



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

# MATHEMATICS ESSENTIAL

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General course

**Year 12 syllabus for teaching from 2027**

**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 2027.

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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## Overview of Mathematics courses

There are six mathematics courses. Each course is organised into four units, with Unit 1 and Unit 2 being taken in Year 11 and Unit 3 and Unit 4 in Year 12. The ATAR course examination for each of the three ATAR courses is based on Unit 3 and Unit 4 only.

The courses are differentiated, each focusing on a pathway that will meet the learning needs of a particular group of senior secondary students.

**Mathematics Preliminary** is a course which focuses on the practical application of knowledge, skills and understandings to a range of environments that will be accessed by students with special education needs. Grades are not assigned for these units. Student achievement is recorded as 'completed' or 'not completed'. This course provides the opportunity for students to prepare for post-school options of employment and further training.

**Mathematics Foundation** is a course which focuses on building the capacity, confidence and disposition to use mathematics to meet the numeracy standard for the WACE. It provides students with the knowledge, skills and understanding to solve problems across a range of contexts, including personal, community and workplace/employment. This course provides the opportunity for students to prepare for post-school options of employment and further training.

**Mathematics Essential** is a General course which focuses on using mathematics effectively, efficiently and critically to make informed decisions. It provides students with the mathematical knowledge, skills and understanding to solve problems in real contexts for a range of workplace, personal, further learning and community settings. This course provides the opportunity for students to prepare for post-school options of employment and further training.

**Mathematics Applications** is an ATAR course which focuses on the use of mathematics to solve problems in contexts that involve financial modelling, geometric and trigonometric analysis, graphical and network analysis, and growth and decay in sequences. It also provides opportunities for students to develop systematic strategies based on the statistical investigation process for answering statistical questions that involve analysing univariate and bivariate data, including time series data.

**Mathematics Methods** is an ATAR course which focuses on the use of calculus and statistical analysis. The study of calculus provides a basis for understanding rates of change in the physical world, and includes the use of functions, their derivatives and integrals, in modelling physical processes. The study of statistics develops students' ability to describe and analyse phenomena that involve uncertainty and variation.

**Mathematics Specialist** is an ATAR course which provides opportunities, beyond those presented in the Mathematics Methods ATAR course, to develop rigorous mathematical arguments and proofs, and to use mathematical models more extensively. The Mathematics Specialist ATAR course contains topics in functions and calculus that build on and deepen the ideas presented in the Mathematics Methods ATAR course as well as demonstrate their application in many areas. The Mathematics Specialist ATAR course also extends understanding and knowledge of statistics and introduces the topics of vectors, complex numbers and matrices. The Mathematics Specialist ATAR course is the only ATAR mathematics course that should not be taken as a stand-alone course.

## Rationale

The Mathematics Essential General course develops students' ability to apply mathematics effectively, efficiently and critically in personal, community and workplace settings. The course integrates mathematical and statistical thinking, helping students develop confidence in solving real-world problems.

The course focuses on enabling students to use mathematics in everyday contexts and make informed decisions in their daily lives. It develops students' practical mathematical skills through measurement, scales and models, interpreting graphs, collecting and analysing data, applying probability and statistics, calculating time zones and travel schedules, and developing financial literacy.

Students develop numeracy, analytical and reasoning skills to solve real-world problems. They gain fluency in calculations, statistical interpretation, financial decision-making and measurement analysis, while refining their ability to clearly communicate mathematical reasoning.

Students apply their mathematical knowledge in practical scenarios, such as managing finances (comparing loan options and calculating compound interest), workplace problem-solving (measurement quantities, materials and costs for building, and scale drawings of house plans), travel and navigation (interpreting time zones, scheduling and distances), and data analysis (reading graphs, making predictions and evaluating trends).

The Mathematics Essential General course provides a foundation for vocational education and training, apprenticeships, traineeships and employment. The numeracy skills developed are valuable in trades, retail, hospitality, administration, community services and any career path where practical mathematics is essential. By strengthening their problem-solving abilities, the course prepares students for further education and career success.

