DEPARTMENT OF EDUCATION
learners first

Work-based Learning

Mathematics

Essential Mathematics 3

COURSE DOCUMENT

DRAFT

PHASE 3 CONSULTATION

Catholic Education Tasmania

INDEPENDENT SCHOOLS TASMANIA

Years 9 to 12 Learning

Tasmanian Government

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Essential Mathematics, 150 hours – Level 3

This course is the Level 3 component of the Essential Mathematics program.

Aims

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 supports 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 highly flexible range of learning opportunities suited to their level of readiness, interests and aspirations.

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 3 is a Work-based Learning course.

Focus Area – Work-based Learning

Work-based Learning enables students to acquire workplace skills either through a TASC accredited course or through nationally recognised training within an industry developed Training Package. Inclusion of Work-based Learning as a focus area is a response to a range of contemporary research findings that highlight the value of work-based learning. Work-based learning, when connected to quality curriculum, equips young people to navigate the changing nature of work, successfully transition to post-school options, and thrive in a complex and changing world.

Work-based Learning courses have three key features that guide teaching and learning:

- prepare for workplace learning
- undertake workplace learning
- reflect and exhibit/present

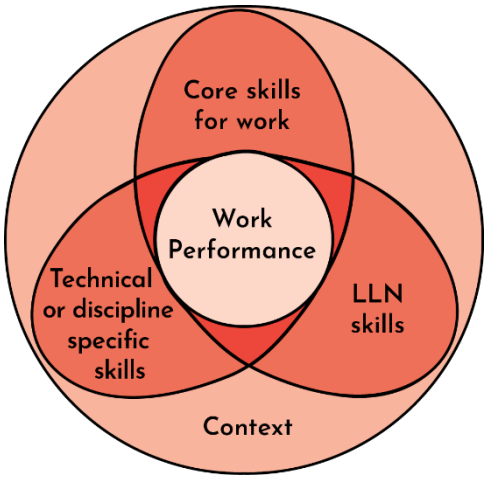


Figure 1: Core skills for work in context (source: https://www.dese.gov.au/uncategorised/resources/core-skills-work-developmental-framework)

In this course learners will develop their mathematical proficiency through participation in workplace learning, engaging with specialist knowledge and core concepts in the strands of algebra, probability, statistics, measurement and geometry. Learners will actively apply their knowledge through collaborative problem-solving, ideation and testing of mathematical ideas. They will interact and connect with others, plan, organise and make decisions and work innovatively with and without the aid of technology. Learners will critically reflect on their ability to interpret and analyse mathematical ideas and objects in the workplace and will exhibit or present their work in a folio.

Rationale

The *Essential Mathematics* Level *3* course enables students to develop the mathematical competence to use mathematics effectively, efficiently and critically to make informed decisions in their daily lives including in workplace contexts. Essential Mathematics provides students with the mathematical knowledge, skills and understanding to solve problems in real contexts, in a range of workplace, personal, further learning and community settings. The course is designed to develop learners' understanding of concepts and techniques drawn from number and algebra, probability and statistics, and measurement and geometry. Learners will reflect on their ability to interpret, understand and apply these concepts and techniques in the workplace. This subject offers students the opportunity to prepare for post-school options of employment, and further education and training.

This course will enable learners to develop the mathematical competence required to enter the workforce and contribute productively in an ever-changing global economy, and with both rapid revolutions in technology and global and local social challenges. This is a key factor in ensuring Tasmania and Australia's current and emerging needs are met as an economy competing globally requires substantial numbers of proficient workers able to learn, adapt, create, interpret, analyse and apply mathematical information.

Integration of General Capabilities and Cross-Curriculum Priorities

The general capabilities addressed specifically in this course are:

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

The cross-curriculum priorities are 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 3 enables students to develop their understanding of concepts and techniques drawn from:

- number including finance and proportional reasoning
- algebra including linear equations and their graphs
- probability including understanding relative frequency
- statistics including handling data
- measurement including 2D and 3D shape
- geometry including trigonometry, scale and mapping.

Engagement with the content will:

- develop their ability to identify and solve problems in a range of workplace, personal, further learning and community settings
- assist in making informed decisions in their daily lives including in workplace contexts
- allow them to work collaboratively with others to generate ideas, and to find innovative approaches to engaging with mathematics in the workplace
- provide opportunity for reflection on their ability to interpret, understand and apply these concepts and techniques in the workplace.

Pathways

The *Essential Mathematics Level 3* course enables learning continuity from Year 10 Australian Curriculum: Mathematics for learners who have achieved a 'C' rating or higher. Additionally, learners who have successfully undertaken the currently accredited TASC course Workplace Maths – MTW215120 or the Level 2 component of the Essential Mathematics suite of courses under development could progress into Level 3 of this course.

