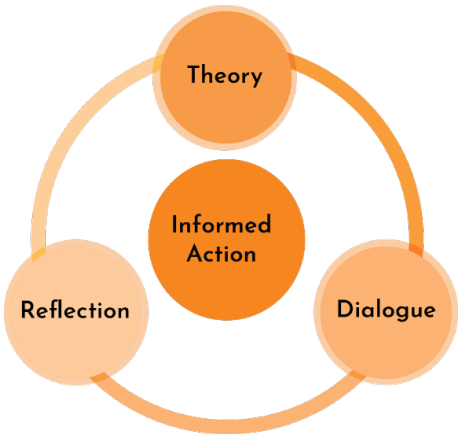
Courses aligned to the Years 9 to 12 Curriculum Framework belong to one of the five focus areas of Discipline-based Study, Transdisciplinary Projects, Professional Studies, Work-based Learning and Personal Futures.

Essential Mathematics Level 2B is a Personal Futures course.

Personal Futures courses prepare students to be independent young adults, able to lead healthy, fulfilled and balanced lives. Learning is highly personalised. Students develop strategies to optimise learning, make decisions, solve problems, set career and life goals, and pursue areas of strong personal interest. Personal Futures supports students 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 students 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 Level 2B is one of two proposed Level 2 offerings in the Essential Mathematics suite of courses. Its pair, the proposed *Essential Mathematics* Level 2A provides learners with an alternate set of topics. The two courses provide breadth rather than progression of complexity and as such there is no defined order for completion of these courses and learners may choose to do one or both according to their personal interest and needs.

The *Essential Mathematics* Level 2B course enables students to develop their understanding of concepts and techniques drawn from strands of number, algebra, probability, statistics, measurement and geometry, which will assist them in making informed personal decisions in their daily lives including in workplace contexts. By undertaking *Essential Mathematics* Level 2B, learners will develop their ability to identify and solve problems in real contexts, in a range of workplace, personal, further learning and community settings. Learners will work collaboratively with others to generate ideas and to find innovative approaches to engaging with mathematics. Learners will reflect on their ability to interpret, understand and apply these concepts and techniques in a variety of contexts.

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 as an economy where competing globally requires substantial numbers 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 students 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 students 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 their 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. understand concepts and apply techniques involving finance and money management
7. understand concepts and apply techniques involving relative frequency and collecting and handling data
8. understand concepts and apply techniques involving measurement, scales, plans and models.

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 Level 2B enables learners to develop essential mathematical skills and understanding. They will study finance and money management, probability and statistics, and measurement, scales, plans and models.

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

By discussing ideas with others, learners will reflect and extend their own thinking. They will apply their learning to make informed decisions and take on further challenges.

Pathways

The *Essential Mathematics* Level 2B course enables learning continuity from Year 10 Australian Curriculum: Mathematics, for learners who have achieved a 'D' rating or higher. Learners who have successfully undertaken the TASC-accredited course *Essential Skills - Maths* – MTN210114 or the Level 1 component of the proposed Essential Mathematics suite of courses could progress into this course. Additionally, learners who have completed the proposed *Essential Mathematics* Level 2A and wish to broaden their essential mathematical knowledge and understanding could enrol in this course.

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

Course Requirements

Access

This course requires learners to collaborate with others.

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.

Modules Available
Core Module 1: Finance and money management
Core Module 2: Probability and statistics
Core Module 3: Measurement, scale, plans and models

Delivery

There is no specific recommended delivery sequence for the modules.

Course Content

Module 1 – Finance and money management

This module contains two topics:

- Earning and managing money
- Interest and depreciation

'Earning and managing money' involves the application of knowledge, skills and understanding of numbers to calculate earnings through wages, benefits and allowances, and understanding tax.

'Interest and depreciation' enables learners to analyse different financial situations, to calculate the best options for given circumstances, and to solve financial problems.

The study of financial mathematics is important in developing learners' ability to interpret financial records, make informed financial decisions, be aware of the consequences of such decisions, and to manage personal financial resources effectively.