## Aims

The Mathematics Essential General course aims to develop students':

- understanding and application of key mathematical and statistical concepts in real-world contexts
- practical problem-solving skills, using mathematical reasoning, estimation and problem-solving techniques, including the effective use of digital tools
- interpretation and analysis of numerical and statistical information to make informed decisions
- ability to communicate mathematical ideas clearly and systematically, using appropriate terminology and representations.

## 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 12 syllabus is divided into two units which are delivered as a pair. The notional time for the pair of units is 110 class contact hours.

### Unit 3

This unit includes the following four topics:

- Measurement
- Scales, plans and models
- Graphs in practical situations
- Data collection

### Unit 4

This unit includes the following three topics:

- Probability and relative frequencies
- Earth geometry and time zones
- Loans and compound interest

Each unit includes:

- a unit description – a short description of the focus of the unit and suggested contexts through which the content could be taught
- 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, including examples in context which emphasise the intent of the course.

Throughout each unit, students apply the mathematical thinking process to real-world problems

- interpret the task and gather the key information
- identify the mathematics which could help to complete the task
- analyse information and data from a variety of sources
- apply existing mathematical knowledge and strategies to obtain a solution
- verify the reasonableness of the solution
- communicate findings in a systematic and concise manner.

Students apply the statistical investigation process to real-world tasks

- clarify the problem and pose one or more questions that can be answered with data
- design and implement a plan to collect or obtain appropriate data
- select and apply appropriate graphical or numerical techniques to analyse the data
- interpret the results of this analysis and relate the interpretation to the original question
- communicate findings in a systematic and concise manner.

## Organisation of content

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

Teachers are advised to apply the content of all topics in contexts which are meaningful and of interest to the students. Possible contexts for this unit are Construction and design, and Medicine.

Unit 4 provides students with the mathematical skills and understanding to solve problems related to probability, earth geometry and time zones, loans and compound interest. Teachers are advised to apply the content of all topics in contexts which are meaningful and of interest to the students.

Possible contexts for this unit are Finance, and Travel. However these contexts may not be relevant for all students and teachers are encouraged to find a suitable context that will make the mathematical topics of this unit relevant for their particular student cohort.

## Role of technology

It is assumed that students will be taught the Mathematics Essential General course with a range of technological applications and techniques. If appropriately used, these 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 be able to choose when, or when not, to use some form of technology and to be able to work flexibly with technology are important skills in this course.

## 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 Essential General course.

### Critical and creative thinking

Students have opportunities to use their mathematical knowledge, skills and understanding to solve problems in personal, workplace, community and further learning contexts. They identify and examine relevant information from a range of sources, including visual information and digital sources, and evaluate the accuracy and validity of the information. Students draw on their mathematical knowledge to make choices that will help reach a conclusion.

### Digital literacy

Students use digital tools to apply mathematical knowledge to a range of problems. They use digital tools for statistical analysis, data representation and calculation, as well as in performing simulations and in locating positions. Students use software to visualise, manipulate and construct scale drawings and shapes in design, and use spreadsheets to tabulate and graph data.

## Literacy

Students develop literacy skills through reading, writing, visualising and talking about situations involving a range of mathematical ideas. They apply and further develop their literacy skills and strategies by shifting between verbal, written and spoken, graphic, 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 and data displays to illustrate the relationships they have observed or constructed.

## Numeracy

Students develop numeracy skills in the course by equipping them with the knowledge, confidence and reasoning needed to apply mathematics in real-world contexts. With a focus on financial literacy, measurement, data analysis and proportional reasoning, students learn to interpret information, solve problems and make informed decisions in personal, workplace and community settings. This practical approach supports their ability to transfer mathematical skills across different contexts, preparing them for employment, further education and everyday life.

## Addressing the other General Capabilities

Although the following General Capabilities have not been identified as a focus in the Mathematics Essential General Year 12 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 Essential General 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 Essential (GEMAE) | General     | ✓                    | ✓  |    |    | ✓ | ✓ |     |
| Year 12 | Mathematics Essential (GTMAE) | General     | ✓                    | ✓  |    |    | ✓ | ✓ |     |

### 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 which students face in a globalised world. Teachers may find opportunities to incorporate them into the teaching and learning program for the Mathematics Essential General 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' past and ongoing contributions to contemporary Australian society and culture. Through the study of mathematics within relevant contexts, opportunities may allow for the development of students' 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. Through analysis of relevant data, students are provided with opportunities to further develop an understanding of the diverse nature of Asia's environments and traditional and contemporary cultures.