Essential Mathematics Level 3 will provide the foundational knowledge for students wishing to pursue tertiary education in non-STEM specific fields and technical knowledge required for further vocational education and training. Additionally, successful completion of this course at a 'High Achievement' or higher may enable learners to transition into *General Mathematics* Level 3 if recommended through ongoing course and career counselling by their provider of education.

Course Requirements

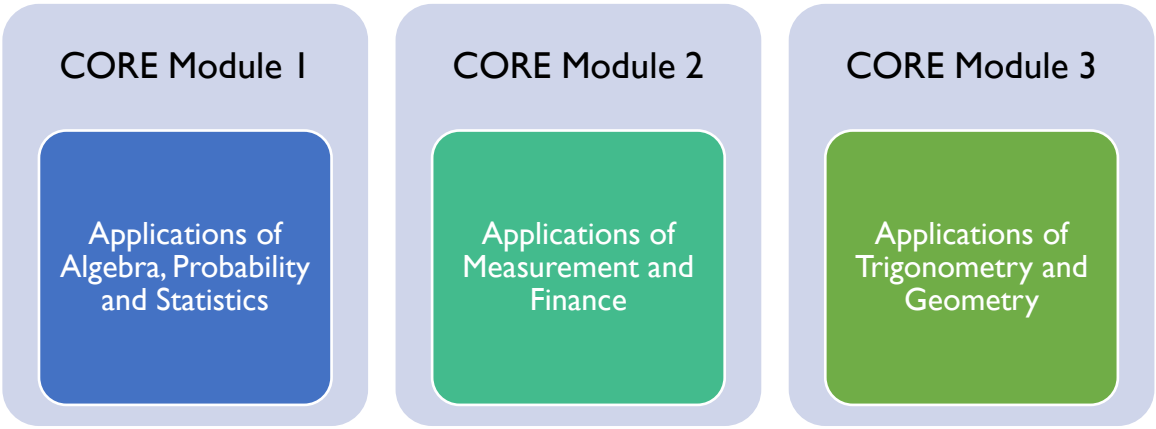
- Resources – Students will require access to graphics calculators.
- Learning environment – Students will require opportunities to engage in real or simulated workplace environments during at a minimum, two out of the three modules.

Course Structure, Delivery and Progression

Structure

This course consists of three 50-hour modules.

Modules Available
Core Module 1: Applications of algebra, probability and statistics
Core Module 2: Applications of measurement and finance
Core Module 3: Applications of trigonometry and geometry



Delivery

There is no specific recommended delivery sequence for the modules

Developmental Progression

At both the module and course level the learner is introduced to and builds upon key ideas, concepts, skills, knowledge and understanding leading to performance of understanding reflected in the work requirements.

Individual modules have a developmental progression that introduces, builds upon and culminates in a performance of understanding in the work requirements. Between modules there is also a developmental progression that leads to a culminating performance of understanding in the final work requirements.

Module 1 - Applications of algebra, probability and statistics

This module contains two topics:

- Linear equations and their graphs
- Probability and relative frequency

'Linear equations and their graphs' uses linear equations and straight line graphs, as well as piecewise and step graphs to model and analyse practical situations that learners may confront in a workplace context. These representations of linear equations find application in a wide range of situations, including modelling and interpreting bivariate data through scatterplots and establishing break-even points in a business' cost and revenue data.

'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. These techniques have a wide range of application in the workplace, including identifying risk and reward, implications upon

decision-making and understanding the impact and perceived chance of events disrupting or effecting the workplace including for example weather events, traffic flow and introduction of competitors.

Module 1 Learning Outcomes

On successful completion of this module, learners will be able to:

1. Define and explain key knowledge and concepts and apply a range of related mathematical techniques and procedures to solve practical problems.
2. Interpret and engage with mathematical objects and information in workplace contexts.
3. Manage self, connect and collaborate with others and reflect on learning including in workplace contexts.
4. Identify problems that can be modelled and solved mathematically, select and apply problem solving processes and review outcomes including in workplace contexts.