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. understand concepts and apply techniques involving finance and money management

Module 1 Content

Key knowledge and skills

Topic 1 - Earning and managing money:

- calculate monthly, fortnightly, weekly, daily or hourly pay rates from a given salary; wages involving hourly rates and penalty rates, including situations involving overtime and other special allowances; and earnings based on commission (including commission based on a sliding scale), piecework or royalties
  - calculate annual leave loading
  - calculate payments based on government allowances and pensions
- calculate income tax

    - identify allowable tax deductions
    - calculate taxable income after allowable tax deductions are taken from gross pay
    - calculate the Medicare levy (basic levy only)
    - calculate the amount of Pay As You Go (PAYG) tax payable per fortnight or week using current tax scales, and use this to determine if more tax is payable or if a refund is owed after completing a tax return
- calculate net pay following deductions from income
- use technology to perform financial computations – for example, calculating percentage change, calculating tax payable and preparing a wage-sheet.

Topic 2 - Interest and depreciation:

- review the principles of simple interest
- calculate simple interest for different rates and periods
- use a spreadsheet to calculate and graph compound interest as a recurrence relation involving repeated applications of simple interest
- consider similar problems involving compounding – for example, population growth
- use technology to calculate the future value of a compound interest loan or investment and the total interest paid or earned
- use technology to compare, numerically and graphically, the growth of simple interest and compound interest loans and investments
- use technology to investigate the effect of the interest rate and the number of compounding periods on the future value of a loan or investment
- use technology and a recurrence relation to model a reducing balance loan
- investigate the effect of the interest rate and repayment amount on the time taken to repay a loan
- calculate the depreciation of an asset using the straight-line method as an application of the simple interest formula.

Module 1 Work Requirements Summary

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.

This module includes a connected series of short responses that investigate many different aspects of personal finance as the folio work requirement.

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) or health (BMI, 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. understand concepts and apply 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 slope 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/negative), form (linear/non-linear) and strength (strong/moderate/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 Summary

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.

This module includes one (1) investigation as a work requirement.

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, scales, plans and models

This module consists of two topics:

- Measurement and shape
- Scales, plans and models

'Measurement' provides opportunities to conduct measurements in practical situations relating to two-dimensional shapes and three-dimensional objects, including mass and capacity, and to calculate, compare and solve problems relating to these measurements. Learners will also consider implications of factors including estimation, precision and accuracy when using scaled instruments in this topic.

'Scales, plans and models' includes recognising and using the properties, symbols and conventions for representing geometric information relating to two-dimensional shapes and three-dimensional objects. It involves using similarity and scale factor to obtain measurements and to construct and interpret plans and models, which has practical application in many fields, including construction, design, landscaping and photography.

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. understand concepts and apply techniques involving measurement, scales, plans and models

Module 3 Content

Key knowledge and skills

Topic 1 - Perimeter, area, volume and capacity:

- consider the importance of accuracy, describe when estimation is acceptable, make estimations and describe possible implications of error in a variety of practical scenarios
- calculate the absolute error of a reported measurement using

- $\text{Absolute error} = 1/2 \times \text{Precision}$ and state the corresponding limits of accuracy

  find the limits of accuracy as given by:

  - 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, eg human error or device limitations
  - calculate the percentage error of a reported measurement using:

    $$\text{Percentage error} = \frac{\text{Absolute error}}{\text{Measurement}} \times 100\%$$

- make conversions between units of length, area and volume
- review and extend how to solve practical problems requiring the calculation of perimeters and areas of triangles, rectangles, parallelograms, trapezia, circles, sectors of circles, arc lengths and composite shapes
- calculate perimeters and areas of irregularly shaped blocks of land by decomposition into regular shapes including triangles and trapezia
  - derive the trapezoidal rule for a single application, $A \approx \frac{h}{2}(x_1 + x_2)$
- solve problems involving surface area of solids including prisms, cylinders, spheres, pyramids and composite solids
- solve problems involving volume and capacity of solids including prisms, cylinders, spheres, pyramids and composite solids
  - convert between units of volume and capacity
  - use the trapezoidal rule to solve a variety of practical problems with and without technology, e.g. the volume of water in a swimming pool
- solve practical problems involving taking measurements and calculating perimeters, area, surface area, volumes and capacity in a variety of contexts.

Topic 2 - Scales, plans and models

This topic has three subtopics:

- Geometric information
- Interpreting scale drawings, plans and models
- Creating scale drawings

Geometric information:

- recognise the properties of common two-dimensional geometric shapes and three-dimensional solids
- interpret different forms of two-dimensional representations of three-dimensional objects, including nets and perspective diagrams
- use symbols and conventions for the representation of geometric information – for example, point, line, ray, angle, diagonal, edge, curve, face and vertex.