### Sustainability

The Mathematics Essential General course provides the opportunity for the development of informed and reasoned points of view, discussion of issues, research and problem solving. Therefore, teachers are encouraged to select contexts for discussion connected with sustainability. Through analysis of data, students have the opportunity to research and discuss this global issue and learn the importance of respecting and valuing a wide range of world perspectives.

## Unit 3

### Unit description

This unit provides students with the mathematical skills and understanding to solve problems related to measurement, scales, plans and models, drawing and interpreting graphs and data collection. Students use the mathematical thinking process and apply the statistical investigation process. Teachers are encouraged to apply the content of the four topics in this unit: Measurement; Scales, plans and models; Graphs in practical situations; and Data collection, in a context which is meaningful and of interest to the students. A variety of approaches could be used to achieve this purpose. Possible contexts for this unit are Construction and design, and Medicine.

It is assumed that an extensive range of technological applications and techniques will be used in teaching this unit. 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.

The number formats for the unit are positive and negative numbers, decimals, fractions, percentages, rates, ratios, square and cubic numbers written with powers and square roots.

### Learning outcomes

By the end of this unit, students:

- understand the concepts and techniques used in measurement, scales, plans and models, graphs and data collection
- apply reasoning skills and solve practical problems in measurement, scales, plans and models, graphs and data collection
- 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.

### Unit content

An understanding of the Year 11 content is assumed knowledge for students in Year 12.

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

For topics 3.1, 3.2 and 3.3 students apply the mathematical thinking process to real-world problems relating to the topic content.

Students:

- interpret the task and gather the key information
- identify the mathematics which could help to complete the task
- analyse information and data from a variety of sources
- apply existing mathematical knowledge and strategies to obtain a solution
- verify the reasonableness of the solution
- communicate findings in a systematic and concise manner.

## Topic 3.1: Measurement (15 hours)

### Linear measure

- 3.1.1 extend the calculation of perimeters to include polygons, circles and composites of familiar shapes

### Area measure

- 3.1.2 calculate areas of parallelograms, trapeziums, circles and semi-circles
- 3.1.3 determine the area of composite figures by decomposition into familiar shapes
- 3.1.4 determine the surface area of familiar solids, including, cubes, rectangular and triangular prisms, spheres and cylinders
- 3.1.5 use addition of the area of the faces of solids to determine the surface area of composite solids

Examples in context – Area measure:

- calculating surface area of various buildings to compare costs of external painting

### Volume and capacity

- 3.1.6 recognise relations between volume and capacity, recognising that  $1 \text{ cm}^3 = 1 \text{ mL}$  and  $1 \text{ m}^3 = 1 \text{ kL}$
- 3.1.7 calculate the volume and capacity of cylinders, pyramids and spheres

Examples in context – Volume and capacity:

- interpreting dosages for children and adults from dosage panels on medicines, given age or weight
- calculating and interpreting dosages for children from adults' medication using various formulas (Fried, Young, Clark) in millilitres
- comparing the capacity of rainwater tanks

## Topic 3.2: Scales, plans and models (15 hours)

### Geometry

- 3.2.1 recognise the properties of common two-dimensional geometric shapes and three-dimensional solids
- 3.2.2 interpret different forms of two-dimensional representations of three-dimensional objects, including nets and perspective diagrams
- 3.2.3 use terminology of geometric shapes; for example, point, line, angle, diagonal, edge, curve, face and vertex, parallel and perpendicular

### Interpret scale drawings

- 3.2.4 interpret commonly used symbols and abbreviations in scale drawings
- 3.2.5 determine actual measurements of angle, perimeters and areas from scale drawings
- 3.2.6 estimate and compare quantities, materials and costs using actual measurements from scale drawings, for example using measurements for packaging, clothes, painting, bricklaying and landscaping