Module 1 Content

Linear equations and their graphs

Subtopics:

- Linear equations and the Cartesian plane
- Graphs and modelling of practical situations

Linear equations and the Cartesian plane:

Key knowledge and skills:

- Identify and solve linear equations (ACMGM038)
- develop a linear formula from a word description (ACMGM039)
- demonstrate familiarity with Cartesian coordinates in two dimensions by plotting points on the Cartesian plane (ACMEM121)
- generate tables of values for linear functions, including for negative values of x (ACMEM122)
- graph linear functions for all values of x with pencil and paper and with graphing software. (ACMEM123)
- construct straight-line graphs both with and without the aid of technology (ACMGM040)
- determine the slope and intercepts of a straight-line graph from both its equation and its plot (ACMGM041)

Graphs and modelling of practical situations:

Key knowledge and skills:

- interpret, in context, the slope and intercept of a straight-line graph used to model and analyse a practical work-based situation (ACMGM042)
- construct and analyse a straight-line graph to model a given linear relationship; for example, modelling the cost of vaccination of livestock against a known disease against the number of livestock. (ACMGM043)
- interpret and use graphs in practical situations, including travel graphs and conversion graphs (ACMEM124)
- draw graphs from given data to represent practical situations (ACMEM125)
- 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. (ACMEM126)
- describe the patterns and features of bivariate data (ACMEM138)

- describe the association between two numerical variables in terms of direction (positive/negative), form (linear/non-linear) and strength (strong/moderate/weak). (ACMEM139)
- identify the dependent and independent variable (ACMEM140)
- find the line of best fit by eye (ACMEM141)
- use technology to find the line of best fit (ACMEM142)
- interpret relationships in terms of the variables (ACMEM143)
- use technology to find the correlation coefficient (an indicator of the strength of linear association) (ACMEM144)
- use the line of best fit to make predictions, both by interpolation and extrapolation (ACMEM145)
- recognise the dangers of extrapolation (ACMEM146)
- distinguish between causality and correlation through examples. (ACMEM147)
- solve a pair of simultaneous linear equations, using technology when appropriate (ACMGM044)
- solve practical work-based problems that involve finding the point of intersection of two straight-line graphs; for example, determining the break-even point of cost and revenue in manufacturing of an item (ACMGM045)
- sketch piece-wise linear graphs and step graphs, using technology when appropriate (ACMGM046)
- interpret piece-wise linear and step graphs used to model practical work-based situations e.g. the change in the level of water in a reservoir over time when water is drawn off at different intervals for irrigation of vegetation (ACMGM047)

Probability and relative frequency:

Key knowledge and skills:

- interpret commonly used probability statements, including 'possible', 'probable', 'likely', 'certain' (ACMEM148)
- describe ways of expressing probabilities formally using fractions, decimals, ratios, and percentages. (ACMEM149)
- perform simulations of experiments using technology (ACMEM150)
- recognise that the repetition of chance events is likely to produce different results (ACMEM151)
- identify relative frequency as probability (ACMEM152)
- identify factors that could complicate the simulation of real-world events. (ACMEM153)
- construct a sample space for an experiment (ACMEM154)
- use a sample space to determine the probability of outcomes for an experiment (ACMEM155)
- use arrays or tree diagrams to determine the outcomes and the probabilities for experiments. (ACMEM156)
- determine the probabilities associated with simple games (ACMEM157)
- determine the probabilities of occurrence of simple traffic-light problems. (ACMEM158)

Module 1 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.

This module includes 3-4 short responses in a reflective journal and an extended response / inquiry as work requirements.

See Appendix 3 for summary of Work Requirement specifications for this course.

Module 1 Assessment

This module will assess criteria 1, 2, 3, 4.

Module 2 - Applications of measurement and finance

This module consists of three topics:

- Measurement in the workplace
- Application of rates and ratio
- Finance in the workplace

'Measurement in the workplace' provides opportunity to conduct measurements in practical situations relating to two-dimensional shapes, three-dimensional objects including mass and capacity and to calculate, compare and solve problems relating to these measurements. Implications regarding the practicalities of measurement including estimation, precision and accuracy will be investigated and analysed.

'Application of rates and ratios' will explore direct and indirect proportion between quantities, and will provide opportunities to solve practical problems and model situations relating to energy use, heart-rate, motion and unit-costing that has a diverse range of applications in many fields.

'Finance in the workplace' will explore earning and money management and situations involving interest and depreciation. These sub-topics provide extensive information on both personal finance and management of human resources, plant equipment and assets that is applicable to business management in all fields.

Module 2 Learning Outcomes

On successful completion of this module, learners will be able to:

1. Define and explain key knowledge and concepts and apply a range of related mathematical techniques and procedures to solve practical problems.
2. Interpret and engage with mathematical objects and information in workplace contexts.
3. Manage self, connect and collaborate with others and reflect on learning including in workplace contexts.
5. Apply mathematical reasoning and creative thinking to generate, test and apply ideas in a mathematical inquiry and evaluate their impact including in workplace contexts.