Interpreting scale drawings, plans and models:

- review the use of a scale factor to find unknown lengths in similar figures
- obtain measurements from scale drawings, including maps (including cultural mappings or models) or building plans, to solve problems

- interpret commonly used symbols and abbreviations on building plans and elevation view
- find actual measurements from scale drawings, such as lengths, perimeters and areas
- calculate the perimeter or area of a section of land, using the trapezoidal rule where appropriate, from a variety of sources, including a site plan, an aerial photograph, radial surveys or maps that include a scale
- calculate the volume of rainfall over an area, using $V = Ah$, from a variety of sources, including site plans, aerial photographs, radial surveys or maps that include a scale
- estimate and compare quantities, materials and costs using actual measurements from scale drawings – for example, using measurements for packaging, clothes, painting, bricklaying and landscaping
- interpret and sketch elevation views of models
- interpret diagrams of three-dimensional objects.

Creating scale drawings:

- understand and apply drawing conventions of scale drawings, such as scales in ratio, clear indications of dimensions, and clear labelling
- construct scale drawings by hand and by using software packages.

Module 3 Work Requirements Summary

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.

This module includes one (1) test as a work requirement.

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 end-point 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 end-point 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

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

The assessment for *Essential Mathematics* Level 2B 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 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, scales, plans and models

Standards

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

Standard Element	Rating C	Rating B	Rating A
E1 – communicates observations and judgements	communicates 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 clear and reasoned observations and judgements using appropriate mathematical and statistical terminology and language
E2 – uses conventions	uses mathematical conventions, systems and constructs based on definitions and rules when prompted	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 including manipulation and use of symbolic expressions, rules and formal systems accurately and purposefully

Standard Element	Rating C	Rating B	Rating A
E3 – uses units and notation	uses correct units and notation when prompted to include them in an answer	presents the final answer with correct use of units and notation as required	presents work with correct use of units and notation throughout calculations to convey mathematical information
E4 – identifies solutions	presents work with the final answer apparent.	presents work with the final answer clearly identified.	presents work with the final answer clearly identified and articulated in terms of the questions where necessary.

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

Standard Element	Rating C	Rating B	Rating A
E1 – self-awareness	identifies own personal traits that promote and inhibit learning performance and understanding	recognises learning strengths and weaknesses and establishes processes to plan, monitor and assess understanding and performance	analyses learning strengths and weaknesses in order to establish processes used to plan, monitor and assess understanding and performance
E2 – time management	sets goals and timelines and monitors with support	sets goals and timelines and monitors progress	monitors and analyses progress towards meeting goals and timelines
E3 – planning and organisation	with support uses some tools to organise and plan in order to manage resources and complete set tasks	applies organisational, planning and self-management skills to manage resources and consistently complete tasks	selects and applies effective organisational, planning and self-management skills to manage resources and complete all learning tasks
E4 - completion of individual and collaborative tasks	performs tasks as directed to contribute 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, demonstrates initiative, and guides others in their contribution to the completion of individual and collaborative activities

Standard Element	Rating C	Rating B	Rating A
E5 – self-monitoring	identifies own contribution to completion of collaborative activities.	describes own contribution to completion of collaborative activities.	explains own and other learners' contributions to completion of collaborative activities.

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

Standard Element	Rating C	Rating B	Rating A
E1 – represents real-world situations	explores simple familiar real-world situations and frames them in mathematical terms	interprets complex familiar real-world situations and frames them in mathematical terms	interprets complex familiar and non-familiar real-world situations and frames them in mathematical terms
E2 – represents numbers and applies numeric techniques	identifies fractions, decimals, percentages and ratios and the relationships between them, and uses them accurately in simple calculations	converts between fractions, decimals, percentages and ratios, and uses them accurately in complex familiar calculations	moves flexibly between representations of fractions, decimals, percentages and ratios, and uses them accurately in complex unfamiliar calculations
E3 - uses standard algorithms and algebraic techniques to solve problems	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.	applies order of operations correctly, and accurately substitutes variables into complex familiar equations to find an unknown that is the subject of the equation.	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.