**Creating scale drawings**

- 3.2.7 understand and apply drawing conventions of scale drawings, such as scales in ratio, dimensions and labelling
- 3.2.8 construct scale drawings by hand and by using appropriate software/technology

**Three dimensional objects**

- 3.2.9 interpret plans and elevation views of models
- 3.2.10 sketch elevation views of different models
- 3.2.11 interpret diagrams of three-dimensional objects

**Right-angled triangles (no bearings)**

- 3.2.12 apply Pythagoras' theorem to solve problems in practical two-dimensional views
- 3.2.13 apply the tangent ratio to determine unknown angles and sides in right-angled triangles
- 3.2.14 work with the concepts of angle of elevation and angle of depression
- 3.2.15 apply the cosine and sine ratios to determine unknown angles and sides in right-angle triangles
- 3.2.16 solve problems involving trigonometric ratios in practical two-dimensional views

Examples in context – Scales, plans and models:

- drawing scale diagrams of everyday two-dimensional shapes
- interpreting common symbols and abbreviations used on house plans
- using the scale on a plan to calculate actual external or internal dimensions, the lengths of the house and the dimensions of particular rooms
- using technology to translate two-dimensional house plans into three-dimensional buildings
- creating landscape designs using technology

**Topic 3.3: Graphs in practical situations (10 hours)****Cartesian plane**

- 3.3.1 demonstrate familiarity with Cartesian co-ordinates in two dimensions by plotting points on the Cartesian plane
- 3.3.2 generate tables of values for linear functions drawn from practical contexts
- 3.3.3 graph linear functions drawn from practical contexts with pencil and paper and with graphing software

**Using graphs**

- 3.3.4 interpret and use graphs in practical situations, including travel graphs, time series and conversion graphs
- 3.3.5 draw graphs from given data to represent practical situations
- 3.3.6 describe trend as increasing or decreasing for time series data
- 3.3.7 identify the rate of change of the dependent variable, relating it to the difference pattern in a table and the slope of an associated line drawn from practical contexts
- 3.3.8 determine and describe the significance of the vertical intercept in practical situations
- 3.3.9 use the rate of change and the initial value to determine the linear relationship in practical situations
- 3.3.10 interpret the point of intersection and other important features of given graphs of two linear functions drawn from practical contexts; for example, the 'break-even' point

Examples in context – Graphs in practical situations:

- interpreting graphs showing growth ranges for children (height or weight or head circumference versus age)
- interpreting hourly hospital charts showing temperature and pulse
- interpreting graphs showing life expectancy with different variables

For topic 3.4 students apply the statistical investigation process to real-world tasks relating to the topic content.

Students:

- clarify the problem and pose one or more questions that can be answered with data
- design and implement a plan to collect or obtain appropriate data
- select and apply appropriate graphical or numerical techniques to analyse the data
- interpret the results of this analysis and relate the interpretation to the original question
- communicate findings in a systematic and concise manner.

**Topic 3.4: Data collection (15 hours)****Census**

- 3.4.1 investigate the procedure for conducting a census
- 3.4.2 investigate the advantages and disadvantages of conducting a census

**Surveys**

- 3.4.3 understand the purpose of sampling to provide an estimate of population values when a census is not used
- 3.4.4 investigate the different kinds of samples, for example, systematic samples, self-selected samples, simple random samples
- 3.4.5 recognise the advantages and disadvantages of these kinds of samples; for example, comparing simple random samples with self-selected samples

**Simple survey procedure**

- 3.4.6 identify the target population to be surveyed
- 3.4.7 investigate questionnaire design principles; for example, simple language, unambiguous questions, consideration of number of choices, issues of privacy and ethics, freedom from bias

**Sources of bias**

- 3.4.8 describe the faults in the collection of data process
- 3.4.9 describe sources of error in surveys; for example, sampling error and measurement error
- 3.4.10 describe possible misrepresentation of the results of a survey due to the unreliability of generalising the survey findings to the entire population, for example, because of limited sample size or chance variation between samples
- 3.4.11 describe errors and misrepresentation of the results of a survey, including examples of media misrepresentations of surveys and the manipulation of data to serve different purposes

