DEPARTMENT OF EDUCATION
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Discipline-based Study

Mathematics

General Mathematics 3

COURSE DOCUMENT

PHASE 4
DRAFT FOR CONSULTATION

Catholic Education Tasmania

INDEPENDENT SCHOOLS TASMANIA

Years 9 to 12 Learning

Tasmanian Government

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General Mathematics, 150 hours – Level 3

This course is the Level 3 component of the proposed *General Mathematics* suite.

Focus Area – Discipline-based Study

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.

General Mathematics Level 3 is a Discipline-based Study course.

Discipline-based Study includes content, core concepts and big ideas; enabling deep knowledge and understanding of the content and the application of what is learned. Students consider accepted key disciplinary knowledge, apply distinctive ways of thinking and become increasingly independent learners. They use methodologies specific to the discipline to explore and strengthen their understanding of key concepts and develop deep knowledge, skills and understanding.

Discipline-based Study courses have three key features that guide teaching and learning:

- specialist knowledge
- theories and concepts and
- methodology and terminology.

In this course learners will engage with specialist knowledge, core concepts and big ideas in the strands of algebra, finance, trigonometry, statistics and networks. Students will apply their knowledge and understanding through strategic selection and application of methodologies including problem solving, mathematical modelling and statistical investigations with and without the aid of technology.

Throughout the course, learners will demonstrate conceptual understanding through their fluency of calculation, mathematical reasoning and communication of mathematical ideas and information using appropriate conventions, terminology and representations.

Rationale

The *General Mathematics* Level 3 course is designed to develop learners' understanding of concepts and techniques drawn from number including finance and algebra including sequences, networks and decision mathematics, and statistics. This breadth of mathematical experience will enable learners to apply mathematical concepts and perform techniques to solve applied problems, synthesise mathematical information, and design and conduct mathematical investigations to calculate and communicate possible solutions.

The *General Mathematics* Level 3 course will enable learners to develop the foundations for study in many disciplines at tertiary level and engage in applications of those disciplines. Mathematics and numeracy provide a way of interpreting everyday practical situations and provide the basis for many informed personal decisions.

This course will enable learners to develop their mathematical expertise such that they may contribute productively in an ever-changing global economy, with 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 professionals with a strong grounding in mathematics. This course is designed to support learners on this pathway into tertiary education for non-STEM specific professions including teaching, social sciences, allied health, accounting, business and marketing.

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 arguments and strategies, when solving mathematical and statistical problems, using appropriate mathematical or statistical language
2. plan, organise and manage learning in order to complete tasks and evaluate progress
3. apply techniques to solve practical problems and implement the statistical investigation process to answer questions
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of their solutions to problems and their answers to statistical questions
5. choose and use technology appropriately and effectively
6. understand and apply the concepts and techniques in growth and decay in sequences and loans, investment and annuities
7. understand and apply the concepts and techniques in bivariate data analysis and time series analysis
8. understand and apply the concepts and techniques in applications of trigonometry and networks and decision mathematics.

Integration of General Capabilities and Cross-Curriculum Priorities

The general capabilities addressed specifically in this course are:

- Critical and creative thinking
- Information and communication technology capability
- 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

General Mathematics 3 enables learners to extend their mathematical experience beyond Grade 10 with increasing sophistication. It provides increasingly abstract scenarios for incorporating mathematical arguments and problem solving in situations involving growth and decay, standard financial models, bivariate data analysis, time series analysis, trigonometry, geometry, networks and decision mathematics.

Learners will apply mathematical concepts and techniques to communicate reasoned arguments, solve problems and explain reasonableness of solutions.

In this course, learners will model and investigate situations with and without the use of technology. By working collaboratively, they will reflect upon and extend their own thinking.

Pathways

- *General Mathematics* Level 3 has a clear pathway from Australian Curriculum Mathematics F-10 and the proposed *General Mathematics* Level 2.
- *General Mathematics* Level 3 provides a clear pathway into a wide range of educational and employment aspirations, including continuing their studies at university or TAFE. While the successful completion of this course will gain entry into some post-secondary courses, other courses may require the successful completion of *Mathematics Methods* – Level 4.

Course Requirements

Access

This course requires learners to collaborate with others.

Resource Requirements

Learners are required to have access to graphics calculators that meets the requirements as outlined in the External Assessment Specifications.

Computers and the internet are required to enable learners' access to information and data sources. Additionally, the use of computer software packages is strongly recommended as an aid to student learning and mathematical development. In particular, digital spreadsheets should be available.

Course Structure and Delivery

Structure

This course consists of three 50-hour modules:

- Core Module 1: Growth and decay in sequences and standard financial models
- Core Module 2: Bivariate data analysis and time series analysis
- Core Module 3: Trigonometry, Earth geometry, networks and decision mathematics

Delivery

There is no specific recommended delivery sequence for the modules.

Course Content

Module 1 - Growth and decay in sequences and standard financial models

This Module contains two topics:

- Growth and decay in sequences
- Investment, loans and annuities

'Growth and decay in sequences' employs recursion to generate sequences that can be used to model and investigate patterns of growth and decay in discrete situations. These sequences find application in a wide range of practical situations, including modelling the growth of a compound interest investment, the growth of a bacterial population, or the decrease in the value of a car over time.

'Investment, loans and annuities' aims to provide students with sufficient knowledge and understanding of financial mathematics to solve practical problems associated with taking out or refinancing a mortgage, depreciation on plant and equipment, contributions to superannuation and making investments. Study of this topic will assist students to develop awareness of mechanisms to optimise their financial position, both now and into the future, justifying their thinking and reasoning mathematically.

Module 1 Learning Outcomes

The following Learning Outcomes are a focus of this module:

1. communicate their arguments and strategies, when solving mathematical and statistical problems, using appropriate mathematical or statistical language
2. plan, organise and manage learning in order to complete tasks and evaluate progress
3. apply techniques to solve practical problems and implement the statistical investigation process to answer questions
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of their solutions to problems and their answers to statistical questions
5. choose and use technology appropriately and effectively
6. understand and apply the concepts and techniques in growth and decay in sequences and loans, investment and annuities.

Module 1 Content

Topic 1 – Growth and decay in sequences:

Subtopics:

- the arithmetic sequence
- the geometric sequence

- sequences generated by first-order linear recurrence relations

Key knowledge and skills:

The arithmetic sequence:

- use recursion to generate an arithmetic sequence
- represent terms of an arithmetic sequence in both tabular and graphical form
- use arithmetic sequences to model linear growth and decay in discrete situations
- deduce a rule for the nth term of a particular arithmetic sequence from the pattern of the terms in an arithmetic sequence, $t_n = a + (n - 1)d$ and use this rule to make predictions
- use arithmetic sequences to model and analyse practical situations involving linear growth or decay
- determine the sum (to n terms) of an arithmetic sequence, represented as $S_n = \frac{n}{2}(a + l)$ or $S_n = \frac{n}{2}(2a + (n - 1)d)$

The geometric sequence:

- use recursion to generate a geometric sequence
- represent the terms of a geometric sequence in both tabular and graphical form
- use geometric sequences to model exponential growth and decay in discrete situations
- deduce a rule for the nth term of a particular geometric sequence from the pattern of the terms in the sequence, $t_n = ar^{n-1}$ and use this rule to make predictions
- use geometric sequences to model and analyse (numerically, or graphically only) practical problems involving geometric growth and decay
- determine the sum (to n terms) of an arithmetic sequence, represented as $S_n = \frac{a(1-r^n)}{1-r}$, where $r \neq 1$

Sequences generated by first-order linear recurrence relations:

- use a general first-order linear recurrence relation to generate the terms of a sequence and to display it in both tabular and graphical form
- recognise that a sequence generated by a first-order linear recurrence relation can have a long-term increasing, decreasing or steady-state solution
- use first-order linear recurrence relations to model and analyse (numerically or graphically only) practical problems involving growth or decay, with or without the aid of technology.

Topic 2 – Investment, loans and annuities:

Subtopics:

- compound interest investments and loans
- reducing balance loans
- annuities and perpetuities

Key knowledge and skills:

Compound interest investments and loans:

- use a recurrence relation to model a compound interest loan or investment, and investigate (numerically or graphically) the effect of the interest rate and the number of compounding periods on the future value of the loan or investment
- calculate the effective annual rate of interest, $E = (1 + i)^n - 1$, and use the results to compare investment returns and cost of loans when interest is paid or charged daily, fortnightly, monthly, quarterly or six-monthly

- solve, with and without the aid of a calculator or computer-based financial software, problems involving compound interest loans or investments, for example:
    - calculate the future value (FV) or present value (PV) and the interest rate (i) of a compound interest investment using the formula $FV = PV(1+i)^n$
    - determine the number of compounding periods for an investment to exceed a given value
    - investigate the effect of varying the interest rate, the term or the compounding period on the future value of an investment, using technology
- compare and contrast different investment strategies, performing appropriate calculations when needed
- solve practical problems (algebraically or graphically) involving compounding, for example determine the impact of inflation on prices and wages, or depreciation tables on assets.