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

Standard Element	Rating C	Rating B	Rating A
E1 – makes inferences	identifies problem elements and makes inferences	identifies and explains problem elements to make informed inferences that can be tested mathematically	explores and links problem elements to make logical inferences that can be tested mathematically
E2 – analyses results	compares experimental findings to expected results in familiar contexts, and identifies possible reasons for differences	relates experimental findings to real-world phenomena, noting differences and identifying possible reasons for these differences	relates experimental findings to real-world phenomena, describing differences and analysing possible reasons for these differences
E3 – justifies chosen approaches	describes the mathematical applications and processes used to solve problems	describes and explains how the mathematical applications and processes used were appropriate for the context	justifies why the mathematical applications and processes used were appropriate for the context
E4 - explains reasonableness of solutions	describes the reasonableness of the results and solutions to routine problems.	explains the reasonableness of the results and solutions to routine and non-routine problems.	evaluates and explains the reasonableness of the results and solutions to routine and non-routine problems in a variety of contexts.

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

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

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

Standard Element	Rating C	Rating B	Rating A
E1 – interpret financial information	interprets basic financial records†	interprets financial records†	interprets and solves problems involving reconciliation of financial records†
E2 – calculate earnings and associated taxes and levies	calculates pay rates, wages and tax in simple familiar situations	calculates pay rates, wages and tax including deductions and levies in complex familiar situations	calculates and compares pay rates, wages including government allowances or pensions and tax including deductions and levies in complex familiar situations

Standard Element	Rating C	Rating B	Rating A
E3 – calculate and compare simple and compound interest / depreciation	calculates simple interest or depreciation using a given formula, and represents graphically	calculates compound interest as a recurrence relation involving repeated application of simple interest, and represents graphically	calculates future value of simple and compound interest loans and compares and describes the growth of different loans over time
E4 – use technology to model, compare and investigate loans and investments	uses technology to calculate and solve simple familiar financial problems.	uses technology to model financial situations and solve complex familiar financial problems.	uses technology to model and compare results of alternative financial decisions and solve complex unfamiliar financial problems.

† financial records in this course include those that are basic (pay slips, single component invoices, receipts) and more complex (bank statements, credit card statements, utility bills, multiple component invoices, repayment schedules)

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

Standard Element	Rating C	Rating B	Rating A
E1 – data collection	identifies the procedure for conducting a census, and different types of sampling	describes the advantages and disadvantages of conducting a census and different types of sampling	purposefully selects and justifies conducting a census or sampling type based on the target population to be surveyed and the statistical question being asked
E2 – sources of bias	identifies errors in data collection and misrepresentations in survey findings	describes errors in data collection and misrepresentations in survey findings, including in reports in the media	analyses survey findings, including in reports in the media, and presents evidence to interrogate the reliability or misrepresentation of findings

Standard Element	Rating C	Rating B	Rating A
E3 - describe bivariate data and interpret relationships	identifies the key features of graphs, describes patterns in data and recognises relationships between variables	interprets key features of graphs, describes relationships between variables and finds line of best fit with and without the aid of technology and makes predictions by interpolation and extrapolation	interprets relationships between variables including finding the correlation coefficient, makes predictions by interpolation and extrapolation, and evaluates the reliability of results
E4 – describing probability	describes chance events using common probability statements and routine fractions	expresses probability formally using fractions, decimals, ratios and percentages, and describes likelihood of chance events	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
E5 – calculating and comparing probability	identifies relative frequency as probability and use sample spaces to determine the probability of outcomes for an experiment.	calculates and compares probability of events using theoretical expectation and relative frequency from repeated trials.	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.

Criterion 8: interpret concepts and apply mathematical techniques to solve problems involving measurement, scales, plans and models

Standard Element	Rating C	Rating B	Rating A
E1 – practicalities of measurement using scaled instruments	calculates the absolute error of reported measurements and identifies possible causes of error	investigates types of errors, calculates errors as a percentage and identifies what percentage error is acceptable in a given context	describes possible implications of error and explains what level of error is acceptable or not in a given context

Standard Element	Rating C	Rating B	Rating A
E2 - solve problems involving perimeter, area, surface area, volume and capacity	solves routine problems involving perimeter and area of standard two-dimensional shapes, and surface area, volume and capacity of standard three-dimensional objects	solves routine and non-routine problems involving perimeter and area of standard two-dimensional shapes, and surface area, volume and capacity of standard three-dimensional objects	solves routine and non-routine problems involving perimeter and area of composite two-dimensional shapes, and surface area, volume and capacity of composite three-dimensional objects
E3 – conversions and attributes	recognises the properties of common two-dimensional shapes and three-dimensional solids, and converts between units of length	identifies different forms of two-dimensional representations of three-dimensional objects, and converts between units of perimeter and area	interprets three-dimensional objects by describing properties and creating two-dimensional representations, and converts between units of surface area, volume and capacity
E4 – interpret scale drawings, plans and models	uses scale factor to find unknown lengths in similar figures, and obtains measurements from scale drawings, plans and models.	interprets scale drawings, plans and models to obtain measurements such as lengths, perimeters and areas, and solves familiar problems.	interprets scale drawings, plans and models to obtain and calculate measurements, and solves complex familiar problems such as comparison of different quantities, materials and costs.