**Bivariate scatterplots**

- 3.4.12 describe the patterns and features of bivariate data
- 3.4.13 describe the association between two numerical variables in terms of direction (positive/negative), form (linear/non-linear) and strength(strong/moderate/weak)

**Trend lines**

- 3.4.14 identify the dependent and independent variable
- 3.4.15 fit a trend line by eye
- 3.4.16 interpret relationships in terms of the variables, for example, describe trend as increasing or decreasing
- 3.4.17 use the trend line to make predictions, both by interpolation and extrapolation
- 3.4.18 recognise the dangers of extrapolation
- 3.4.19 distinguish between causality and association through examples

Examples in context:

- analysing data obtained from medical sources, including bivariate data
- analysing and interpreting tables and graphs that compare body ratios, such as hip height versus stride length, foot length versus height

## Unit 4

### Unit description

This unit provides students with the mathematical skills and understanding to solve problems related to probability, earth geometry and time zones, loans and compound interest. Students use the mathematical thinking process and apply the statistical investigation process to solve problems involving probability. Teachers are advised to apply the content of the three topics in this unit: Probability and relative frequencies; Earth geometry and time zones; and Loans and compound interest, in a context which is meaningful and of interest to the students. Possible contexts for this unit are Finance, and Travel.

It is assumed that an extensive range of technological applications and techniques will be used in teaching this unit. 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.

The number formats for the unit are positive and negative numbers, decimals, fractions, percentages, rates, ratios and numbers expressed with integer powers.

### Learning outcomes

By the end of this unit, students:

- understand the concepts and techniques used in probability and relative frequencies, earth geometry and time zones, loans and compound interest
- apply reasoning skills and solve practical problems in probability and relative frequencies, earth geometry and time zones, loans and compound interest
- communicate their arguments and strategies when solving mathematical problems using appropriate mathematical or statistical language
- interpret mathematical information and ascertain the reasonableness of their solutions to problems.

### Unit content

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

For topic 4.1 students apply the statistical investigation process to real-world tasks relating to the topic content.

Students:

- clarify the problem and pose one or more questions that can be answered with data
- design and implement a plan to collect or obtain appropriate data
- select and apply appropriate graphical or numerical techniques to analyse the data
- interpret the results of this analysis and relate the interpretation to the original question
- communicate the findings in a systematic and concise manner.

## Topic 4.1: Probability and relative frequencies (20 hours)

### Probability expressions

- 4.1.1 interpret commonly used probability statements, including 'possible', 'probable', 'likely', 'certain'
- 4.1.2 describe ways of expressing probabilities formally using fractions, decimals, ratios and percentages

### Simulations

- 4.1.3 perform simulations of experiments using technology
- 4.1.4 recognise that the repetition of chance events is likely to produce different results
- 4.1.5 recognise the law of large numbers and identify relative frequency as probability
- 4.1.6 identify factors that may cause the simulation to no longer model the real world event

### Simple probabilities in practical situations

- 4.1.7 construct a sample space for an experiment which represents a practical situation
- 4.1.8 use a sample space to determine the probability of outcomes for an experiment
- 4.1.9 use arrays or tree diagrams to determine the outcomes and the probabilities for experiments

### Probability applications

- 4.1.10 identify situations in real-life contexts where probability is used for decision making
- 4.1.11 determine and use probabilities (relative frequencies) from given data to predict proportions and the number of outcomes that are likely to occur

Examples in context:

- using data to calculate the relative frequencies of the different countries of origin of visitors to a particular tourist venue or country
- using data to calculate the relative frequencies of the amounts of household expenditure
- using data to predict the number of people likely to be infected with a strain of flu or experience side effects with a certain medication

For topics 4.2 and 4.3 students apply the mathematical thinking process to real-world problems relating to the topic content.

Students:

- interpret the task and gather the key information
- identify the mathematics which could help to complete the task
- analyse information and data from a variety of sources
- apply existing mathematical knowledge and strategies to obtain a solution
- verify the reasonableness of the solution
- communicate findings in a systematic and concise manner.