Reducing balance loans:

- use a recurrence relation (algebraically) to model a reducing balance loan and investigate (numerically or graphically) the effect of the interest rate and repayment amount on the time taken to repay the loan
- calculate the depreciation of an asset using the declining-balance method using the formula $S = P(1-i)^n$, where S is the salvage value of the asset after n periods, P is the initial value of the asset, i is the depreciation rate per period expressed as a decimal, and n is the number of periods, as an application of the compound interest formula
- with and without the aid of a financial calculator or computer-based financial software, solve practical problems involving reducing balance loans, for example: determining the total loan amount and monthly repayments
- recognise credit cards as an example of a reducing balance loan and solve practical problems relating to credit cards
    - identify the various fees and charges associated with credit card usage
    - compare credit card interest rates with interest rates for other loan types
    - interpret credit card statements, recognising the implications of only making the minimum payment
    - understand what is meant by an interest-free period
    - calculate the compounding interest charged on a retail purchase, transaction or the outstanding balance for a given number of days, with or without the aid of technology.

Annuities and perpetuities:

- identify an annuity as an investment account with regular, equal contributions and interest compounding at the end of each period, or as a single sum investment from which regular, equal withdrawals are made
- use a recurrence relation (algebraically) to model an annuity and investigate (numerically or graphically) the effect of varying the amount invested, the frequency of each contribution, the interest rate or the payment amount on the duration and/or future value of the annuity
- use a table of interest factors to perform annuity calculations, for example: calculating the present or future value of an annuity, the contribution amount required to achieve a given future value or the single sum that would produce the same future value as a given annuity.
- with the aid of technology, solve problems involving annuities (including perpetuities, $P = \frac{R}{i}$ as a special case, where i = effective interest rate).

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 one (1) extended response as the work requirement.

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

Module 1 Assessment

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

Module 2 - Bivariate data analysis and time series analysis

This Module contains two topics:

- Bivariate data analysis
- Time series analysis

The content in this module is to be taught within the framework of the statistical investigation process.

'Bivariate data analysis' introduces students to some methods for identifying, analysing and describing associations between pairs of variables, including the use of the least-squares method as a tool for modelling and analysing linear associations.

'Time series analysis' furthers students' study of statistics by introducing them to the concepts and techniques of time series analysis, including the use of simple moving averages, seasonal indices and fitting least-squares lines to model and describe long term trends in time series data.

Module 2 Learning Outcomes

The following Learning Outcomes are a focus of this module:

1. communicate their arguments and strategies, when solving mathematical and statistical problems, using appropriate mathematical or statistical language
2. plan, organise and manage learning in order to complete tasks and evaluate progress
3. apply techniques to solve practical problems and implement the statistical investigation process to answer questions
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of their solutions to problems and their answers to statistical questions
5. choose and use technology appropriately and effectively
7. understand and apply the concepts and techniques in bivariate data analysis and time series analysis

Module 2 Content

Topic 1 – Bivariate data analysis:

Subtopics:

- identifying and describing associations between variables
- modelling and analysing linear relationships
- recognising association and causation
- implementing the data investigation process

Key knowledge and skills:

Identifying and describing associations between variables:

- review the statistical investigation process; for example, identify a problem and pose a statistical question, collect or obtain data, analyse the data, interpret and communicate the results
- construct two-way frequency tables and determine the associated row and column sums and percentages
- use an appropriately percentaged two-way frequency table to identify patterns that suggest the presence of an association
- describe an association in terms of differences observed in percentages across categories in a systematic and concise manner and interpret this in the context of the data
- construct a scatterplot to identify patterns in the data suggesting the presence of an association
- describe an association between two numerical variables in terms of direction (positive/negative), form (linear/non-linear) and strength (strong/moderate/weak)
- calculate and interpret the correlation coefficient (r) to quantify the strength of a linear association.

Modelling and analysing linear relationships:

- review straight line equations and graphs ($y = mx + c$) by constructing graphs from given equations and solving equations from given graphs
- identify the response (dependent) variable and the explanatory (independent) variable
- use a scatterplot to identify the nature of the relationship between variables
- model a linear relationship by fitting a least-squares line to the data with and without the aid of technology
- use a residual plot to assess the appropriateness of fitting a linear model to the data
- interpret, in context, the intercept and gradient (slope) of the fitted line used to model and analyse a practical situation
- use the coefficient of determination (r^2) to assess the strength of a linear association in terms of the explained variation
- use the equation of a fitted line to make predictions
- distinguish between interpolation and extrapolation when using the fitted line to make predictions, recognising the potential dangers of extrapolation
- communicate the results of bivariate data analysis in a systematic and concise manner.

Recognising association and causation:

- recognise that an observed association between two variables does not necessarily mean that there is a causal relationship between them
- identify possible non-causal explanations for an association, including coincidence and confounding due to a common response to another variable, and communicate these explanations in a systematic and concise manner.

Implementing the data investigation process:

- implement the statistical investigation process to answer questions that involve identifying, analysing and describing associations between two categorical variables or between two numerical variables; for example, is there an association between attitude to capital punishment (agree with, no opinion, disagree with) and sex (male, female)? is there an association between height and foot length?

Topic 2 – Time series analysis:

Subtopics:

- describing and interpreting patterns in time series data
- analysing time series data
- the data investigation process.

Key knowledge and skills:

Describing and interpreting patterns in time series data:

- construct time series plots
- describe time series plots by identifying features such as trend (long term direction), seasonality (systematic, calendar-related movements), and irregular fluctuations (unsystematic, short-term fluctuations), and recognise when there are outliers, for example, one-off unanticipated events.

Analysing time series data:

- smooth time series data by using a simple moving average, including the use of spreadsheets to implement this process
- calculate seasonal indices by using the average percentage method
- deseasonalise a time series by using a seasonal index, including the use of spreadsheets to implement this process
- fit a least-squares line to model long-term trends in time series data.

The data investigation process:

- implement the statistical investigation process to answer questions that involve the analysis of time series data.

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 the 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 - Trigonometry, Earth geometry, networks and decision mathematics

This Module contains two topics:

- Applications of trigonometry and Earth geometry
- Networks and decision mathematics

'Trigonometry and Earth geometry' extends students' 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. Additionally, it enables students to solve problems relating to identifying locations and measuring distances between locations on the Earth's surface and to make 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.

'Networks and decision mathematics' builds students' capacity to graphically represent and model situations as an approach to decision-making. Knowledge of networks enables development of a logical sequence of tasks or a clear understanding of connections between people or items and project planning and management tools such as critical path analysis and the 'maximum-flow, minimum-cut' theorem. Study of this topic is important in developing students' ability to interpret a set of connections or sequence of tasks as a concise diagram in order to solve related problems and to use critical path analysis in the optimisation of real-life problems.

Module 3 Learning Outcomes

The following Learning Outcomes are a focus of this module:

1. communicate their arguments and strategies, when solving mathematical and statistical problems, using appropriate mathematical or statistical language
2. plan, organise and manage learning in order to complete tasks and evaluate progress
3. apply techniques to solve practical problems and implement the statistical investigation process to answer questions
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of their solutions to problems and their answers to statistical questions
5. choose and use technology appropriately and effectively
8. understand and apply the concepts and techniques in applications of trigonometry and networks and decision mathematics

Module 3 Content

Topic 1 – Trigonometry and Earth geometry

Subtopics:

- applications of trigonometry
- Earth geometry and time zones

Key knowledge and skills:

Applications of trigonometry:

- 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
- determine the area of a triangle given two sides and an included angle by using the rule $Area = \frac{1}{2}ab \cdot sin(C)$, or given three sides by using Heron's rule, and solve related practical problems
- solve problems involving non-right-angled triangles using the sine rule $\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$ (ambiguous case excluded) and the cosine rule $c^2 = a^2 + b^2 - 2ab \cdot \cos(C)$
- 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

Earth geometry and time zones:

- understand and perform calculations in relation to great circles, small circles, latitude, longitude and angular distance
- find distances between two places on Earth on the same longitude
- use arc length and plane geometry to calculate distances in kilometres, along great and small circles associated with parallels of latitude and meridians of longitude

- locate positions on Earth's surface given latitude and longitude using GPS, a globe, an atlas, and digital technologies
- calculate great circle distances between two points B and C using the spherical cosine rule $\cos\theta = \sin latP \cdot \sin latQ + \cos latP \cdot \cos latQ \cdot \cos\Delta long$, where θ is the angle subtended at the centre of the great circle by the great circle arc between two points P and Q and check using appropriate technology. Latitudes should be considered as positive above the equator and negative below the equator
- understand the link between longitude and time
- solve problems involving time zones in Australia and in neighbouring nations, making any necessary allowances for daylight saving
- solve problems involving Greenwich Mean Time and the International Date Line
- find time differences between two places on Earth
- solve problems associated with time zones; for example, internet and phone usage
- solve problems relating to travelling east and west, incorporating time zone changes
- carry out time and distance calculations involving world travel problems, including scenarios involving more than one destination with 'stop overs'.