Quality Assurance

- This will be determined by TASC at time of accreditation.

Qualifications and Award Requirements

Level 2

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

The minimum requirements for an award are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)

6 'A' ratings, 2 'B' rating

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

- This will be confirmed by time of accreditation.

Course Developer

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

Accreditation and Version History

- Details to be determined by TASC at time of accreditation.

Appendix 1 - Line of Sight

Learning Outcomes	Course Content	Work Requirements	Criteria	Standards	General Capabilities (GC)
1. communicate thinking, strategies and using appropriate mathematical or statistical language	Module 1, 2, 3	Module 1, 2, 3	C 1	E 1, 2, 3, 4	GC:
2. plan, organise and manage learning in order to complete tasks and evaluate progress	Module 1, 2, 3	Module 1, 2, 3	C 2	E 1, 2, 3, 4, 5	GC:
3. apply numeric techniques and algebraic processes to represent situations and solve problems	Module 1, 2, 3	Module 1, 2, 3	C 3	E 1, 2, 3	GC:
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of solutions to problems	Module 1, 2, 3	Module 1, 2, 3	C 4	E 1, 2, 3, 4	GC:
5. act as creative, critical and reflective thinkers to assess ideas and take informed action	Module 1, 2, 3	Module 1, 2, 3	C 5	E 1, 2, 3, 4	GC:

Learning Outcomes	Course Content	Work Requirements	Criteria	Standards	General Capabilities (GC)
6. understand concepts and apply techniques involving finance and money management	Module 1	Module 1	C 6	E 1, 2, 3, 4	GC:
7. understand concepts and apply techniques involving relative frequency and collecting and handling data	Module 2	Module 2	C 7	E 1, 2, 3, 4, 5	GC:
8. understand concepts and apply techniques involving measurement, scales, plans and models	Module 3	Module 3	C 8	E 1, 2, 3, 4	GC:

Appendix 2 - Alignment to Curriculum Frameworks

Links to Foundation to Year 10:

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

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 3 and 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. The content covered in Essential Mathematics Unit 4 Topic 2 on Earth geometry and time zones is covered in the proposed *General Mathematics* Level 3 as it is more contextually appropriate when taught alongside applications of trigonometry.

Additional content on the topic of 'Earning and managing money' has been included as it provides important information on wages, income, benefits, tax and other money management principles that are requisite to financial literacy beyond school. Additional content is also included in the topic 'Interest and depreciation' to provide conceptual understanding of depreciation through repeated application of the simple interest formula using the straight-line method.

Summary of Aligned Content:

Module	Topics	Australian Curriculum Framework Source or otherwise
Module 1	Earning and managing money Interest and depreciation	NSW Mathematics Standard Year 11 Essential Mathematics Unit 4 Topic 3
Module 2	Graphs and modelling Data collection and analysis Probability and relative frequency	Essential Mathematics Unit 3 Topic 3 Essential Mathematics Unit 3 Topic 4 Essential Mathematics Unit 4 Topic 1
Module 3	Measurement and shape Scales, plans and models	Essential Mathematics Unit 3 Topic 1 Essential Mathematics Unit 3 Topic 2

Appendix 3 - Work Requirements

Module 1 Work Requirements Specifications

Focus Area: Personal Futures

Title of Work Requirement: Managing Money

Format: Series of connected short responses

Description: This series of connected short responses will focus on the interpretation, analysis, examination and/or evaluation of ideas and information in response to a particular question, situation or stimulus relating to finance and money management.

Learners will take informed action by analysing and calculating earnings, tax and benefits in a given situation and will investigate many possible situations involving interest and depreciation. Learners' responses will include providing recommendations for the given situation, enabling them to demonstrate mathematical reasoning.

