Government of **Western Australia**
School Curriculum and Standards Authority

DRAFT FOR CONSULTATION

MATHEMATICS APPLICATIONS

ATAR course

Year 11 syllabus for teaching from 2028

Acknowledgement of Country

Kaya. The School Curriculum and Standards Authority (the Authority) acknowledges that our offices are on Whadjuk Noongar boodjar and that we deliver our services on the country of many traditional custodians and language groups throughout Western Australia. The Authority acknowledges the traditional custodians throughout Western Australia and their continuing connection to land, waters and community. We offer our respect to Elders past and present.

Important information

As part of the Western Australian Certificate of Education (WACE) Refreshment, the School Curriculum and Standards Authority (the Authority) has revised the course rationale and aims, and updated the General Capabilities to create clearer connections with the syllabus content.

This syllabus is effective from 1 January 2028.

Users of this syllabus are responsible for checking its currency.

Syllabuses are formally reviewed by the Authority on a cyclical basis, typically every five years.

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Contents

Rationale

The Mathematics Applications ATAR course is the study of mathematical concepts and techniques used to analyse, interpret and solve real-world problems. It focuses on applying mathematical concepts to help students make informed choices in personal and professional settings, including financial and statistics-based decisions.

The course focuses on solving practical problems that involve financial mathematics , measurement, statistical analysis of univariate data and graphical, algebraic and matrix representations of information. The course develops students' understanding of the statistical investigation process for analysing univariate data.

By studying this course, students develop fluency in calculations, analytical reasoning and the ability to interpret and communicate mathematical ideas effectively. The course encourages logical thinking, attention to detail and the ability to evaluate information critically, fostering a deeper understanding of the role mathematics plays in everyday decision-making.

The mathematical skills and concepts covered in the course have broad applications in daily life. Students learn to manage personal finances, manipulate and represent real-world information to solve problems, and summarise and analyse statistical data. Students apply graph theory to analyse real-world connections and explore shape and measurement concepts to solve practical problems involving surface area, volume and scale with applications in design, construction and everyday planning.

The Mathematics Applications ATAR course provides a strong foundation for students intending to pursue tertiary education or vocational training in business, finance, social sciences, health sciences, information technology and environmental studies. Careers in areas such as economics, data analysis, logistics, public administration and education all benefit from the skills developed in this course.

Aims

The Mathematics Applications ATAR course aims to develop students':

- understanding of concepts and techniques drawn from number and algebra, geometry and trigonometry, graphs and networks, and statistics
- ability to apply mathematical knowledge to solve real-world problems
- proficiency in reasoning and interpretation within mathematical and statistical contexts
- capacity to communicate findings clearly and systematically, using precise and appropriate mathematical and statistical language
- confidence to select and use digital tools appropriately and efficiently to support problem-solving and data analysis.

Organisation

This course is organised into a Year 11 syllabus and a Year 12 syllabus. The cognitive complexity of the syllabus content increases from Year 11 to Year 12.

Structure of the syllabus

The Year 11 syllabus is divided into two units, each of one semester duration, which are typically delivered as a pair. The notional time for each unit is 55 class contact hours.

Organisation of content

Unit 1

Contains three topics:

- Matrices, networks and graphs
- Functions and formulas
- Financial mathematics.

Unit 2

Contains three topics:

- Univariate data analysis
- Measurement and scale
- Graphical applications.

Each unit includes:

- a unit description – a short description of the focus of the unit
- learning outcomes – a set of statements describing the learning expected as a result of studying the unit
- unit content – the content to be taught and learned.

Role of technology

It is assumed that students will be taught this course with an extensive range of technological applications and techniques. These technologies have the potential to enhance the teaching and learning of mathematics; however, students also need to continue to develop skills that do not depend on technology. The ability to choose when and when not to use some form of technology, and the ability to work flexibly with technology, are important skills in this course.

Progression from the Years 7–10 curriculum

The Mathematics Applications ATAR course extends students' understanding, fluency, problem-solving and reasoning from all three strands of the Years 7–10 Mathematics curriculum. Students extend their use of the mathematical modelling process to investigate and understand real-world phenomena and solve practical problems in context.

Representation of the General Capabilities

The General Capabilities encompass the knowledge, skills, behaviours and dispositions that will support students to live and work successfully now and into the future. They are not assessed unless identified within the specified unit content. Teachers should find opportunities to incorporate the following General Capabilities into the teaching and learning program for the Mathematics Applications ATAR course.