Topic 2 – Networks and decision mathematics

Subtopics:

- trees and minimum connector problems
- critical path analysis
- flow networks and assignment problems.

Key knowledge and skills:

Trees and minimum connector problems:

- explain the meaning of the terms tree and spanning tree and identify practical examples
- identify a minimum spanning tree in a weighted connected graph either by inspection or by using Prim's algorithm
- use minimal spanning trees to solve minimal connector problems; for example, minimising the length of cable needed to provide power from a single power station to substations in several towns.

Critical path analysis:

- construct a network to represent the durations and interdependencies of activities that must be completed during the project; for example, preparing a meal
- use forward and backward scanning to determine the earliest starting time (EST) and latest starting times (LST) for each activity in the project
- use ESTs and LSTs to locate the critical path(s) for the project
- use the critical path to determine the minimum time for a project to be completed
- calculate float times for non-critical activities.

Flow networks and assignment problems:

- solve small-scale network flow problems including the use of the 'maximum-flow minimum-cut' theorem; for example, determining the maximum volume of oil that can flow through a network of pipes from an oil storage tank (the source) to a terminal (the sink)
- use a bipartite graph and/or its tabular or matrix form to represent an assignment/ allocation problem; for example, assigning four swimmers to the four places in a medley relay team to maximise the team's chances of winning

- determine the optimum assignment(s), by inspection for small-scale problems, or by use of the Hungarian algorithm for larger problems.

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) extended response or an equivalent series of connected short responses as the work requirements.

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.

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

The assessment for *General Mathematics* Level 3 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 mathematical and statistical models to investigate and represent real-world situations and solve problems*
4. apply mathematical reasoning to interpret information, explain the reasonableness of solutions and draw conclusions from mathematical results*

5. use digital technology to develop mathematical ideas and find solutions to mathematical problems
6. interpret concepts and apply mathematical techniques to solve problems involving growth and decay in sequences and standard financial models*
7. interpret concepts and apply mathematical techniques to solve problems involving bivariate data analysis and time series analysis using the statistical investigation process*
8. interpret concepts and apply mathematical techniques to solve problems involving trigonometry, Earth geometry, networks and decision mathematics*

*denotes criteria that are both internally and externally assessed.

Standards

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

This criterion is only internally assessed.

Standard Element	Rating C	Rating B	Rating A
E1 – communicates arguments	communicates mathematical and statistical arguments using appropriate mathematical terminology and language	communicates reasoned mathematical and statistical judgments and arguments using appropriate mathematical terminology and language	communicates reasoned mathematical and statistical judgments and arguments using appropriate mathematical terminology and concise language
E2 – uses mathematical 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
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 solution	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

This criterion is only internally assessed.

Standard Element	Rating C	Rating B	Rating A
E1 – self-awareness	recognises own learning strengths and weaknesses and establishes processes to plan, monitor and assess understanding and performance	analyses own learning strengths and weaknesses in order to establish processes used to plan, monitor and assess understanding and performance	critically reflects upon own 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	monitors and analyses progress towards meeting goals and timelines	monitors and evaluates progress towards meeting goals and timelines, and plans future actions
E3 – resource management	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
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 mathematical and statistical models to investigate and represent real-world situations and solve problems*

This criterion is both internally and externally assessed.

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 – applies mathematical and statistical models to solve problems	applies mathematical and statistical models to solve simple familiar problems	selects and applies mathematical and statistical models to solve complex familiar problems	selects and applies mathematical and statistical models to solve complex unfamiliar problems in a variety of contexts
E3 – applies techniques to investigate situations and find solutions	uses given mathematical applications and processes to find solutions or results to prescribed investigations	selects and applies a range of mathematical applications and processes to find accurate solutions or results to prescribed investigations of real-world situations	strategically selects and applies a broad range of mathematical applications and processes to find efficient and accurate solutions or results to open-ended investigations
E4 – identifies limitations of models	identifies limitations of models used when developing solutions or results to simple familiar problems or prescribed investigations.	identifies and explains limitations of models used when developing solutions or results to complex familiar problems or prescribed investigations.	identifies and explains the validity and limitations of models used when developing solutions or results to complex unfamiliar problems or investigations.

Criterion 4: apply mathematical reasoning to interpret information, explain the reasonableness of solutions and draw conclusions from mathematical results*

This criterion is both internally and externally assessed.

Standard Element	Rating C	Rating B	Rating A
E1 – makes inferences	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

Standard Element	Rating C	Rating B	Rating A
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 identify possible reasons for these differences	relates experimental findings to real-world phenomena, describing differences and analysing possible reasons for these differences
E3 – explains reasonableness of solutions	describes the reasonableness of the results and solutions to simple familiar problems	explains the reasonableness of the results and solutions to complex familiar problems	evaluates and explains the reasonableness of the results and solutions to complex unfamiliar problems in a variety of contexts
E4 – draws conclusions	draws conclusions that are plausible but lack detailed supporting evidence.	draws plausible conclusions with supporting evidence that provides some insight appropriate to the context.	draws valid evidence-based conclusions showing perception and insight that is appropriate to the context.

Criterion 5: uses digital technology to develop mathematical ideas and find solutions to mathematical problems

This criterion is only internally assessed.

Standard Element	Rating C	Rating B	Rating A
E1 – uses technology to solve problems	uses given calculator techniques or other digital technology to solve routine problems	selects and applies appropriate calculator techniques or other digital technologies to solve a range of routine and non-routine problems	explores and applies effective calculator techniques or other digital technologies to solve a range of routine and non-routine problems in a variety of contexts
E2 - uses technology to represent mathematical information	uses simple familiar processes on digital technologies to graph, display and organise mathematical and statistical information	uses complex familiar processes on digital technologies to graph, display and organise mathematical and statistical information	uses digital technologies effectively to move flexibly between different representations of mathematical and statistical information

Standard Element	Rating C	Rating B	Rating A
E3 - accesses and manages information	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
E4 – evaluates technology	identifies and describes how the use of technology can affect outcomes obtained in routine contexts.	identifies and discusses the inputs and outputs of technology and describes how the use of technology can affect outcomes obtained in simple non-routine contexts.	interprets and evaluates the inputs and outputs of technology, including critically reflecting on and evaluating the technology used and the outcomes obtained relative to personal, contextual and real-world implications.

Criterion 6: interpret concepts and apply mathematical techniques to solve problems involving growth and decay in sequences and standard financial models*

This criterion is both internally and externally assessed.

Standard Element	Rating C	Rating B	Rating A
E1 - uses arithmetic and geometric sequences	recognises and generates arithmetic and geometric sequences	recognises, generates and determines the rule for the n^{th} term of arithmetic and geometric sequences	recognises, generates and determines the rule for the n^{th} term of arithmetic and geometric sequences, using this to make predictions
E2 - represents arithmetic and geometric sequences	displays arithmetic and geometric sequences in both tabular and graphical form	displays arithmetic and geometric sequences in both tabular and graphical form, using the sequence to model problems involving growth and decay	displays arithmetic and geometric sequences in both tabular and graphical form, using the sequence to model and analyse practical problems involving growth and decay
E3 - calculates sum to n terms	calculates the sum of sequences in simple familiar problems	calculates the sum of sequences in complex familiar problems	calculates the sum of sequences in modelled practical problems

Standard Element	Rating C	Rating B	Rating A
E4 - solves problems involving standard financial models	applies given formulae and techniques to calculate and solve routine financial problems	selects and applies formulae and techniques to calculate and solve complex financial problems	selects and applies formulae and techniques to calculate and compare complex financial strategies and make informed recommendations
E5 - uses recurrence relations to model and describe situations involving patterns of growth and decay and financial scenarios	uses a given recurrence relation to model situations involving patterns of growth and decay or financial scenarios.	selects and applies the appropriate recurrence relation to model and describe familiar situations involving patterns of growth and decay or financial scenarios.	selects and applies the appropriate recurrence relation to model, analyse and solve complex familiar problems involving patterns of growth and decay or financial scenarios.