Learners should be given opportunities to work collaboratively to generate, refine and test ideas and strategies and 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 define which work is their own.

Time allowance: 8-10 hours of class time

Timing: Devoted class time should be provided throughout the module at the teacher's discretion

External Agencies: At provider discretion

Relevant Criteria:

- Criterion 1: all elements
- Criterion 2: E1, E2, E3 and where relevant E4 and E5
- Criterion 3: all elements
- Criterion 4: E1, E3
- Criterion 5: all elements
- Criterion 6: all elements

Module 2 Work Requirements Specifications

Focus Area: Personal Futures

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 and/or confirmed 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: At teachers' discretion

External Agencies: At teachers' discretion

Relevant Criteria:

- Criterion 1: chosen elements at teacher discretion
- Criterion 2: chosen elements at teacher discretion
- Criterion 3: all elements
- Criterion 4: all elements
- Criterion 5: all elements
- Criterion 7: elements 4 and 5

Module 3 Work Requirements Specifications

Focus Area: Personal Futures

Title of Work Requirement: Measurement Test

Format: Short responses

Description: Learners will complete a series of connected short responses to investigate, interpret and construct scale drawings, plans and models and obtain the relevant measurements to calculate length, perimeter area and volume. Within the series of responses, learners will use a minimum of 8 different formula (including the trapezoidal rule) to calculate and solve problems involving perimeter, area, surface area, volume and capacity, including at least one problem involving spheres and one problem involving composite solids. Learners will perform conversions, including at least one problem involving conversions between mm^3 and L.

Size: Approximately 2 hours of class time.

Timing: Devoted class time should be provided throughout the module at the teachers' discretion

External agencies: At provider discretion

Relevant criteria:

- Criterion 1: all elements
- Criterion 3: all elements
- Criterion 4: E3, E4
- Criterion 8: E2, E3, E4

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	Course Context
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	Essential Mathematics 2A: • Module 3 – Practicalities of measurement Essential Mathematics 2B: • Module 3 – Perimeter, area, volume and capacity
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	Essential Mathematics 2A: • Module 3 – Practicalities of measurement Essential Mathematics 2B: • Module 3 – Perimeter, area, volume and capacity
algorithm	An algorithm is a precisely defined routine procedure that can be applied and systematically followed through to a conclusion.	ACARA	Essential Mathematics 1, 2A and 2B
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 usedwhen referring to the strength of a linear relationship between two numerical variables.	ACARA	Essential Mathematics 2B: • Module 2 – Data collection and analysis

Term	Definition	Source Acknowledgement	Course Context
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	Essential Mathematics 1: • Module 1 – Number and place value
average speed	Average speed is the total distance travelled divided by the total time taken.	ACARA	Essential Mathematics 2A: • Module 3 – Units of energy and mass, time and motion
array	An ordered collection of objects or numbers	QCAA	Essential Mathematics 2B: • Module 2 – Probability and relative frequency
back-to-back stem-and-leaf plots	A back-to-back stem and leaf plot is a method for comparing two data distributions attaching two sets of 'leaves' to the same 'stem' in a stem and leaf plot.	ACARA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation

Term	Definition	Source Acknowledgement	Course Context
bias	Bias generally refers to a systematic favouring of certain outcomes more than others, due to unfair influence (knowingly or otherwise).	NESA	Essential Mathematics 2B: • Module 2 – Data collection and analysis
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	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
break-even point	The break-even point is the point at which revenue begins to exceed the cost of production.	ACARA	Essential Mathematics 2B: • Module 2 – Graphs and modelling
calculates	Determine or find (e.g. a number, answer) by using mathematical processes; obtain a numerical answer showing the relevant stages in the working; ascertain/determine from given facts, figures or information	QCAA	Essential Mathematics 1, 2A and 2B
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	Essential Mathematics 2B: • Module 2 – Graphs and modelling

Term	Definition	Source Acknowledgement	Course Context
categorical data	Data associated with a categorical variable is called categorical data.	ACARA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
categorical variable	A categorical variable is a variable whose values are categories. Examples include blood group (A, B, AB or O) or house construction type (brick, concrete, timber,steel, other). Categories may have numerical labels, e.g. the numbers worn by player in a sporting team, but theselabels have no numerical significance, they merely serve as labels.	ACARA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
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	Essential Mathematics 2B: • Module 2 – Data collection and analysis