Critical and creative thinking

Students identify and clarify information from a range of sources, including visual information and digital sources. They identify the relevant aspects of a concept or problem, understanding that a single mathematical process can be used in seemingly different situations and that approaches may change depending on the context or nature of the problem. Students draw conclusions and make choices when completing tasks by connecting evidence from within and across the mathematical content to provide reasons and evaluate arguments for choices made.

Digital literacy

Students use appropriate digital tools to support the development of mathematical understanding and to apply mathematical knowledge to a range of problems. They use technologies aligned with areas of work they may be involved with such as statistical analysis, computation of algorithms, manipulation of data and expressions, and complex calculations. Students use digital tools to make connections between mathematical theory, practice and application.

Literacy

Students develop literacy skills and strategies that enable them to express, interpret and communicate complex mathematical information, ideas and processes. Mathematics provides a specific and rich context for students to develop their ability to read, write, visualise and talk about complex situations involving a range of mathematical ideas. They apply and further develop their literacy skills and strategies by shifting between verbal, graphical, numerical and symbolic forms of representing problems to formulate, understand and solve problems and communicate results. Students learn to communicate their findings in different ways, using multiple systems of representation to illustrate the relationships they have observed or constructed.

Numeracy

Students develop their numeracy skills at a more sophisticated level, making decisions about the relevant mathematics to use, following through with calculations, selecting appropriate methods and being confident of their results. This course contains topics that will equip students for the increasing demands of the information age, developing the skills of critical evaluation of numerical information in its various forms of collection and presentation. They will enhance their numerical operation skills via engagement with consumer arithmetic problems, mensuration and trigonometric calculations, algebraic modelling and analysis of practical situations, and the statistical analysis of univariate data.

Addressing the other General Capabilities

Although the following General Capabilities have not been identified as a focus in the Mathematics Applications ATAR Year 11 syllabus, teachers may find opportunities to incorporate them into the teaching and learning program.

- Ethical understanding
- Intercultural understanding
- Personal and social capability

Such opportunities may occur through the application of different contexts, pedagogical practices and/or assessment strategies that relate to the syllabus as part of the teaching and learning program.

Summary representation of the General Capabilities in the Mathematics Applications ATAR course

The unit content and assessment types for this course provide students with the opportunity to develop the General Capabilities summarised in the table below.

Year	Course	Course type	General Capabilities						
			CCT	DL	EU	IU	L	N	PSC
Year 11	Mathematics Applications (AEMAA)	ATAR	✓	✓			✓	✓	
Year 12	Mathematics Applications (ATMAA)	ATAR	✓	✓			✓	✓	

Key
CCT: Critical and creative thinking, DL: Digital literacy, EU: Ethical understanding, IU: Intercultural understanding, L: Literacy, N: Numeracy, PSC: Personal and social capability

Representation of the Cross-curriculum Priorities

The Cross-curriculum Priorities address the contemporary issues that students face in a globalised world. Teachers may find opportunities to incorporate them into the teaching and learning program for the Mathematics Applications ATAR course. The Cross-curriculum Priorities are not assessed unless they are identified within the specified unit content.

Aboriginal and Torres Strait Islander histories and cultures

Mathematics courses value the histories, cultures, traditions and languages of Aboriginal and Torres Strait Islander peoples and their past and ongoing contributions to contemporary Australian society and culture. Through the study of mathematics within relevant contexts, students develop an understanding and appreciation of the diversity of Aboriginal and Torres Strait Islander peoples' histories and cultures.

Asia and Australia's engagement with Asia

There are strong social, cultural and economic reasons for Australian students to engage with the countries of Asia and with the past and ongoing contributions made by the peoples of Asia in Australia. It is through the study of mathematics in an Asian context that students engage with Australia's place in the region. By analysing relevant data, students further develop an understanding of the diverse nature of Asia's environments and traditional and contemporary cultures.

Sustainability

Each of the mathematics courses provides students with the opportunity to develop informed and reasoned points of view, discuss issues, research and problem-solve. Teachers are therefore encouraged to select contexts for discussion that are connected with sustainability. Through the analysis of data, students have the opportunity to research and discuss sustainability and learn the importance of respecting and valuing a wide range of world perspectives.

Unit 1

Unit description

This unit has three topics:

- Graphs, networks and matrices introduces students to the language of graphs and the way in which matrices and graphs, represented as a collection of points and interconnecting lines, can be used to model relationships.
- Functions and formulas uses linear functions and graphs to model and analyse practical situations. This topic includes representation and manipulation of variables in formulas and using spreadsheets.
- Financial mathematics extends the concept of rates and percentages from the Years 7–10 curriculum to include contexts such as superannuation, government allowances, investments, GST, inflation and currency exchange. This topic includes financial calculations and analysis in real-world applications.