Criterion 7: interpret concepts and apply mathematical techniques to solve problems involving bivariate data analysis and time series analysis using the statistical investigation process*

This criterion is both internally and externally assessed.

Standard Element	Rating C	Rating B	Rating A
E1 - represents statistical information and applies associated calculations and techniques	represents statistical information in tables and plots and applies associated calculations and techniques	represents statistical information in tables and plots, applies associated calculations and techniques and describes results in context	represents statistical information in tables and detailed plots, selects and applies associated techniques and interprets results appropriately in context
E2 - models linear and non-linear relationships from given data	models a linear relationship from given bivariate data, finding r and r^2	models a linear relationship from given bivariate data, interpreting the r and r^2 figures	models linear and non-linear relationships from given bivariate data, interprets results and evaluates the appropriateness of the model
E3 - interpolates and extrapolates results graphically and algebraically	interpolates and extrapolates results both graphically and algebraically	interpolates and extrapolates results both graphically and algebraically and, using a templated approach discusses the reliability of results	interpolates and extrapolates results both graphically and algebraically and evaluates the reliability of results, identifying indicators of unreliability

Standard Element	Rating C	Rating B	Rating A
E4 - interprets, explains and communicates findings	identifies the key features of graphs and recognises relationships between variables.	interprets key features of graphs, describes relationships between variables, makes predictions based on data and communicates findings.	interprets key features of graphs, explains relationships between variables, makes logical inferences based on data and communicates findings in a concise and systematic manner.

Criterion 8: interpret concepts and apply mathematical techniques to solve problems involving trigonometry, Earth geometry, networks and decision mathematics*

This criterion is both internally and externally assessed.

Standard Element	Rating C	Rating B	Rating A
E1 - represents mathematical information and applies calculations and techniques	represents given mathematical information in diagrams, graphs or networks and performs routine calculations	represents mathematical information in diagrams, graphs or networks, applies techniques and describes results in context	interprets real-world situations to model and represent mathematical information in diagrams, graphs or networks, applies techniques and describes results in context
E2 - applies trigonometry concepts to solve problems	uses given formula, rules and diagrams to calculate length, angle and area of triangles	selects and applies the correct formula to solve complex familiar problems involving length, angle, bearings and area of triangles	selects and correctly applies multiple formula to derive information and solve complex unfamiliar problems involving length, angle, bearings and area of triangles
E3 – applies Earth geometry concepts to solve problems	uses given formula and information to calculate distance between and likely time zones of two places on the Earth's surface and solve simple familiar travel problems	selects and applies appropriate formula and information to calculate distance on the Earth's surface correctly and solves complex familiar problems involving time zones and multi-step travel problems	selects and applies appropriate formula correctly to calculate distance on the Earth's surface and solves complex unfamiliar problems involving time zones and multi-step travel problems

Standard Element	Rating C	Rating B	Rating A
E4 – applies network concepts to solve problems involving weighted graphs and minimum spanning trees	determines the shortest path between two vertices in simple weighted graphs, and identifies minimum spanning trees by inspection	determines the shortest path between two vertices in complex familar weighted graphs and identifies minimum spanning trees using Prim's algorithm	determines the shortest path between two vertices in complex unfamilar weighted graphs and uses minimum spanning trees to solve minimum connector problems
E5 - applies network concepts to aid mathematical decision making	identifies the critical path of simple activity networks by inspection and uses bipartite graphs to represent straight forward assignment problems.	identifies the critical path of an activity network by determining earliest starting times, and determines optimum assignments using column and/or row reduction in matrices.	identifies the critical path of complex activity networks, determining earliest starting times, latest starting times and float times, and determines optimum assignments using the Hungarian algorithm as applicable.

Quality Assurance

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

Qualifications and Award Requirements

Level 3

The final award will be determined by the Office of Tasmanian Assessment, Standards and Certification from 13 ratings (8 from the internal assessment, 5 from external assessment).

The minimum requirements for an award are as follows:

EXCEPTIONAL ACHIEVEMENT (EA)

10 'A' ratings, 3 'B' ratings (3 'A' ratings, 2 'B' ratings from external assessment)

HIGH ACHIEVEMENT (HA)

5 'A' ratings, 5 'B' ratings, 3 'C' ratings (1 'A' ratings, 3 'B' ratings, 1 'C' rating from external assessment)

COMMENDABLE ACHIEVEMENT (CA)

6 'B' ratings, 6 'C' ratings (2 'B' ratings, 3 'C' ratings from external assessment)

SATISFACTORY ACHIEVEMENT (SA)

11 'C' ratings (3 'C' ratings from external assessment)

PRELIMINARY ACHIEVEMENT (PA)

6 '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.

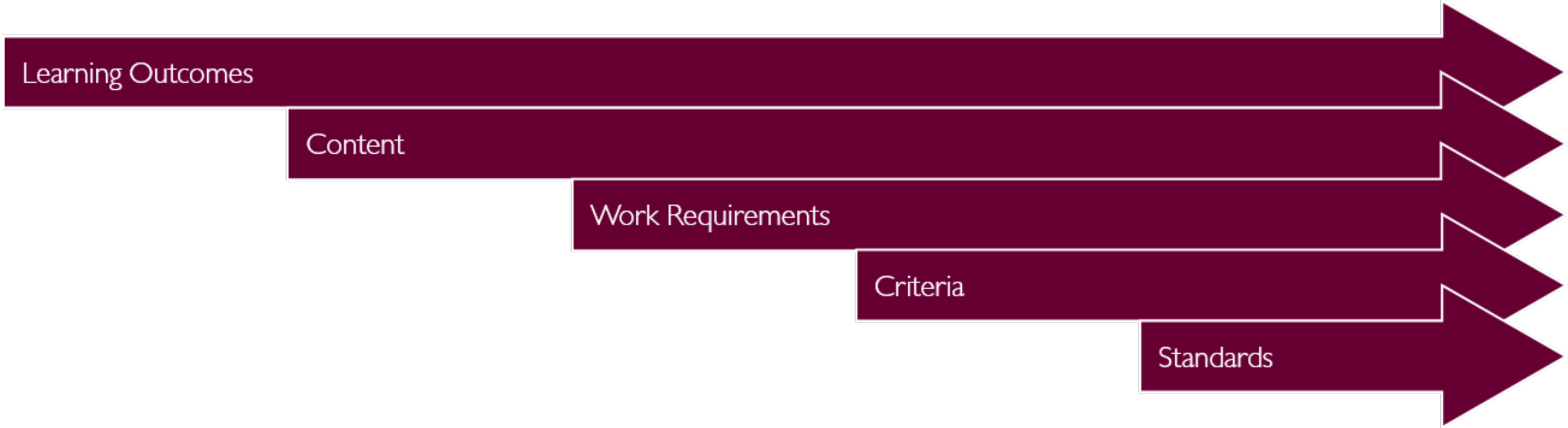
Course Developer

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. communicate their arguments and strategies, when solving mathematical and statistical problems, 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 techniques to solve practical problems and implement the statistical investigation process to answer questions	Module 1, 2, 3	Module 1, 2, 3	C 3	E 1, 2, 3, 4	GC:
4. apply reasoning skills to interpret mathematical and statistical information, and ascertain the reasonableness of their solutions to problems and their answers to statistical questions	Module 1, 2, 3	Module 1, 2, 3	C 4	E 1, 2, 3, 4	GC:
5. choose and use technology appropriately and effectively	Module 1, 2, 3	Module 1, 2, 3	C 5	E 1, 2, 3, 4	GC:
6. understand and apply the concepts and techniques in growth and decay in sequences and loans, investment and annuities	Module 1	Module 1	C 6	E 1, 2, 3, 4, 5	GC:

Learning Outcomes	Course Content	Work Requirements	Criteria	Standards	General Capabilities (GC)
7. understand and apply the concepts and techniques in bivariate data analysis and time series analysis	Module 2	Module 2	C 7	E 1, 2, 3, 4	GC:
8. understand and apply the concepts and techniques in applications of trigonometry and networks and decision mathematics	Module 3	Module 3	C 8	E 1, 2, 3, 4, 5	GC:

Appendix 2 - Alignment to Curriculum Frameworks

Links to Foundation to Year 10:

The proposed *General Mathematics* suite provides students with a breadth of mathematical and statistical experience that encompasses and builds on all three strands of the F-10 curriculum.