Term	Definition	Source Acknowledgement	Course Context
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	Essential Mathematics 1: • Module 1 – Number and place value
conversion	A change in the form or units of an expression	QCAA	Essential Mathematics 2B: • Module 2 – Graphs and modelling

Term	Definition	Source Acknowledgement	Course Context
compound interest	The interest earned when each successive interest payment is added to the principal for the purpose of calculating the next interest payment. e.g. 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	Essential Mathematics 2B: • Module 1 – Earning and managing money
correlation	Correlation is a measure of the strength of the linear relationship between two variables.	ACARA	Essential Mathematics 2B: • Module 2 – Data collection and analysis
correlation coefficient	The correlation coefficient (r) is a measure of the strength of the liner relationship between a pair ofvariables.	ACARA	Essential Mathematics 2B: • Module 2 – Data collection and analysis
decile	Any of the nine values that divide a ranked dataset into ten equal parts	QCAA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation

Term	Definition	Source Acknowledgement	Course Context
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	Essential Mathematics 1: • Module 1 – Number and place value
elevation views	Elevation views are scale drawings showing what a building looks like from the front, back and sides.	NESA	Essential Mathematics 2B: • Module 3 – Scales, plans and models
equivalence	Two expressions are said to be equivalent if they are equal in value.		Essential Mathematics 1: • Module 1 – Number and place 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	Essential Mathematics 2B: • Module 2 – Data collection and analysis
face (shape)	Any of the individual flat surfaces of a solid object.	mathsisfun.com	Essential Mathematics 2B: • Module 3 – Scales, plans and models

Term	Definition	Source Acknowledgement	Course Context
five-number summary	A five-number summary is a method of summarising a set of data using the minimum value, the lower or first-quartile (Q_1), the median, the upper or third-quartile (Q_3) and the maximum value. Forms the basis for a boxplot.	ACARA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
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	Essential Mathematics 2B: • Module 1 – Earning and managing money
gradient (slope)	The gradient or slope 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	Essential Mathematics 2B: • Module 2 – Graphs and modelling
histogram	A histogram is 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	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
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	Essential Mathematics 1: • Module 1 – Number and place value

Term	Definition	Source Acknowledgement	Course Context
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 therange of the original data.	ACARA	Essential Mathematics 2B: • Module 2 – Data collection and analysis
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	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
kilowatt hour (kWh)	The kilowatt hour is a unit of energy equal to 1000 watt hours or 3.6 megajoules. The kilowatt hour is most commonly known as a billing unit for energy delivered to consumers by electric utilities.	ACARA	Essential Mathematics 2A: • Module 3 – Units of energy and mass, time and motion
megajoule (MJ)	A joule is the SI unit of work. The megajoule (MJ) is equal to one million joules.	ACARA	Essential Mathematics 2A: • Module 3 – Units of energy and mass, time and motion
mean	The arithmetic mean, $\bar{x}$, of a list of numbers is the sum of the data values divided by the number ofvalues in the list. In everyday language, the arithmetic mean is commonly called the average.	ACARA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation

Term	Definition	Source Acknowledgement	Course Context
measures of central tendency	Measures of central tendency are 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	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
measures of spread	Measures of spread describe 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	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
median	The 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	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
mode	The mode is the most frequently occurring value is a data set.	ACARA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation

Term	Definition	Source Acknowledgement	Course Context
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	Essential Mathematics 1, 2A and 2B
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	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
parallel box plots	Parallel box plots are used to visually compare the five-number summaries of two or more datasets;	QCAA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
partitioning	Partitioning means dividing a quantity into parts. In the early years, 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	Essential Mathematics 1: • Module 1 – Number and place value
percentage error	The percentage error of a measurement is the absolute error expressed as a percentage of the recorded measurement.	NESA	Essential Mathematics 2A: • Module 3 – Practicalities of measurement Essential Mathematics 2B: • Module 3 – Perimeter, area, volume and capacity

Term	Definition	Source Acknowledgement	Course Context
picture graph	A picture graph is a statistical graph for organising and displaying categorical data.	ACARA	Essential Mathematics 1: • Module 2 – Data collection, representation and interpretation
piecework	Piecework is employment where a worker is paid a fixed rate for each item produced or action performed regardless of the time taken.	NESA	Essential Mathematics 2B: • Module 1 – Earning and managing money
place value	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	Essential Mathematics 1: • Module 1 – Number and place value
precision	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	Essential Mathematics 2A: • Module 3 – Practicalities of measurement Essential Mathematics 2B: • Module 3 – Perimeter, area, volume and capacity