Classroom access to the technology necessary to support the computational and graphical aspects of the topics in this unit is assumed.

Learning outcomes

By the end of this unit, students:

- demonstrate the concepts and techniques used in graphs, networks and matrices, linear functions, and financial mathematics
- apply reasoning skills and solve practical problems in graphs, networks and matrices, linear functions, and financial mathematics
- communicate their arguments and strategies when solving problems using appropriate mathematical language
- interpret mathematical information and ascertain the reasonableness of their solutions to problems
- choose and use technology appropriately and efficiently.

Unit content

This unit includes the knowledge, understandings and skills described below.

Topic 1.1: Graphs, networks and matrices

Networks and graphs

1.1.1 construct directed and undirected graphs (networks) using vertices (nodes) and edges (arcs) to represent a practical situation such as transportation routes, utility grids and social connections, and solve associated problems

1.1.2 construct and interpret graphs in practical contexts, including simple graphs, complete graphs, connected and disconnected graphs (identifying bridges), subgraphs, and loops, and solve associated problems

1.1.3 use Euler's formula to identify whether a graph is planar and represent the graph in the plane to solve practical problems

1.1.4 solve real-world problems that require traversing every edge in a network by the identification of Eulerian circuits on Eulerian graphs and Semi-Eulerian trails on Semi-Eulerian graphs

1.1.5 solve real-world problems that require visiting a set of locations or completing a set of tasks exactly once by the identification of Hamiltonian cycles on Hamiltonian graphs and Hamiltonian paths on Semi-Hamiltonian graphs

Matrices

1.1.6 use matrices to display information from practical, real-world situations that can be represented using rows and columns, such as social and transport networks, competition data, sales and production

1.1.7 construct an adjacency matrix to represent connections in an undirected network or a route matrix to represent connections in a directed network and solve associated real-world problems

1.1.8 add and subtract matrices and raise a square matrix to a power (with the aid of digital tools) to solve two- and three-step connection problems involving situations such as social and transport networks and interpret the meaning of the resulting matrix in the context of the situation

Topic 1.2: Functions and formulas

Linear functions

1.2.1 formulate linear functions from graphs and contextual descriptions to model practical situations

1.2.2 graph linear functions that represent practical situations, and interpret the axes intercepts and gradient in context

1.2.3 solve applied problems that are modelled by linear functions, graphically, algebraically and using digital tools, and verify the solution by substitution

1.2.4 sketch step graphs to represent authentic situations and interpret to solve associated problems

Practical formulas

1.2.5 substitute values into linear formulas, transpose to solve for an unknown in applied problems and verify the solution by substitution

1.2.6 substitute values into practical formulas to evaluate the subject in a range of contexts

Topic 1.3: Financial mathematics

Earning, spending and investing

1.3.1 solve problems involving wages, annual salaries and other income, including:
- overtime and work-related allowances such as travel, food and living away from home allowances
- Australian Government support payments, such as Youth Allowance, Disability Support Pension, Austudy, ABSTUDY and JobSeeker Payment
- Medicare levy
- applying income tax to determine net income

1.3.2 calculate compulsory superannuation contributions based on income, and examine the effect on tax paid and net income received when making different voluntary superannuation contributions before and after income tax

1.3.3 calculate the capital gain or loss and income from investments such as shares, property and exchange traded funds (ETF), determine percentage return and discuss advantages, disadvantages and risk involved

1.3.4 apply percentage changes to calculate decreases and increases, including discounts, GST, mark-ups and inflation in real-world situations

1.3.5 apply compound interest in savings, investment and borrowing scenarios (without payments), including compounding periods shorter than a year, solving to determine unknown variables, such as interest rate, principal, time

1.3.6 use spreadsheets or tables of values to compare the effect of changing the value of variables for practical formulas in financial contexts

1.3.7 sketch and interpret step graphs used to model financial situations where values change at fixed intervals, such as tax brackets, pay rates, pay day loans and other contexts that use tiered billing

1.3.8 use currency exchange rates to determine and compare the cost of goods and services in other countries and in Australia

Unit 2

Unit description

This unit has three topics:

- Univariate data analysis develops students' ability to organise and summarise univariate data in the context of conducting a statistical investigation. This topic includes calculating statistical measures, comparing data displays and describing variability in authentic situations.
- Measurement and scale extends students' knowledge and skills from the Years 7–10 curriculum to include complex three-dimensional structures and the application of scale in practical contexts.
- Graphical applications develops students' ability to use simultaneous linear functions and inequalities, as well as exponential and quadratic functions, to model and analyse practical situations.