For all content areas of *General 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.

Alignment to Australian Curriculum Senior Secondary Framework:

Almost all content in this course is drawn from the Australian Curriculum Senior Secondary Framework: General Mathematics. The content selected for this course primarily comes from Units 3 and 4, with one exception. The topic 'Graphs and Networks' from Unit 3 has been excluded as the proposed refinements to the Australian Curriculum F-10 have introduced the concepts covered in this topic into Years 9 and 10. As such, this content will not need to be reviewed in this course. Instead, content from Unit 2 'Applications of trigonometry' has been included, as the concepts of Heron's rule, the Sine rule and the Cosine rule all extend beyond the content covered in F-10. Further to this, the content from the Essential Mathematics framework Unit 4 'Earth geometry and time zones' along with the inclusion of the spherical Cosine rule have been included to further extend the application of trigonometry in this course.

Summary of Aligned Content:

Module	Topics	Australian Curriculum Framework Source
Module 1	Growth and decay in sequences Loans, investment and annuities	General Mathematics Unit 3 General Mathematics Unit 4
Module 2	Bivariate data analysis Time series analysis	General Mathematics Unit 3 General Mathematics Unit 4
Module 3	Applications of trigonometry Earth geometry and time zones Networks and decision mathematics	General Mathematics Unit 2 Essential Mathematics Unit 4 General Mathematics Unit 4

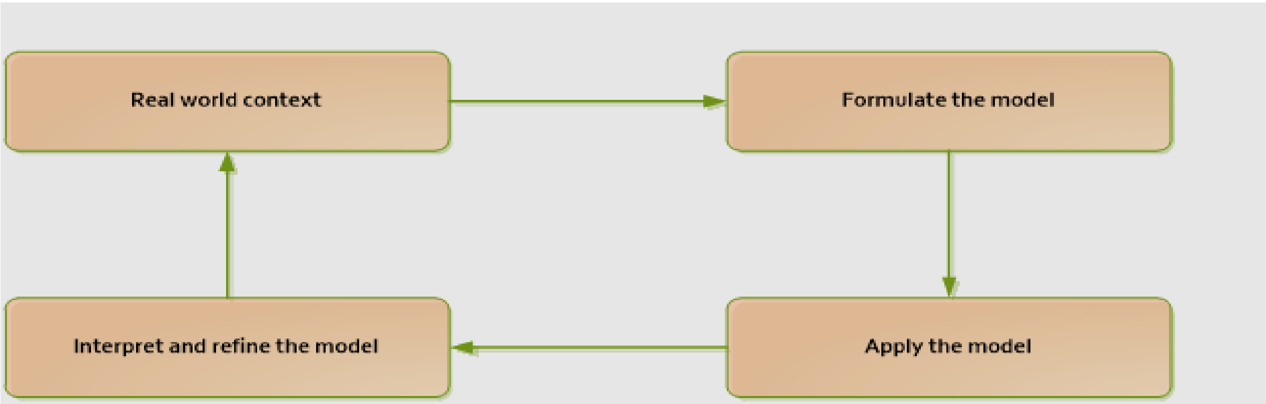
Appendix 3 - Work Requirements

Some of the work requirements in this course require learners to employ mathematical modelling and/or problem-solving processes to investigate open-ended contexts.

These processes are defined as follows:

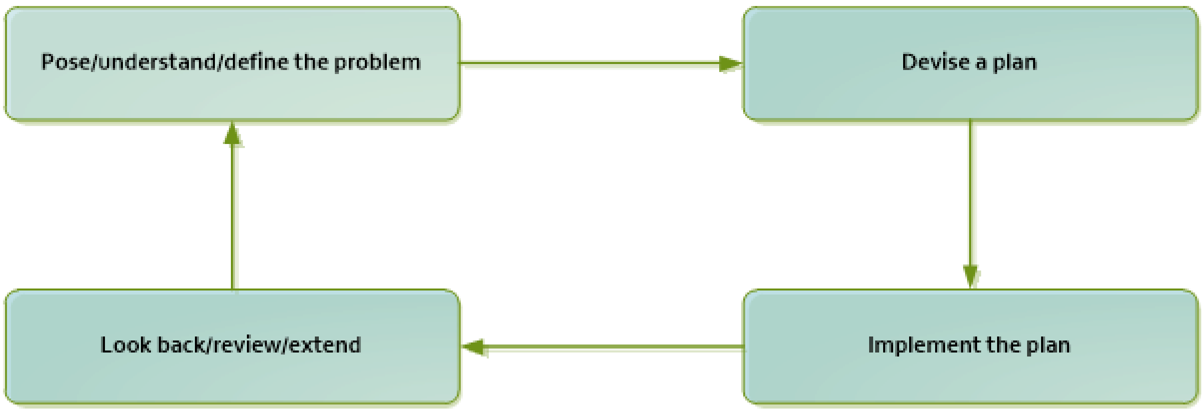
Mathematical modelling

- Mathematical modelling is the process of using mathematical constructs, structures and techniques to represent and describe a real-world context or system, in a simple and concise way that enables one to investigate features and characteristics of its behaviour, analyse particular aspects or solve problems of interest, and to make predictions related to the context or system.
- A simple diagrammatic representation of the mathematical modelling process is shown below.



Problem-solving:

- Problem solving is a process that occurs in a context where a question, task or issue needs to be solved or resolved, and there is a motivation, but not yet the means, to do so.
- Questions or tasks for which there are already recognised methods or approaches for solution or resolution, do not require problem-solving in this sense.
- In Mathematics problems are generated from questions, conjectures and hypotheses within and across areas of study. New problems may arise in their own right, or as a variation, re-formulation, extension or generalisation of a known problem or class of problems.
- A simple diagrammatic representation of the problem-solving process, adapted from *How to Solve It* (Polya, 1945, Princeton University Press) follows.



- Mathematical modelling and problem-solving are complementary processes. Developing a model may be a strategy that is employed to solve a problem, and problem-solving may be required in developing and applying aspects of a model.

Module 1 Work Requirements Specifications

Focus Area: Discipline-based study
Title of Work Requirement: Mathematical modelling and/or problem-solving task
Mode/Format: Extended response
Description: Learners will engage in problem solving and/or mathematical modelling of a real-world context involving growth and decay in sequences and/or standard financial models. Learners' responses to the chosen stimulus will focus on interpretation of the context, selection and application of mathematical techniques, analysis of results or solutions and communication of drawn conclusions including describing any limitations or assumptions made. 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. The extended response should be submitted as a single-word processed document of no more than 8 pages which:

- may include photos of hand-written work (including mathematical calculations) written format with the exception of mathematical calculations
- may include photographs or embedded diagrams or representations taken from graphical software packages.
- must be submitted as a single PDF in digital format and no larger than 10 MB.

Time allowance: 6 to 8 hours of class time including support tasks
Timing: No specified timing
External agencies: Involvement at teacher discretion
Relevant criteria:

- Criterion 1: all standard elements
- Criterion 2: elements 1, 2, 3 and where relevant 4 and 5
- Criterion 3: all standard elements
- Criterion 4: all standard elements
- Criterion 5: chosen elements as applicable to the context
- Criterion 6: chosen elements as applicable to the context

Module 2 Work Requirements Specifications

Focus Area: Discipline-based study
Title of Work Requirement: Statistical investigation
Mode/Format: Investigation
Description: Learners will engage in a statistical investigation to respond to a specific problem, question, issue or hypothesis evidenced by the collection, analysis, and synthesis of primary and/or secondary data sets with several variables. The investigation will use investigative practices and mathematical techniques as outlined in the course content of this module, supported by research as appropriate. The investigation should occur over an extended and defined timeframe. The task has three components of increasing complexity:

- the construction, description and interpretation of data plots, including smoothed plots where time series data is used
- the calculation and interpretation of summary statistics, including seasonal indices and their application where time series data is used

- the modelling of linear associations, or trends where time series data is used, including the use of data transformation as appropriate.