Module 2 Content

Measurement in the workplace

This topic contains two subtopics which are taught concurrently:

- Practicalities of measurement
- Perimeter, area, volume, capacity and mass

Practicalities of measurement

Key knowledge and skills:

- 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 $\text{Absolute error} = 1/2 \times \text{Precision}$ 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, e.g. 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 / device limitations

Perimeter, area, volume, capacity and mass

Key knowledge and skills:

- consider the importance of accuracy, describe when estimation is acceptable, make estimations and describe possible implications of error in a variety of work-based scenarios
- 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, $A \approx \frac{h}{2}(d_f + d_l)$
  - 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 problems involving surface area of solids including prisms, cylinders, spheres 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
- review metric units of mass (and weight), their abbreviations, conversions between them, and appropriate choices of units including consideration of the importance of accuracy (ACMEM098)
- solve practical problems involving taking measurements and calculating perimeters, area, surface area, volumes and capacity in a variety of work-based contexts

Application of rates and ratios

Key knowledge and skills:

- use, simplify and convert between units of rates, for example km/h and m/s, mL/min and L/h (ACMEM071, ACMEM072)
- use rates to solve and describe practical work-based problems
    - use rates to make comparisons, e.g. 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, e.g. calculating the cost of a trade professional using rates per hour and call-out fees (ACMEM075)
    - 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 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, e.g. calculate the cost of running a 200-watt television for six hours if the average peak rate for domestic electricity is $0.15/kWh
    - investigate local council requirements for energy-efficient housing
- solve practical problems involving expressing a ratio in simplest form, finding the ratio of two quantities and dividing a quantity in a given ratio
    - use ratio to describe map scales
    - calculating mixtures for building materials or cost per item
    - scaling recipes for use in a commercial setting

Finance in the workplace

This topic contains two subtopics:

- Earning and managing money
- Interest and depreciation

Earning and managing money:

Key knowledge and skills:

- 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 (ACMGM003)
- 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 owing 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

Interest and depreciation:

Key knowledge and skills:

- apply percentage increase or decrease in various contexts, e.g. 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
- review the principles of simple interest (ACMEM168)
- 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 (ACMEM170)
- use technology to calculate the future value of a compound interest loan or investment and the total interest paid or earned (ACMEM171)
- use technology to compare, numerically and graphically, the growth of simple interest and compound interest loans and investments (ACMEM172)
- 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. (ACMEM173)
- use technology and a recurrence relation to model a reducing balance loan (ACMEM174)
- investigate the effect of the interest rate and repayment amount on the time taken to repay a loan. (ACMEM175) calculate the depreciation of an asset using the straight-line method as an application of the simple interest formula
- use $S = V_0 - Dn$, where S is the salvage value of the asset after n periods, V_0 is the initial value of the asset, D is the amount of depreciation per period, and n is the number of periods

Module 2 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.

This module includes 3-4 short responses in a reflective journal and an extended response / inquiry as work requirements.

See Appendix 3 for summary of Work Requirement specifications for this course.

Module 2 Assessment

This module will assess criteria 1, 2, 3, 5.

Module 3 - Applications of trigonometry and geometry

This module consists of three topics:

- Scales, plans and models
- Applications of trigonometry
- Earth geometry and time zones

'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.

'Applications of trigonometry' provides additional techniques involving the measurement and calculation of angles, and linear and area measure of triangles which has practical application in the fields described above and others that involve navigation and/or surveying of geographical features.

'Earth geometry and time zones' involves solving problems relating to identifying locations and measuring distances between locations on the Earth's surface and making connections between longitudinal location and time zones which has practical implications for the global nature of the world of work, specifically relating to implications upon travel and connectivity.

Module 3 Learning Outcomes

On successful completion of this module, learners will be able to:

1. Define and explain key knowledge and concepts and apply a range of related mathematical techniques and procedures to solve practical problems.
2. Interpret and engage with mathematical objects and information in workplace contexts.
3. Manage self, connect and collaborate with others and reflect on learning including in workplace contexts.
6. Communicate and represent mathematical information and apply mathematical conventions including in workplace contexts.

Module 3 Content

Scales, plans and models

This topic has three subtopics:

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

Geometric information:

Key knowledge and skills:

- recognise the properties of common two-dimensional geometric shapes and three-dimensional solids (ACMEM105)
- interpret different forms of two-dimensional representations of three-dimensional objects, including nets and perspective diagrams (ACMEM106)

- use symbols and conventions for the representation of geometric information; for example, point, line, ray, angle, diagonal, edge, curve, face and vertex. (ACMEM107)

Interpreting scale drawings, plans and models

Key knowledge and skills:

- 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 (ACMEM109)
  - 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 a site plan, an aerial photograph, 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. (ACMEM110)
  - interpret diagrams of three-dimensional objects. (ACMEM115)

Creating scale drawings

Key knowledge and skills:

- understand and apply drawing conventions of scale drawings, such as scales in ratio, clear indications of dimensions, and clear labelling (ACMEM111)
- construct scale drawings by hand and by using software packages. (ACMEM112)