Classroom access to the technology necessary to support the computational, graphical and statistical aspects of this unit is assumed.

Learning outcomes

By the end of this unit, students:

- demonstrate the concepts and techniques used in univariate data analysis, measurement and scale, and functions and inequalities
- apply reasoning skills and solve practical problems in univariate data analysis, measurement and scale, and functions and inequalities
- implement the statistical investigation process in contexts requiring the analysis of univariate data
- communicate their arguments and strategies when solving mathematical and statistical problems, using appropriate mathematical or statistical language
- interpret mathematical and statistical information, and ascertain the reasonableness of their solutions to problems and answers to statistical questions
- choose and use technology appropriately and efficiently.

Unit content

This unit includes the knowledge, understandings and skills described below.

Topic 2.1: Univariate data analysis

The statistical investigation process

2.1.1 solve real-world problems involving authentic univariate data, using a statistical investigation process

Making sense of data

2.1.2 record, classify and organise authentic primary or secondary data that is categorical (ordinal and nominal) or numerical (discrete and continuous) and present the information in an appropriate display (choosing from line graph, dot plot, box plot, stem and leaf plot, bar graph or histogram) including with the use of digital tools

2.1.3 analyse cumulative frequency polygons representing authentic data, and identify and interpret the median, percentiles and deciles in the context of the situation

2.1.4 interpret a range of visual representations of authentic data to respond to claims and inferences in the context of the situation

2.1.5 describe and compare the location of two or more data sets in the context of an authentic situation, using measures of central tendency (mean, mode, median)

2.1.6 describe and compare the distribution of two or more data sets in the context of an authentic situation, using measures of spread (range, standard deviation, interquartile range) and skewness as appropriate

2.1.7 describe the impact of outliers on measures of central tendency and spread

Normally distributed data

2.1.8 use digital tools to graph large authentic data sets that approximate a bell-shaped curve, and describe how the features of the curve relate to the mean and the standard deviation

2.1.9 use the proportion of data expected to fall within one, two and three standard deviations of the mean in a large set of data that is normally distributed to solve applied problems

2.1.10 describe and compare points in two or more large authentic data sets in terms of the number of standard deviations from the mean

2.1.11 calculate boundaries for normally distributed data using the 68%, 95%, 99.7% rule in practical situations

Topic 2.2: Measurement and scale

Three-dimensional structures

2.2.1 use formulas, including Pythagoras' theorem, to solve authentic problems involving the surface area, volume and capacity of real-world objects that can be modelled by right prisms, cylinders and related composite solids

2.2.2 use formulas, including Pythagoras' theorem, to solve authentic problems involving the surface area, volume and capacity of real-world objects that can be modelled by spheres, cones, pyramids and related composite solids

2.2.3 determine and interpret how rounding and measurement error affect calculations of surface area, volume and capacity in practical and real-world contexts

Applications of scale

2.2.4 determine and apply a ratio scale to calculate measurements on maps, plans and models

2.2.5 determine and apply a scale factor to solve authentic problems involving areas, surface areas and volumes

Topic 2.3: Graphical applications

Simultaneous linear functions and inequalities

2.3.1 formulate a pair of linear functions to represent a real-world situation, solve graphically or algebraically (in simple cases) and interpret the solution in the context of the situation

2.3.2 formulate and graph a pair of linear inequalities in two variables to represent a real-world situation and interpret the solution as a region on the Cartesian plane

Exponential functions

2.3.3 formulate and graph exponential functions given the initial value and growth/decay factor in practical situations and use the graph to solve applied problems

Quadratic functions

2.3.4 use technology to graphically analyse and interpret key features of a parabola, including the turning point (vertex), line of symmetry and intercepts, to solve and communicate solutions to real-world problems

Assessment

Assessment is an integral part of teaching and learning that in the senior secondary years:

- provides evidence of student achievement
- identifies opportunities for further learning
- connects to the standards described for the course
- contributes to the recognition of student achievement.

Assessment for learning (formative) and assessment of learning (summative) enable teachers to gather evidence to support students and make judgements about student achievement. These are not necessarily discrete approaches and may be used individually or together, and formally or informally.