Learners' responses to the chosen stimulus will focus on:
- making inferences and/or hypothesis
- classifying and organising data (including collection if relevant)
- interpretation of the constructed data plots
- selection and application of mathematical techniques
- modelling of linear associations or trends
- analysis of association including causation, correlation and identification of outliers and their causes
- communication of drawn conclusions including describing any limitations or assumptions made.

The statistical investigation should be submitted as a single-word processed document of no more than 10 pages (plus appendices) which:
- may include photos of hand-written work (including mathematical calculations) written format with the exception of mathematical calculations
- may include photographs, screenshots or embedded data representations taken from graphical software packages.
- must include references and raw data as appendices (excluded from page count)
- must be submitted as a single PDF in digital format and no larger than 10 MB.

The Harvard referencing style is recommended to be used throughout the folio.

- Regardless of the formal referencing style chosen, you must consistently use a single referencing style in all components of your folio.
- Refer to Academic Integrity information on the TASC website for information about referencing styles, frequently asked questions, and tips and hints for correct referencing.
- A detailed list of works cited must be shown in the Reference list.

Time allowance: 8 – 10 hours of class time
Timing: No specified timing
External agencies: Involvement at teacher discretion
Relevant criteria:
- Criterion 1: all standard elements
- Criterion 2: elements 1, 2, 3 and where relevant 4 and 5
- Criterion 3: all standard elements
- Criterion 4: all standard elements
- Criterion 5: chosen elements as applicable to the context
- Criterion 7: chosen elements as applicable to the context

Module 3 Work Requirements Specifications

Focus Area: Discipline-based study
Title of Work Requirement: Mathematical modelling and/or problem-solving task
Mode/Format: Extended response
Description: Learners will engage in problem solving and/or mathematical modelling of one or more real-world contexts involving trigonometry and Earth geometry, and/or networks and decision mathematics. In this module, an extended response may be a series of connected short responses to multiple contexts. Learners' responses to the chosen stimulus will focus on interpretation of the

context(s), selection and application of mathematical techniques, analysis of results or solutions and communication of drawn conclusions including describing any limitations or assumptions made. 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.
The extended response should be submitted as a single-word processed document of no more than 8 pages which:

- may include photos of hand-written work (including mathematical calculations) written format with the exception of mathematical calculations
- may include photographs or embedded diagrams or representations taken from graphical software packages.
- must be submitted as a single PDF in digital format and no larger than 10 MB.

Time allowance: 6 to 8 hours of class time including support tasks
Timing: No specified timing
External agencies: Involvement at teacher discretion
Relevant criteria:

- Criterion 1: all standard elements
- Criterion 2: elements 1, 2, 3 and where relevant 4 and 5
- Criterion 3: all standard elements
- Criterion 4: all standard elements
- Criterion 5: chosen elements as applicable to the context
- Criterion 8: chosen elements as applicable to the context

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
adjacency matrix	An adjacency matrix for a non-directed graph with n vertices is a $n \times n$ matrix in which the entry in row i and column j is the number of edges joining the vertices i and j. In an adjacency matrix a loop is counted as one edge. For a directed graph, the entry in row i and column j is the number of directed edges (arcs) joining the vertex i and j in the direction i to j.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
algorithm	An algorithm is a precisely defined routine procedure that can be applied and systematically followed through to a conclusion.	ACARA	General Mathematics 3
angle of depression	When an observer looks at an object that is lower than the eye of the observer, the angle between the line of sight and the horizontal is called the angle of depression.	ACARA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
angle of elevation	When an observer looks at an object that is higher than the eye of the observer, the angle between the line of sight and the horizontal is called the angle of elevation.	ACARA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
annuity	An annuity is a compound interest investment from which payments are made on a regular basis for a fixed period of time. At the end of this time the investment has no residual value.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities

Term	Definition	Source Acknowledgement	Course Context
arithmetic sequence	A sequence of numbers such that the difference between any two successive members of the sequence is constant, e.g. the sequence 2, 5, 8, 11, 14, 17, … is an arithmetic sequence with first term 2 and common difference 3, by inspection of the sequence, the rule for the nth term t_n of this sequence is: $t_n = 2 + (n-1)3 = 3n - 1$, $n \geq 1$, if t_n is used to denote the nth term in the sequence, then a recursion relation that will generate this sequence is: $t_1 = 2, t_{n+1} = 3$, $n \geq 1$	QCAA	General Mathematics 3: • Module 1 – Growth and decay in sequences
association	A general term used to describe the relationship between two (or more) variables. The term association is often used interchangeably with the term correlation. The latter tends to be used when referring to the strength of a linear relationship between two numerical variables.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
average percentage method	In the average percentage method for calculating a seasonal index, the data for each 'season' are expressed as percentages of the average for the year. The percentages for the corresponding 'seasons' for different years are then averaged using a mean or median to arrive at a seasonal index.	ACARA	General Mathematics 3: • Module 2 – Time series analysis
bearing	The direction of a fixed point, or the path of an object, from the point of observation.	QCAA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry

Term	Definition	Source Acknowledgement	Course Context
bipartite graph	A bipartite graph is a graph whose set of vertices can be split into two distinct groups in such a way that each edge of the graph joins a vertex in the first group to a vertex in the second group.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
book value	The book value is the value of an asset recorded on a balance sheet. The book value is based on the original cost of the asses less depreciation. There are three commonly used methods for calculating yearly depreciation in the value of an asset, namely, reducing balance depreciation, flat rate depreciation or unit cost depreciation.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities
break-even point	The break---even point is the point at which revenue begins to exceed the cost of production.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities
categorical data	Data associated with a categorical variable is called categorical data.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
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 these labels have no numerical significance, they merely serve as labels.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis

Term	Definition	Source Acknowledgement	Course Context
causal relationship	A relationship between an explanatory and a response variable is said to be causal if the change in the explanatory variable actually causes a change in the response variable. Simply knowing that two variables are associated, no matter how strongly, is not sufficient evidence by itself to conclude that the two variables are causally related.	QCAA	General Mathematics 3: • Module 2 – Bivariate data analysis
coefficient of determination	In a linear model between two variables, the coefficient of determination (R2) is the proportion of the total variation that can be explained by the linear relationship existing between the two variables, usually expressed as a percentage. For two variables only, the coefficient of determination is numerically equal to the square of the correlation coefficient (r2).	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
common response	A response it said to be common when there is no causation, but instead the association is explained by at least one other variable that is associated with both the explanatory and the response variable	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
compass bearings	Compass bearings are specified as angles either side of North or South, that describe the direction of a fixed point, or the path of an object. For example: a compass bearing of N50°E is found by facing North and moving through an angle of 50° towards East.	ACARA	General Mathematics 3: • Module 3 - Trigonometry and Earth geometry
complete graph	A complete graph is a simple graph in which every vertex is joined to every other vertex by an edge. The complete graph with n vertices is denoted Kn .	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics

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	General Mathematics 3: • Module 1 – Investment, loans and annuities
confounding	Confounding exists in situations where there may be causation, but the change may also be caused by one or more uncontrolled variables whose effects cannot be disentangled from the effect of the response variable.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
connected graph	A graph is connected if there is a path between each pair of vertices. A bridge is an edge in a connected graph that, if removed, leaves a graph disconnected.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
Consumer Price Index	The Consumer Price Index (CPI) is a measure of changes, over time, in retail prices of a constant basket of goods and services representative of consumption expenditure by resident households in Australian metropolitan areas.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities
continuous data	Data associated with a continuous variable is called continuous data.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis

Term	Definition	Source Acknowledgement	Course Context
continuous variable	A continuous variable is a numerical variable that can take any value that lies within an interval. In practice, the values taken are subject to accuracy of the measurement instrument used to obtain these values. Examples include height, reaction time, temperature and systolic blood pressure.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
correlation	Correlation is a measure of the strength of the linear relationship between two variables.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
correlation coefficient	The correlation coefficient (r) is a measure of the strength of the liner relationship between a pair of variables.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
cosine ratio	In any right-angled triangle, $$\cos\theta = \frac{adjacent}{hypotenuse}$$	QCAA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
cosine rule	For a triangle of side lengths a, b and c and angles A, B and C, the cosine rule states that: $$c^2 = a^2 + b^2 - 2ab\cdot\cos C$$	ACARA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry

Term	Definition	Source Acknowledgement	Course Context
critical path analysis (CPA)	A project often involves many related activities some of which cannot be started until one or more earlier tasks have been completed. One way of scheduling such activities that takes this into account is to construct a network diagram. Critical path analysis is a method for determining the longest path (the critical path) in such a network and hence the minimum time in which the project can be completed. There may be more than one critical path in the network.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
cut (in a flow network)	In a flow network, a cut is a partition of the vertices of a graph into two separate groups with the source in one group and the sink in the other. The capacity of the cut is the sum of the capacities of the cut edges directed from source to sink. Cut edges directed from sink to source are ignored.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
cycle	A cycle is a closed walk begins and starts at the same vertex and in which has no repeated edges or vertices except the first.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
degree of a vertex	In a graph, the degree of a vertex is the number of edges incident with the vertex, with loops counted twice. It is denoted deg v.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
directed graph (digraph)	A directed graph is a diagram comprising points, called vertices, joined by directed lines called arcs. The directed graphs are commonly called digraphs.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics

Term	Definition	Source Acknowledgement	Course Context
discrete data	Discrete data is data associated with a discrete variable. Discrete data is sometimes called count data.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
discrete variable	A discrete variable is a numerical variable that can take only integer values. Examples include the number of people in a car, the number of decayed teeth in an 18 year---old male etc.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
earliest starting time (EST)	Using a forward scan of a network diagram to determine the earliest time an activity can begin	QCAA	General Mathematics 3: • Module 3 – Networks and decision mathematics
edge	In a graph, an edge is a line that connects tow vertices	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
effective annual rate of interest	The effective annual rate of interest $i_{effective}$ is used to compare the interest paid on loans (or investments) with the same nominal annual interest rate i but with different compounding periods (daily, fortnightly, monthly, quarterly, annually, other). If the number of compounding periods per annum is n, then: $i_{effective} = (1 + \frac{i}{n})^n - 1$	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities

Term	Definition	Source Acknowledgement	Course Context
Euler's rule	For a connected planar graph, Euler's rule states that $v + f - e = 2$ where v is the number vertices, e the number of edges and f is the number of faces.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
Eulerian graph	A connected graph is Eularian if it has a closed trail (starts and ends at the same vertex), that is, includes every edge once only; such a trail is called an Eulerian trail. An Eularian trail may include repeated vertices. A connected graph is semi-Eularian if there is an open trail that includes every edge once only.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
explanatory variable	When investigating relationships in bivariate data, the explanatory variable (independent variable) is the variable used to explain or predict a difference in the response variable (dependent variable), e.g. when investigating the relationship between the temperature of a loaf of bread and the time it has spent in a hot oven, temperature is the response variable and time is the explanatory variable.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
extrapolation	In the context of fitting a linear relationship between two variables, extrapolation occurs when the fitted model is used to make predictions using values of the explanatory variable that are outside the range of the original data. Extrapolation is a dangerous process as it can sometimes lead to quite erroneous predictions.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis

Term	Definition	Source Acknowledgement	Course Context
face	The faces of a planar graph are the regions bounded by the edges including the outer infinitely large region.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
first-order linear recurrence relation	A first-order linear recurrence relation is defined by the rule: $t_0 = a, t_{n+1} = bt_n + c$, for $n \geq 1$ For example, the rule $t_0 = 10, t_n = 5t_{n-1} + 1$, for $n \geq 1$ is a first-order recurrence relation. The sequence generated by this rule starting at t_0 is: 10, 51, 256, … as show below. $t_0 = 10, t_1 = 5t_0 + 1 = 5 \times 10 + 1 = 51,$ $t_2 = 5t_1 + 1 = 5 \times 51 + 1 = 256, \ldots$	ACARA	General Mathematics 3: • Module 1 – Growth and decay in sequences
flat rate depreciation	In flat rate or straight-line depreciation the value of an asset is depreciated by a fixed amount each year. Usually this amount is specified as a fixed percentage of the original cost.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities
float time	Is the amount of time that a task in a project network can be delayed without causing a delay to subsequent tasks. All activities on a critical path have zero floats.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics

Term	Definition	Source Acknowledgement	Course Context
flow network	A flow network is a directed graph where each edge has a capacity (e.g. 100 cars per hour, 800 litres per minute etc.) and each edge receives a flow. The amount of flow on an edge cannot exceed the capacity of the edge. A flow must satisfy the restriction that the amount of flow into a node equals the amount of flow out of it, except when it is a source, which has more outgoing flow, or a sink, which has more incoming flow. A flow network can be used to model traffic in a road system, fluids in pipes, currents in an electrical circuit, or any situation in which something travels through a network of nodes.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
food web	A food web (or food chain) depicts feeding connections (who eats whom) in an ecological community.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
geometric growth or decay	A sequence displays geometric growth or decay when each term is some constant multiple (greater or less than one) of the preceding term: a multiple greater than one corresponds to growth, a multiple less than one corresponds to decay, e.g. 1, 2, 4, … displays geometric growth because each term is double the previous term, 100, 10, 0.1, … displays geometric decay because each term is one tenth of the previous term	QCAA	General Mathematics 3: • Module 1 – Growth and decay in sequences

Term	Definition	Source Acknowledgement	Course Context
geometric sequence	A sequence of numbers where each term after the first is found by multiplying the previous term by a fixed non-zero number (excluding ±1) called the common ratio, e.g. 2, 6, 18, ... is a geometric sequence with first term 2 and common ratio 3; by inspection of the sequence, the rule for the nth term of this sequence is: $t_n = 2 \times 3^{(n-1)}, n \geq 1$ if t_n is used to denote the nth term in the sequence, then a recursion relation that will generate this sequence is: $t_1 = 2, t_n + 1 = 3t_n , n \geq 1$	QCAA	General Mathematics 3: • Module 1 – Growth and decay in sequences
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	General Mathematics 3: • Module 1 – Investment, loans and annuities
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 a line.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
graph	A graph is a diagram that consists of a set of points, called vertices that are joined by a set of lines called edges. Each edge joins two vertices. A loop is an edge in a graph that joins a vertex in a graph to itself. Two vertices are adjacent if they a joined by an edge. Two or more edges connect the same vertices are called multiple edges.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics

Term	Definition	Source Acknowledgement	Course Context
Hamiltonian cycle	A Hamiltonian cycle is a cycle that includes each vertex in a graph (except the first), once only.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
Hamiltonian path	A Hamiltonian path is path that includes every vertex in a graph once only. A Hamiltonian path that begins and ends at the same vertex is a Hamiltonian cycle.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
Heron's rule	Heron's rule is a rule for determining the area of a triangle given the length of its sides. The area A of a triangle of side lengths a, b and c is given by: $A = \sqrt{s(s-a)(s-b)(s-c)}$ where $s = \frac{a+b+c}{2}$	ACARA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
Hungarian algorithm	The Hungarian algorithm is used to solve assignment (allocation) problems.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
interpolation	In the context of fitting a linear relationship between two variables, interpolation occurs when the fitted model is used to make predictions using values of the explanatory variable that lie within the range of the original data.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
irregular variation or noise (time series)	Irregular variation or noise is erratic and short---term variation in a time series that is the product of chance occurrences.	ACARA	General Mathematics 3: • Module 2 – Time series analysis

Term	Definition	Source Acknowledgement	Course Context
latest starting time (LST)	Using a backward scan of a network diagram to determine the latest time an activity can begin	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
least-squares line	In fitting a straight---line $y = a + bx$ to the relationship between a response variable y and an explanatory variable x, the least---squares line is the line for which the sum of the squared residuals is the smallest.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis General Mathematics 3: • Module 2 – Time series analysis
linear growth or decay (sequence)	A sequence displays linear growth or decay when the difference between successive terms is constant. A positive constant difference corresponds to linear growth while a negative constant difference corresponds to decay. Examples: The sequence, 1, 4, 7, … displays linear growth because the difference between successive terms is 3. The sequence, 100, 90, 80, … displays linear decay because the difference between successive terms is –10. By definition, arithmetic sequences display linear growth or decay.	ACARA	General Mathematics 3: • Module 1 – Growth and decay in sequences
length (of a walk)	The length of a walk is the number of edges it includes.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics

Term	Definition	Source Acknowledgement	Course Context
mean	The arithmetic mean, $\bar{x}$, of a list of numbers is the sum of the data values divided by the number of values in the list. In everyday language, the arithmetic mean is commonly called the average.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
median	The median is the value in a set of ordered set of data values that divides the data into two parts of equal size. When there are an odd number of data values, the median is the middle value. When there is an even number of data values, the median is the arithmetic mean of the two central values.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
minimum cut-maximum flow theorem	The minimum cut-maximum flow theorem states that in a flow network, the maximum flow from the source to the sink is equal to the capacity of the minimum cut.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
mode	The mode is the most frequently occurring value in a data set.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
moving average	In a time series, a simple moving average is a method used to smooth the time series whereby each observation is replaced by a simple average of the observation and its near neighbours. This process reduces the effect of non-typical data and makes the overall trend easier to see.	ACARA	General Mathematics 3: • Module 2 – Time series analysis