Applications of trigonometry

Key knowledge and skills:

- review the use of Pythagoras' theorem to solve problems involving right-angled triangles
- review the use of the trigonometric ratios to find the length of an unknown side or the size of an unknown angle in a right-angled triangle (ACMGM034)
- determine the area of a triangle given two sides and an included angle by using the rule $Area = 1/2absinC$, or given three sides by using Heron's rule, and solve related practical problems (ACMGM035)
- solve problems involving non-right-angled triangles using the sine rule (ambiguous case excluded) and the cosine rule (ACMGM036)
- solve practical problems involving the trigonometry of right-angled and non-right-angled triangles, including problems involving angles of elevation and depression and the use of bearings in navigation. (ACMGM037)

Earth geometry and time zones

This topic has two subtopics:

- Location
- Time

Location:

Key knowledge and skills:

- locate positions on Earth's surface given latitude and longitude using GPS, a globe, an atlas, and digital technologies (ACMEM159)
- find distances between two places on Earth on the same longitude (ACMEM160)
- find distances between two places on Earth using appropriate technology. (ACMEM161)

Time:

Key knowledge and skills:

- understand the link between longitude and time (ACMEM162)
- solve problems involving time zones in Australia and in neighbouring nations, making any necessary allowances for daylight saving (ACMEM163)
- solve problems involving Greenwich Mean Time and the International Date Line (ACMEM164)
- find time differences between two places on Earth (ACMEM165)
- solve problems associated with time zones; for example, internet and phone usage (ACMEM166)
- solve problems relating to travelling east and west, incorporating time zone changes. (ACMEM167)

Module 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.

This module includes 3-4 short responses in a reflective journal and an extended response / inquiry as work requirements.

See Appendix 3 for summary of Work Requirement specifications for this course.

Module 3 Assessment

This module will assess criteria 1, 2, 3, 6.

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.

TASC will supervise the external assessment of designated criteria which will be indicated by an asterisk (*). The ratings obtained from the external assessments will be used in addition to internal ratings from the provider to determine the final award.

Criteria

	Module 1	Module 2	Module 3	Notes
Criteria assessed	1,2,3,4/5	1,2,3,4/5	1,2,3,6	Three common in all modules and one focus criterion per module

The assessment for *Essential Mathematics* Level 3 will be based on the degree to which the learner can:

1. Define and explain key knowledge and concepts and apply a range of related mathematical techniques and procedures to solve practical problems.*
2. Interpret and engage with mathematical objects and information in workplace contexts.*
3. Manage self, connect and collaborate with others and reflect on learning including in workplace contexts.
4. Identify problems that can be modelled and solved mathematically, select and apply problem solving processes and review outcomes including in workplace contexts.*
5. Apply mathematical reasoning and creative thinking to generate, test and apply ideas in a mathematical inquiry and evaluate their impact including in workplace contexts.
6. Communicate and represent mathematical information and apply mathematical conventions including in workplace contexts.

Standards

Criterion 1*: Define and explain key knowledge and concepts and apply a range of related mathematical techniques and procedures to solve practical problems.

This criterion is both internally and externally assessed.

Rating C	Rating B	Rating A
selects, recalls and uses some mathematical facts, rules and definitions to describe mathematical situations	consistently selects, recalls and uses facts, rules, definitions and procedures correctly to describe mathematical situations	consistently selects, recalls and uses facts, rules, definitions and procedures correctly to describe and explain mathematical situations
comprehends and applies aspects of mathematical concepts and techniques to solve some problems in simple familiar situations	comprehends and applies mathematical concepts and techniques to solve problems in simple familiar and complex familiar situations	comprehends and applies mathematical concepts and techniques to solve problems in simple familiar, complex familiar and complex unfamiliar situations
applies mathematical and statistical models to routine problems	selects and applies mathematical and statistical models to routine and non-routine problems	develops, selects and applies mathematical and statistical models to routine and non-routine problems in a variety of contexts
uses digital technologies to graph, display and organise mathematical and statistical information to solve routine problems.	uses digital technologies appropriately to graph, display and organise mathematical and statistical information to solve a range of routine and non-routine problems.	uses digital technologies effectively to graph, display and organise mathematical and statistical information to solve a range of routine and non-routine problems in a variety of contexts.

Criterion 2*: Interpret and engage with mathematical objects and information in workplace contexts

This criterion is both internally and externally assessed.