Formative assessment involves a range of informal and formal assessment procedures used by teachers during the learning process to improve student achievement and to guide teaching and learning activities. It often involves qualitative feedback (rather than scores) for both students and teachers, which focuses on the details of specific knowledge and skills that are being learned.

Summative assessment involves assessment procedures that aim to determine students' learning at a particular time; for example, when reporting against the standards or after completion of a unit or units. These assessments should be limited to eight or less and made clear to students through the assessment outline.

Appropriate assessment of student work in this course is underpinned by reference to a set of predetermined course standards. These standards describe the level of achievement required to achieve each grade from A to E. Teachers use these standards to determine how well a student has demonstrated their learning.

Where relevant, higher order cognitive skills (e.g. application, analysis, synthesis and evaluation) and the General Capabilities should be included in the assessment of student achievement in this course. All assessment should be consistent with the requirements identified in the course assessment table.

Assessment should not generate workload or stress that, under fair and reasonable circumstances, would unduly diminish the performance of students.

School-based assessment

The *Western Australian Certificate of Education (WACE) Manual* contains essential information on principles, policies and procedures for school-based assessment that must be read in conjunction with this syllabus.

School-based assessment involves teachers gathering, describing and quantifying information about student achievement.

Teachers design school-based assessment tasks to meet the needs of students. As outlined in the *WACE Manual*, school-based assessment of student achievement in this course must be based on the Principles of Assessment:

- Assessment is an integral part of teaching and learning.
- Assessment should be educative.
- Assessment must be fair.
- Assessment should be designed to meet its specific purpose/s.
- Assessment should lead to informative reporting.
- Assessment should lead to school-wide evaluation processes.
- Assessment should provide significant data for improvement of teaching practices.

The table below provides details of the assessment types and their weighting for the Mathematics Applications ATAR Year 11 syllabus.

Summative assessments in this course must:

- be limited to eight tasks or less
- allow for the assessment of each assessment type at least once over the year/pair of units
- have a minimum value of five per cent of the total school assessment mark
- provide a representative sampling of the syllabus content.

In addition to this advice on the minimum number of assessments, students must complete one modelling task and one statistical investigation to meet the minimum requirement in the modelling assessment section of the assessment table.

In the assessment outline where a single unit is being studied, each assessment type must be included at least once.

Assessment tasks not administered under test or controlled conditions require appropriate authentication processes.

Assessment table – Year 11

Type of assessment	Weighting
Response Students apply mathematical knowledge and understanding of concepts and relationships to solve a mix of routine and non-routine questions in practical contexts. Response tasks can include tests, assignments and multimedia representations.	40%
Modelling task Students use a mathematical thinking process to interpret and solve an extended practical problem. The problem originates with a real-world scenario that can be turned into a mathematical problem for which the mathematics of the syllabus can be applied. The task enables students to analyse the situation, choose the mathematics required to investigate the problem and evaluate and critically interpret the scenario in context. They make and state assumptions relevant to the problem and consider the validity of the assumptions and the appropriateness of the result in presenting their findings. **Statistical investigation** (Unit 2 only) Students use a statistical investigation process and syllabus-related mathematics to investigate and analyse a real-world situation. A statistical investigation involves the collection and processing of primary or secondary data to analyse then formulate conclusions in response to one or more questions that can be answered with evidence from data. The statistical investigation enables students to choose the mathematics required to collect, organise, summarise, display, analyse, evaluate and critically interpret data to develop evidence-based conclusions. They make and state assumptions relevant to the problem to support the aspects of complexity within their investigation. Evidence can include observation and interview, written work or multimedia presentations.	20%
Examination Students apply mathematical knowledge, understanding and skills to analyse, interpret and respond to questions and situations in practical contexts. Examinations provide for the assessment of conceptual understandings, knowledge of mathematical terminology and techniques and students' ability to reason, interpret and apply this knowledge in a range of contexts. Examination questions can range from those of a routine nature, assessing lower-level concepts, through to those that require responses at the highest level of conceptual thinking. Examinations are typically conducted at the end of each semester and/or unit. In preparation for Unit 3 and Unit 4, the examination should reflect the examination design brief included in the ATAR Year 12 syllabus for this course. Where a combined assessment outline is implemented, the Semester 2 examination should assess content from both Unit 1 and Unit 2. However, the combined weighting of Semester 1 and Semester 2 should reflect the respective weightings of the course content as a whole.	40%

Teachers are required to use the assessment table to develop an assessment outline for the pair of units (or for a single unit where only one is being studied).