Term	Definition	Source Acknowledgement	Course Context
network	The word network is frequently used in everyday life, e.g. television network, rail network, social network etc. Weighted graphs or digraphs can often be used to model such networks.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
outlier	An outlier in a set of data is an observation that appears to be inconsistent with the remainder of that set of data. An outlier is a surprising observation.	ACARA	General Mathematics 3: • Module 2 – Time series analysis
path (in a graph)	A path in a graph is a walk in which all of the edges and all the vertices are different. A path that starts and finishes at different vertices is said to be open, while a path that starts and finishes at the same vertex is said to be closed. A cycle is a closed path.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
perpetuity	A perpetuity is a compound interest investment from which payments are made on a regular basis in perpetuity (forever). This is possible because the payments made at the end of each period exactly equal the interest earned during that period.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities
planar graph	A planar graph is a graph that can be drawn in the plane. A planar graph can always be drawn so that no two edges cross.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
price to earnings ratio (of a share)	The price to earnings ratio of a share (P/E ratio) is defined as: $$\frac{P}{E}ratio = \frac{Market\ price\ per\ share}{Annual\ earnings\ per\ share}$$	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities

Term	Definition	Source Acknowledgement	Course Context
Prim's algorithm	An algorithm for determining a minimum spanning tree in a connected weighted graph.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
Pythagoras' theorem	The square of the hypotenuse of a right-angled triangle equals the sum of the squares of the lengths of the other two sides. As a rule: $c^2 = a^2 + b^2$, where c is the length of the hypotenuse.	ACARA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
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.	ACARA	General Mathematics 3: • Module 1 – Growth and decay in sequences General Mathematics 3: • Module 1 – Investment, loans and annuities
recursion	The repeated application of a recursive procedure or definition.	Oxford Dictionary	General Mathematics 3: • Module 1 – Growth and decay in sequences General Mathematics 3: Module 1 – Investment, loans and annuities

Term	Definition	Source Acknowledgement	Course Context
reducing balance depreciation	In reducing balance depreciation the value of an asset is depreciated by a fixed percentage of its value each year, until the asset has no residual value after a defined number of years. Reducing balance depreciation is sometimes called diminishing value depreciation.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities
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.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities
residual values	The difference between the observed value and the value predicted by a statistical model (e.g., by a least-squares line).	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities General Mathematics 3: • Module 2 – Bivariate data analysis General Mathematics 3: • Module 2 – Time series analysis

Term	Definition	Source Acknowledgement	Course Context
residual plot	A residual plot is a scatterplot with the residual values shown on the vertical axis and the explanatory variable shown on the horizontal axis. Residual plots are useful in assessing the fit of the statistical model (e.g. by a least-squares line).	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities General Mathematics 3: • Module 2 – Bivariate data analysis General Mathematics 3: • Module 2 – Time series analysis
response variable	Also known as the dependent variable; its value is dependent on the value of the explanatory (or independent) variable.	QCAA	General Mathematics 3: • Module 2 – Bivariate data analysis
round-robin sporting competition	A single round robin sporting competition is a competition in which each competitor plays each other competitor once only.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
scale factor	A number that scales, or multiplies, some quantity. In the equation $y = kx$, k is the scale factor for x; if two or more figures are similar, their sizes can be compared. The scale factor is the ratio of the length of one side on one figure to the length of the corresponding side on the other figure. It is a measure of magnification; the change of size.	ACARA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry

Term	Definition	Source Acknowledgement	Course Context
scatterplot	A two---dimensional data plot using Cartesian co---ordinates to display the values of two variables in a bivariate data set.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
seasonal adjustment	A term used to describe a time series from which periodic variations due to seasonal effects have been removed.	ACARA	General Mathematics 3: • Module 2 – Time series analysis
seasonal index (indices)	The seasonal index can be used to remove seasonality from data. An index value is attached to each period of the time series within a year. For the seasons of the year (Summer, Autumn, Winter, Spring) there are four separate seasonal indices; for months, there are 12 separate seasonal indices, one for each month, and so on. There are several methods for determining seasonal indices.	ACARA	General Mathematics 3: • Module 2 – Time series analysis
seasonal variation	A regular rise and fall in the time series that recurs each year. Seasonal variation is measured in terms of a seasonal index.	ACARA	General Mathematics 3: • Module 2 – Time series analysis
sequence	A sequence is an ordered list of numbers (or objects). For example: 1, 3, 5, 7 is a sequence of numbers that differs from the sequence 3, 1, 7, 5 as order matters. A sequence maybe finite, for example, 1, 3, 5, 7 (the sequence of the first four odd numbers), or infinite, for example, 1, 3, 5, … (the sequence of all odd numbers).	ACARA	General Mathematics 3

Term	Definition	Source Acknowledgement	Course Context
similar figures	Two geometric figures are similar if they are of the same shape but not necessarily of the same size	QCAA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
simple graph	A simple graph has no loops or multiple edges.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
sine ratio	In any right-angled triangle, $$\sin\theta = \frac{opposite}{hypotenuse}$$	QCAA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
sine rule	For a triangle of side lengths a, b and c and angles A, B and C, the sine rule states that: $$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$	ACARA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
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	General Mathematics 3: • Module 1 – Investment, loans and annuities

Term	Definition	Source Acknowledgement	Course Context
spanning tree	A spanning tree is a subgraph of a connected graph that connects all vertices and is also a tree.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
standard deviation	The standard deviation is a measure of the variability or spread of a data set. It gives an indication of the degree to which the individual data values are spread around their mean. The standard deviation of n observations $x_1, x_2, \ldots, x_n$ is: $$s = \sqrt{\frac{\Sigma(x_i - \bar{x})^2}{n-1}}$$	QCAA	General Mathematics 3: • Module 2 – Bivariate data analysis
tangent ratio	In any right-angled triangle, $$\tan\theta = \frac{opposite}{adjacent}$$	QCAA	General Mathematics 3: • Module 3 – Trigonometry and Earth geometry
time series	Values of a variable recorded, usually at regular intervals, over a period of time. The observed movement and fluctuations of many such series comprise long---term trend, seasonal variation, and irregular variation or noise.	ACARA	General Mathematics 3: • Module 2 – Time series analysis
time series plot	The graph of a time series with time plotted on the horizontal axis.	ACARA	General Mathematics 3: • Module 2 – Time series analysis

Term	Definition	Source Acknowledgement	Course Context
trend (time series)	Trend is the term used to describe the general direction of a time series (increasing/ decreasing) over a long period of time.	ACARA	General Mathematics 3: • Module 2 – Time series analysis
trail	A trail is a walk in which no edge is repeated.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
tree	A tree is a connected graph with no cycles.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
true bearings	True bearings are measured in degrees in a clockwise direction from the North line. Three figures are used to specify the direction. Thus, North is specified as 000°T, East is specified as 090°T, South-East is specified as 135°T.	ACARA	General Mathematics 3: • Module 3 - Trigonometry and Earth geometry

Term	Definition	Source Acknowledgement	Course Context
two-way frequency table	A two---way frequency table is commonly used for displaying the two---way frequency distribution that arises when a group of individuals or objects are categorised according to two criteria. The row and column totals represent the total number of observations in each row and column and are sometimes called row sums or column sums. If the table is 'percentaged' using row sums the resulting percentages are called row percentages. If the table is 'percentaged' using row sums the resulting percentages are called column percentages.	ACARA	General Mathematics 3: • Module 2 – Bivariate data analysis
unit cost depreciation	In unit cost depreciation, the value of an asset is depreciated by an amount related to the number of units produced by the asset during the year.	ACARA	General Mathematics 3: • Module 1 – Investment, loans and annuities
walk (in a graph)	A walk in a graph is a sequence of vertices such that from each of its vertices there is an edge to the next vertex in the sequence. A walk that starts and finishes at different vertices is said to be an open walk. A walk that starts and finishes at the same vertex is said to be closed walk.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics
weighted graph	A weighted graph is a graph in which each edge is labelled with a number used to represent some quantity associated with the edge. For example, if the vertices represent towns, the weights on the edges may represent the distances in kilometres between the towns.	ACARA	General Mathematics 3: • Module 3 – Networks and decision mathematics

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.