Rating C	Rating B	Rating A
explores routine familiar practical problems or scenarios and frames them in mathematical terms	interprets routine familiar and complex familiar practical problems or scenarios and frames them in mathematical terms	interprets complex familiar and non-familiar practical problems or scenarios and frames them in mathematical terms
identifies situations where mathematical information has been used to support decision-making in workplace contexts	analyses various ways that mathematical information has been used to support decision-making processes in workplace contexts	evaluates how mathematical information has been used to support decision-making processes in workplace contexts
accesses, manages and acknowledges information from digital and non-digital sources to develop mathematical ideas	accesses, synthesises and appropriately acknowledges information taken from a variety of digital and non-digital sources to develop mathematical ideas	evaluates authenticity, reliability and validity of information taken from a variety of digital and non-digital sources to develop mathematical ideas
identifies and describes how the use of technology can affect outcomes obtained in workplace contexts.	identifies and discusses the inputs and outputs of technology and describes how the use of technology can affect outcomes obtained in workplace contexts.	interprets and evaluates the inputs and outputs of technology, including critically reflecting on and evaluating the technology used and the outcomes obtained in workplace contexts.

Criterion 3: Manage self, connect and collaborate with others and reflect on learning including in workplace contexts

Rating C	Rating B	Rating A
recognises own learning strengths and weaknesses and establishes processes to plan, monitor and assess one's understanding and performance including in workplace contexts	analyses own learning strengths and weaknesses in order to establish processes used to plan, monitor and assess one's understanding and performance including in workplace contexts	critically reflects upon own learning strengths and weaknesses in order to establish processes used to plan, monitor and assess one's understanding and performance including in workplace contexts
sets goals and timelines and monitors progress against them with support	recognises different perspectives, completes assigned duties and supports others in team situations	responds to and utilises different perspectives, collaborates with others to support all members to complete assigned duties and monitors team goals
shows some ability to organise and plan in order to manage resources and complete set tasks and is supportive of others	displays organisational, planning and self-management skills and interpersonal skills to manage resources, build rapport with others and consistently complete tasks	selects and displays effective organisational, planning and self-management skills and interpersonal skills to manage resources and maintain rapport and negotiate conflict in team situations
is generally positive including in workplace contexts and with support will persevere through challenges.	demonstrates a positive disposition, can adapt to new situations including in workplace contexts and generally displays perseverance and resilience and seeks help as required.	demonstrates optimism, flexibility and resilience when adapting to new situations including in workplace contexts including persevering through challenges and seeking help appropriately as required.

Criterion 4*: Identify problems that can be modelled and solved mathematically, select and apply problem solving processes and review outcomes including in workplace contexts

This criterion is both internally and externally assessed.

Rating C	Rating B	Rating A
identifies problem elements and makes inferences that may be able to be tested mathematically	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
identifies how a given problem can be solved mathematically	identifies and describes how mathematics can be used to model and solve familiar problems in workplace situations and generates a possible mathematical approach	describes and explains how mathematics can be used to model and solve unfamiliar problems in workplace situations and generates possible mathematical approaches
uses mathematical applications and processes to find solutions to practical problems	selects and applies a range of mathematical applications and processes to find accurate solutions to practical problems	strategically selects and applies a broad range of mathematical applications and processes to find efficient and accurate solutions to practical problems
describes how the mathematical applications and processes used and the outcomes obtained were suitable for the context.	selects and justifies use of mathematical applications and processes and identifies how the outcomes obtained may impact the dignity and wellbeing of individuals and communities.	critically reflects and evaluates the impact of selected processes and the outcomes obtained upon the dignity and wellbeing of individuals or communities.

Criterion 5: Apply mathematical reasoning and creative thinking to generate, test and apply ideas in a mathematical inquiry and evaluate their impact including in workplace contexts

Rating C	Rating B	Rating A
lists ideas that may be able to be tested mathematically	identifies or adapts ideas that can be tested mathematically	generates or adapts ideas and describes how they can be tested mathematically
tests multiple ideas and select sone to implement based on comparison of results	tests multiple ideas and prioritises implementation based on comparison of results and describes potential limitations of the approach	tests multiple ideas, and justifies selection for implementation based on analysis of the positive and negative implications of the approach
follows a given procedure to implement an idea in a workplace context	follows devised procedure to implement own idea in a workplace context	follows devised procedure to implement own idea, and adapts flexibly and efficiently in a workplace context
describes the impact of implemented ideas in workplace contexts	explains and analyses the impact of implemented ideas in workplace contexts on self and others	analyses and evaluates the impact of implemented ideas in workplace contexts on multiple stakeholders and/or from multiple perspectives

Criterion 6: Communicate and represent mathematical information and apply mathematical conventions including in workplace contexts.