The assessment outline must:

- include a set of assessment tasks
- include a general description of each task
- indicate the unit content to be assessed
- indicate a weighting for each task and each assessment type
- include the approximate timing of each task; for example, the week the task is conducted or the issue and submission dates for an extended task.

Reporting

Schools report student achievement, underpinned by a set of predetermined standards, using the following grades:

Grade	Interpretation
A	Excellent achievement
B	High achievement
C	Satisfactory achievement
D	Limited achievement
E	Very low achievement

The grade descriptions for the Mathematics Applications ATAR Year 11 syllabus are provided in Appendix 1. They are used to support the allocation of grades. They can also be accessed, together with annotated work samples, on the course page of the Authority website (www.scsa.wa.edu.au).

To be assigned a grade, a student must have had the opportunity to complete the education program, including the assessment program (unless the school accepts that there are exceptional and justifiable circumstances).

Refer to the *WACE Manual* for further information about the use of a ranked list in the process of assigning grades.

The grade is determined by reference to the standard, not allocated on the basis of a predetermined range of marks (cut-offs).

Appendix 1 – Grade descriptions Year 11*

A	**Interprets the task, identifies and organises relevant information, and chooses strategies** Identifies and organises relevant information from previous parts of a problem and brings them together to solve additional problems. Selects an appropriate strategy and demonstrates mathematical conventions to solve non-routine, unfamiliar, unstructured and/or multi-step problems. Clarifies an investigative task, identifies the key information and relevant assumptions, and chooses the appropriate mathematics.
	Uses mathematical knowledge and understanding to obtain solutions Completes concise and accurate solutions to mathematical problems set in a variety of practical contexts. Navigates between numerical, graphical and symbolic representations appropriately to solve problems in unfamiliar contexts. Effectively uses digital tools and their appropriate functionalities to solve problems in unfamiliar contexts. Applies changed conditions and correctly determines and explains the effect on the solution. Applies comprehensive knowledge and understanding of mathematical and/or statistical procedures to extensively investigate a problem.
	Communicates mathematical reasoning, interprets results and draws conclusions Sets out the steps of the solution in a succinct and logical sequence, including suitable justification and explanation of methods and processes used. Uses mathematical notation and terminology correctly, and consistently applies units and appropriate rounding. Interprets mathematical results and draws conclusions in the context of the problem. Comprehensively interprets and clearly communicates mathematical findings in the context of an investigation. Identifies the strengths and limitations of an investigation and includes some consideration of these when drawing conclusions.
B	**Interprets the task, identifies and organises relevant information, and chooses strategies** Identifies and organises relevant information for problems involving a few steps or processes. Selects an appropriate strategy and demonstrates mathematical conventions to solve non-routine, familiar and/or partly structured problems. Clarifies an investigative task, identifies the key information and some assumptions, and mostly chooses the appropriate mathematics.
	Uses mathematical knowledge and understanding to obtain solutions Produces mostly accurate and complete solutions for mathematical problems set in practical contexts. Navigates between numerical, graphical and symbolic representations appropriately to solve problems in familiar contexts. Uses digital tools and their appropriate functionalities effectively to solve problems in familiar contexts. Applies changed conditions and attempts to determine the effect on the solution. Applies some depth of knowledge and understanding of mathematical and/or statistical procedures to investigate a problem.

	Communicates mathematical reasoning, interprets results and draws conclusions Sets out the steps of the solution in a logical sequence, including some justification and explanation of methods and processes used. Uses mathematical notation, terminology and units correctly most of the time, and uses appropriate rounding. Interprets most mathematical results and draws conclusions in the context of the problem. Interprets and communicates mathematical findings in the context of an investigation. Attempts to identify the limitations of an investigation.