Term	Definition	Source Acknowledgement	Course Context
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	Essential Mathematics 2B: • Module 2 – Probability and relative frequency
quartile	The quartiles of a ranked set of data values are the three points that divide the dataset into four equal groups.	QCAA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
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	Essential Mathematics 2B: • Module 3 – Scales, plans and models
range	The range is the difference between the largest and smallest observations in a data set.	ACARA	Essential Mathematics 2A: • Module 2 – Data representation and interpretation
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	Essential Mathematics 1, 2A and 2B
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	Essential Mathematics 1, 2A and 2B

Term	Definition	Source Acknowledgement	Course Context
ray	A ray is the part of a line that starts at a point and continues in a particular direction to infinity. Rays are usually depicted with an arrow-head, which indicates the direction in which the line continues to infinity.	ACARA	Essential Mathematics 2B: • Module 3 – Scales, plans and models
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	Essential Mathematics 2A: • Module 3 – Units of energy and mass, time and motion
recurrence relation	A recurrence relation is an equation that recursively defines a sequence; that is, once one or more initial terms are given, each further term of the sequence is defined as a function of the preceding terms.	NESA	Essential Mathematics 2B: • Module 1 – Interest and depreciation
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	Essential Mathematics 1: • Module 1 – Fractions, decimals and percentages
reducing balance loan	A reducing balance loan is 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	Essential Mathematics 2B: • Module 1 – Interest and depreciation
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	Essential Mathematics 1: • Module 3 – Geometric reasoning

Term	Definition	Source Acknowledgement	Course Context
relative frequency	The number of items of a certain type divided by the number of all the items considered	QCAA	Essential Mathematics 2B: • Module 2 – Probability and relative frequency
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	Essential Mathematics 2B: • Module 2 – Data collection and analysis
sample space	The sample space of a chance experiment is the set of all possible outcomes for that experiment.	NESA	Essential Mathematics 2B: • Module 2 – Probability and relative frequency
sampling	Sampling is 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/strata in an equivalent proportion to the size of that group/strata in the population. A sample can be used to estimate the characteristics of the statistical population.	NESA	Essential Mathematics 2B: • Module 2 – Data collection and analysis

Term	Definition	Source Acknowledgement	Course Context
scale	a graduated line, as on a map, representing proportionate size	QCAA	Essential Mathematics 2B: • Module 3 – Scales, plans and models
simple interest	Simple interest is 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	Essential Mathematics 2B: • Module 1 – Interest and depreciation
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	Essential Mathematics 2B: • Module 3 – Scales, plans and models
standard deviation	The standard deviation is a measure of the variability or spread of a data set. It gives an indication ofthe 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	Essential Mathematics 2A: • Module 2 – Data representation and interpretation

Term	Definition	Source Acknowledgement	Course Context
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/or conditions of the road which can be found using formulas or tables. Stopping distance = braking distance + reaction time (seconds) × speed	ACARA	Essential Mathematics 2A: • Module 3 – Units of energy and mass, time and motion
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	Essential Mathematics 2B: • Module 1 – Interest and depreciation
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	Essential Mathematics 1: • Module 3 – Geometric reasoning
terminating decimal	A terminating decimal is a decimal that contains a finite number of digits		Essential Mathematics 1: • Module 1 – Fractions, decimals and percentages
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.		Essential Mathematics 1: • Module 3 – Geometric reasoning

Term	Definition	Source Acknowledgement	Course Context
trapezoidal rule	The 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	Essential Mathematics 2A: • Module 3 – Practicalities of measurement Essential Mathematics 2B: • Module 3 – Perimeter, area, volume and capacity
travel graph	Travel graphs are 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	Essential Mathematics 2B: • Module 2 – Graphs and modelling
tree diagram	A tree diagram is 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	Essential Mathematics 2B: • Module 2 – Probability and relative frequency
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	Essential Mathematics 2B: • Module 2 – Probability and relative frequency
vertex (in shape)	A vertex is a point in which edges intersect.	NESA	Essential Mathematics 2B: • Module 3 – Scales, plans and models

Appendix 6 – Degree of difficulty of problems

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 students 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 students 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
    - 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 students 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 students have had limited prior experience.

Students interpret, clarify and analyse problems to develop responses.