Rating C	Rating B	Rating A
communicates mathematical and statistical arguments using appropriate language	communicates reasoned mathematical and statistical judgments and arguments using appropriate language	communicates reasoned mathematical and statistical judgments and arguments using appropriate and concise language
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
represents and explains mathematical and statistical information in numerical, graphical and symbolic form with and without the aid of technology	represents and analyses mathematical and statistical information in numerical, graphical and symbolic form including in workplace contexts with and without the aid of technology	represents, models and analyses mathematical and statistical information in numerical, graphical and symbolic form including in workplace contexts with and without the aid of technology
selects and uses language to express ideas and listens to the perspectives of others.	selects, uses and refines language to respond to multiple perspectives when expressing ideas.	purposefully selects, uses and refines language to effectively connect with address multiple perspectives when expressing ideas.

Quality Assurance

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

Qualifications and Award Requirements

The final award will be determined by the Office of Tasmanian Assessment, Standards and Certification from the 9 ratings (6 ratings from the internal assessment and 3 ratings from the external assessment).

The minimum requirements for an award in *Essential Mathematics* Level 3 are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)
8'A' ratings, 1 'B' rating (2 'A' ratings, 1 'B' rating from external assessment)

HIGH ACHIEVEMENT (HA)
4 'A' ratings, 4 'B' ratings, 1 'C' ratings (1 'A' rating, 1 'B' rating and 1 'C' rating from external assessment)

COMMENDABLE ACHIEVEMENT (CA)
4 'B' ratings, 4 'C' ratings (1 'B' ratings, 2 'C' ratings from external assessment)

SATISFACTORY ACHIEVEMENT (SA)
7 'C' ratings (2 'C' ratings from external assessment)

PRELIMINARY ACHIEVEMENT (PA)
5 'C' ratings

A learner who otherwise achieves the ratings 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.

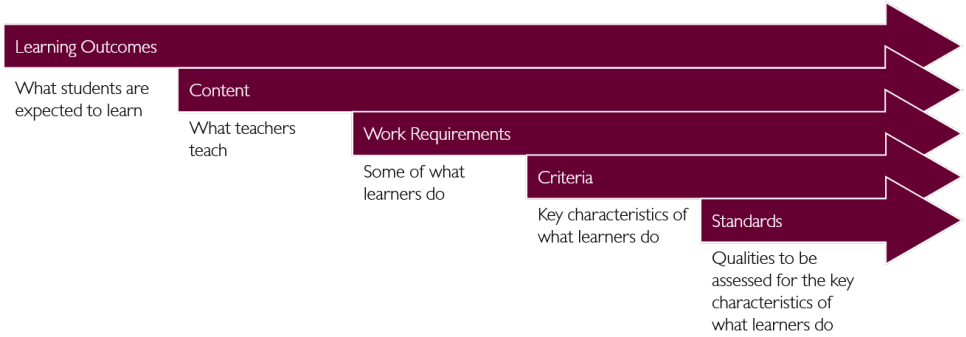
Course Developer

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. Define and explain key knowledge and concepts and apply a range of related mathematical techniques and procedures to solve practical problems.	Module 1, 2, 3	Module 1, 2, 3	C 1	E 1, 2, 3, 4	GC:
2. Interpret and engage with mathematical objects and information in workplace contexts.	Module 1, 2, 3	Module 1, 2, 3	C 2	E 1, 2, 3, 4	GC:
3. Manage self, connect and collaborate with others and reflect on learning including in workplace contexts.	Module 1, 2, 3	Module 1, 2, 3	C 3	E 1, 2, 3, 4	GC:
4. Identify problems that can be modelled and solved mathematically, select and apply problem solving processes and review outcomes including in workplace contexts.	Module 1	Module 1	C 4	E 1, 2, 3, 4	GC:

5. Apply mathematical reasoning and creative thinking to generate, test and apply ideas in a mathematical inquiry and evaluate their impact including in workplace contexts.	Module 2	Module 2	C 5	E 1, 2, 3, 4	GC: 
6. Communicate and represent mathematical information and apply mathematical conventions including in workplace contexts.	Module 3	Module 3	C 6	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.

A vast majority of content in this course is drawn from Unit 3 and Unit 4 of the Australian Curriculum Framework: Essential Mathematics

Unit 3 provides students with the mathematical skills and understanding to solve problems related to measurement, scales, plans and models, drawing and interpreting graphs, and data collection.

Unit 4 provides students with the mathematical skills and understanding to solve problems related to probability, earth geometry and time zones, and loans and compound interest.

Additionally, the topics 'Applications of trigonometry' and 'Linear equations and their graphs' are taken from the Australian Curriculum Framework: General Mathematics Unit 2. 'Applications of trigonometry' will be extended to require students' to apply their knowledge of trigonometry to solve practical problems involving non-right-angled triangles in both two and three dimensions, including problems involving the use of angles of elevation and depression, and bearings in navigation in workplace contexts. Similarly, 'Linear equations and their graphs' will be extended to require students to express linear equations numerically and graphically and to model and analyse practical situations in workplace contexts such as profit-loss break even points and the relationship between two variables in bivariate data sets.