C	**Interprets the task, identifies and organises relevant information, and chooses strategies** Identifies and extracts key information needed to solve a familiar problem. Selects an appropriate strategy and demonstrates mathematical conventions to solve routine, familiar and/or structured problems. Clarifies an investigative task, identifies the key information, and mostly chooses appropriate mathematics.
	Uses mathematical knowledge and understanding to obtain solutions Produces some accurate and mostly complete solutions to mathematical problems set in practical contexts. Recognises and uses numerical, graphical and symbolic representations appropriately to solve routine problems. Uses digital tools and their appropriate functionalities to solve routine problems. Applies changed conditions to determine a solution in routine problems. With direction, applies knowledge and understanding of mathematical and/or statistical procedures to investigate a problem.
	Communicates mathematical reasoning, interprets results and draws conclusions Sets out the steps of the solution and supports methods and processes with simple or routine statements. Demonstrates some correct use of mathematical notation, terminology and units, and appropriate rounding. Interprets some mathematical results and draws some conclusions in the context of the problem. Communicates mathematical findings in the context of an investigation.
D	**Interprets the task, identifies and organises relevant information, and chooses strategies** Uses given information to solve simple, routine problems. Selects inappropriate strategies and/or demonstrates limited mathematical conventions in an attempt to solve familiar problems. Clarifies an investigative task, identifies some key information and chooses some appropriate mathematics.
	Uses mathematical knowledge and understanding to obtain solutions Produces partly accurate and incomplete solutions to mathematical problems set in practical contexts. Uses digital tools in an attempt to solve routine problems. Attempts to apply changed conditions to determine a solution in routine problems. With direction, attempts to apply mathematical and/or statistical procedures to investigate a problem.

	Communicates mathematical reasoning, interprets results and draws conclusions Attempts to set out the steps of the solution. Displays limited use of mathematical notation, terminology, units and appropriate rounding. Displays limited interpretation of mathematical results and conclusions not clearly formulated. Communicates minimal findings from the results of an investigation.

E	Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.

*These grade descriptions will be reviewed at the end of the second year of implementation of this syllabus.

Appendix 2 – Glossary

This glossary is provided to enable a common understanding of the key terms in this syllabus.

Unit 1

Graphs networks and matrices

Networks and graphs

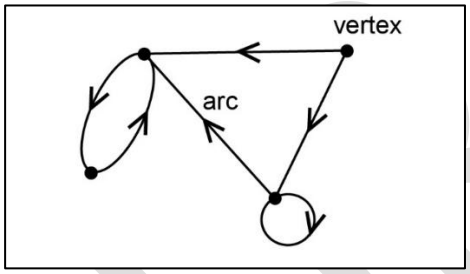
Bridge
A bridge is an edge in a connected graph that, if removed, leaves a graph disconnected.

Complete graph
A complete graph is a simple graph in which every vertex is joined to every other vertex by an edge.

Connected graph
A graph is connected if there is a path between each pair of vertices.

Cycle
A cycle is a closed path that begins and ends at the same vertex, and that has no repeated edges or vertices except the first.

Directed graph
A directed graph is a diagram comprising points called vertices, joined by directed lines called arcs. The directed graphs are commonly called digraphs.



Euler's formula
For a connected planar graph, Euler's rule states that $v + f - e = 2$, where v is the number of vertices, e is the number of edges and f is the number of faces.

Eulerian circuit
An Eulerian circuit is a closed trail that covers all edges exactly once (vertices may be revisited).

Eulerian graph
An Eulerian graph is a connected graph that contains an Eulerian circuit. See also Semi-Eulerian graph.

Hamiltonian cycle
A Hamiltonian cycle is a closed path that visits every vertex, except the first vertex, exactly once (no edge may be repeated).

Hamiltonian graph
A Hamiltonian graph is a connected graph that contains a Hamiltonian cycle. See also Semi-Hamiltonian graph.

Hamiltonian path
A Hamiltonian path is an open path that visits every vertex exactly once (no edge may be repeated).

Path (in a graph)
A path in a graph is a sequence of edges between vertices where no edge or vertex is revisited. A path that starts and finishes at the same vertex is said to be closed.

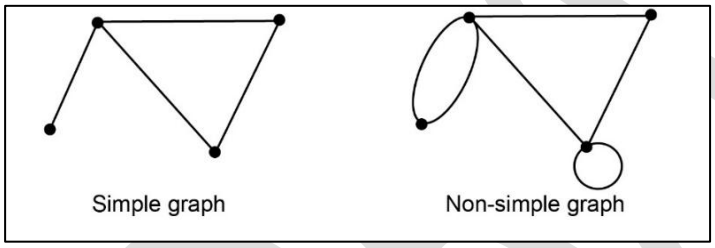
Planar graph
A planar graph is a graph that can be drawn in the plane. A planar graph can always be drawn so that no two edges cross.

Semi-Eulerian graph
A Semi-Eulerian graph is a connected graph that contains a Semi-Eulerian trail but not an Eulerian circuit. See also Eulerian graph.

Semi-Eulerian trail
A Semi-Eulerian trail is an open trail that covers all edges exactly once (vertices may be revisited).