Appendix 3 - Work Requirements

The work requirements for Module 1 and Module 2 provide agency for providers and learners. When completing these two modules, learners must ensure that they provide evidence against both Criterion 4 and 5 (meaning they must complete one extended response and one inquiry).

Module 1 Work Requirements Specifications

Focus Area: Work-based Learning
Title of Work Requirement: Problem Solving Task
Mode /Format: Extended response
Learning Outcomes: 1,2,3,4
Description: Extended response: Formulating and implementing a mathematical process involving problem solving and mathematical modelling of a situation encountered in a real or simulated workplace context including the graphing and interpretation of a linear relationship between two quantities and/or calculating and representing probability and relative frequency of a given event. In

preparation and alongside this task it is likely that shorter practical activities will be engaged. These are designed to support the depth of understanding and engagement in the extended response.
Size: Maximum of 1200 words (and supporting mathematical calculations) – 8 to 10 hours of class time including support tasks.
Timing: No specified timing
External agencies: Involvement at teacher discretion
Relevant Criterion/criteria:

- Criterion 1: all elements
- Criterion 2: all elements
- Criterion 3: 1,3,4 and 2 if work requirement incorporates groupwork
- Criterion 4: all elements

Focus Area: Work-based Learning
Title of Work Requirement: Reflective journal
Mode /Format: Short responses
Learning Outcomes: 2,3
Description: An ongoing journal that provides opportunity for the learner to critically reflect and evaluate their ongoing mathematical development and understanding of the importance of mathematics in the workplace context
Size: 450 words maximum per module
Timing: Throughout the course
External agencies: Involvement at teacher discretion
Relevant Criterion/criteria:

- Criterion 2: all elements
- Criterion 3: all elements

Module 2 Work Requirements Specifications

Focus Area: Work-based Learning
Title of Work Requirement: Inquiry Task
Mode /Format: Inquiry
Learning Outcomes: 1,2,3,5
Description: Inquiry: Conducting a mathematical inquiry to implement and evaluate the effectiveness of an idea to explore a scenario in a real or simulated workplace context involving measurement and/or finance.
Size: Maximum of 1200 words (and supporting mathematical calculations) – 8 to 10 hours of class time including support tasks.
Timing: No specified timing
External agencies: Involvement at teacher discretion
Relevant Criterion/criteria:

- Criterion 1: all elements
- Criterion 2: all elements
- Criterion 3: 1,3,4 and 2 if work requirement incorporates groupwork
- Criterion 5: all elements

Focus Area: Work-based Learning
Title of Work Requirement: Reflective journal
Mode /Format: Short responses
Learning Outcomes: 2,3
Description: An ongoing journal that provides opportunity for the learner to critically reflect and evaluate their ongoing mathematical development and understanding of the importance of mathematics in the workplace context

Size: 450 words maximum per module
Timing: Throughout the course
External agencies: Involvement at teacher discretion
Relevant Criterion/criteria:

- Criterion 2: all elements
- Criterion 3: all elements

Module 3 Work Requirements Specifications

Focus Area: Work-based Learning
Title of Work Requirement: Drawings, plans and/or models
Mode /Format: Product
Learning Outcomes: 1,2,3,6
Description: Learners will engage in the creation of a set of scale drawings, models or plans incorporating measurements and calculations relating to a given workplace context. Students will accompany the product with a written report or multi-modal presentation that identifies the design factors considered in the creation of the product and its relationship with the given workplace context. In preparation and alongside this task it is likely that shorter practical activities will be engaged. These are designed to support the depth of understanding and engagement in the extended response.
Size: Maximum of 15 hours of class time. Maximum of 1500 words or 10 minute multimodal presentation in support of the produced drawings, plans and/or models.
Timing: No specified timing
External agencies: Involvement at teacher discretion
Relevant Criterion/criteria:

- Criterion 1: all elements
- Criterion 2: all elements
- Criterion 3: 1,3,4 and 2 if work requirement incorporates groupwork
- Criterion 6: all elements

Focus Area: Work-based Learning
Title of Work Requirement: Reflective journal
Mode /Format: Short responses
Learning Outcomes: 2,3
Description: An ongoing journal that provides opportunity for the learner to critically reflect and evaluate their ongoing mathematical development and understanding of the importance of mathematics in the workplace context
Size: 450 words maximum per module
Timing: Throughout the course
External agencies: Involvement at teacher discretion
Relevant Criterion/criteria:

- Criterion 2: all elements
- Criterion 3: all elements

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

- A central glossary will be added to the final draft of the course for consultation.