Semi-Hamiltonian graph
A Semi-Hamiltonian graph is a connected graph that contains a Hamiltonian path. See also Hamiltonian graph.

Simple graph
A simple graph has no loops, and no pair of vertices are joined by multiple edges.



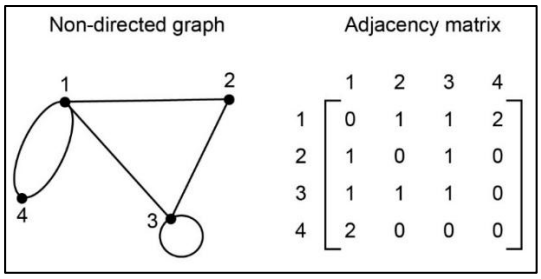
Subgraph
A subgraph is a series of vertices connected by edges that form part of a larger graph.

Trail
A trail in a graph is a sequence of edges between vertices where no edge is revisited. A trail that starts and finishes at the same vertex is said to be closed.

Matrices

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.

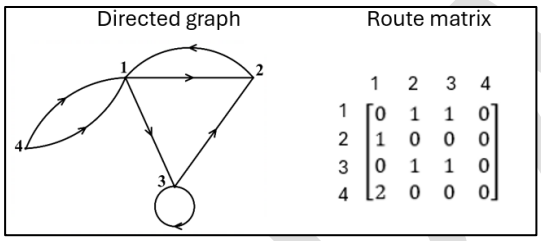


Matrix

A matrix is a rectangular array of elements or entities displayed in rows and columns.

Route matrix

A route matrix for a 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 ways to travel from vertices i to j.



Functions and formulas

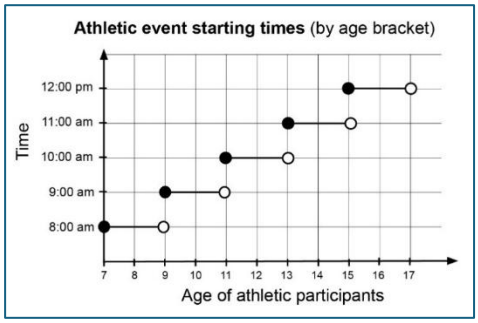
Linear functions

Linear graph

A linear graph is a graph of a linear equation with two variables. If the linear equation is written in the form $y = a + bx$, then a represents the y-intercept and b represents the slope (or gradient) of the linear graph.

Step graph

A graph consisting of one or more non-overlapping horizontal line segments that follow a step-like pattern.



Financial mathematics

Earning, spending and investing

Capital gain or loss
The amount of money gained or lost from the selling of an asset.

Exchange traded funds (ETFs)
Exchange traded funds (ETFs) are open-ended investment funds that pool money from investors to buy a portfolio of underlying assets, such as shares, bonds and commodities.

Government support payments
Financial assistance to eligible individuals to supplement living costs.

GST
The GST (Goods and Services Tax) is a sales tax of 10% added on to goods and services transactions in Australia.

Pay day loans
Small, short-term loans that attract high interest rates and/or fees.

Percentage return
The amount of money gained or lost from selling an asset, expressed as a percentage of the original cost.

Superannuation
A compulsory investment fund into which payments are made to ensure that individuals are financially secure when they retire. Employers pay into this fund based on a percentage of the employee's income and employees may choice to contribute additional amounts.

Unit 2

Univariate data analysis

The statistical investigation process

The statistical investigation process is a cyclical process that involves:

- identifying a real-world problem and formulating some statistical questions for which data can be collected (including consideration of assumptions relevant to the problem)
- designing and implementing a plan to collect or obtain data
- analysing the data using appropriate graphical and numerical techniques
- interpreting the results of the analysis and relating the interpretation to the original real-world problem
- communicating the findings in a systematic and concise manner.

Making sense of data

Outlier
An outlier in a set of data is a data point that appears to be inconsistent with the remainder of that set of data.

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 the mean. Calculation of standard deviation should be done using appropriate technology.

Measurement and scale

Three-dimensional structures

Measurement error
The difference between the actual value and the value calculated based on measured and/or rounded values. Measurement error can be expressed as an absolute value or as a percentage.

Graphical applications

Exponential functions

Growth/decay factor
For an exponential equation in the form $A = kr^t$, the growth/decay factor is the value r, where $0 < r < 1$ indicates decay and $r > 1$ indicates growth.

Initial value
For an exponential equation in the form $A = kr^t$, the initial value, k, occurs when $t = 0$.