## Topic 4.2: Earth geometry and time zones (15 hours)

### Location

- 4.2.1 locate positions on the earth's surface given latitude and longitude using a range of methods; for example, a global positioning system (GPS), a globe, an atlas and digital technologies
- 4.2.2 use the arc length formula to calculate distances between two places on Earth on the same longitude
- 4.2.3 determine distances between two places on Earth using appropriate technology

### Time

- 4.2.4 understand the link between longitude and time
- 4.2.5 solve problems involving time zones in Australia and neighbouring nations making any necessary allowances for daylight saving
- 4.2.6 solve problems involving Greenwich Mean Time and the International Date Line
- 4.2.7 determine time differences between two places on Earth
- 4.2.8 solve problems associated with time zones; for example, internet and phone usage
- 4.2.9 solve problems relating to travelling east and west, incorporating time zone changes

Examples in context:

- plan for a phone call/skype to an interstate/international location, including daylight saving conditions
- plan a schedule for interstate travel, including daylight saving conditions
- design an itinerary involving up to five different places in the world accounting for distances between places, mode of transport: by air, land or sea, arrival and departure times, international time zones, climate/seasonal changes
- use a GPS application to determine time and distance between two locations

## Topic 4.3: Loans and compound interest (20 hours)

### Compound interest

- 4.3.1 review the principles of simple interest
- 4.3.2 understand the concept of compound interest as a recurrence relation
- 4.3.3 consider similar problems involving compounding; for example, population growth
- 4.3.4 use technology to calculate the future value of a compound interest loan or investment and the total interest paid or earned
- 4.3.5 use technology to compare, numerically and graphically, the growth of simple interest and compound interest loans and investments
- 4.3.6 use technology to investigate the effect of changing the interest rate and the number of compounding periods on the future value of a loan or investment

**Reducing balance loans (compound interest loans with periodic repayments)**

4.3.7 use technology and a recurrence relation to model a reducing balance loan

4.3.8 investigate the effect of the interest rate and repayment amount on the time taken to repay a loan

Examples in context:

- using formula, graphs and spreadsheets to calculate the outcomes of investment accounts with compound interest
- using percentages, rates and spreadsheets to investigate personal loan calculations
- calculating and analysing the costs, hidden traps, advantages and disadvantages for payment plans with interest free periods using rates and percentages

## School-based assessment

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

Teachers design school-based assessment tasks to meet the needs of students. The table below provides details of the assessment types for the Mathematics Essential General Year 12 syllabus and the weighting for each assessment type.

### Assessment table – Year 12

| Type of assessment                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Weighting |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>Response</b><br>Students apply mathematical knowledge and understanding of concepts and relationships to solve a mix of routine and non-routine questions in real-life contexts.<br>Response tasks can include: tests, assignments and multimedia representations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 40%       |
| <b>Practical applications</b> (included in both Unit 3 and Unit 4)<br>Students are required to practically apply mathematics understandings and skills using the mathematical thinking process to develop solutions or arrive at conclusions, to real-world tasks.<br>Evidence should include data and information sources, mathematical strategies/calculations and a written solution or conclusion.<br>Evidence forms can include: written work, observation checklists, spreadsheets, pictures, diagrams, tables or graphs, media, photographs, video and/or models created by the student.<br><b>Statistical investigation process</b><br>Students apply the statistical investigation process to solve real-world problems in Unit 3 and with a focus on probability for Unit 4.<br>Evidence should include data collection, information sources, statistical/probability analysis and a written conclusion.<br>Evidence forms can include: written work, spreadsheets, tables and graphs.<br><b>Note:</b> Tasks can be of short or long duration.<br>While these assessment tasks may require scaffolding, eventually responsibility is given to the student to select and use appropriate mathematics/statistics. | 45%       |
| <b>Externally set task</b><br>A written task or item or set of items of 50 minutes duration developed by the School Curriculum and Standards Authority and administered by the school.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 15%       |

Teachers are required to use the assessment table to develop an assessment outline for the pair of units.

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).

In the assessment outline for the pair of units, each assessment type must be included at least once over the year/pair of units. The externally set task occurs in Term 2.

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

The set of assessment tasks must provide a representative sampling of the content for Unit 3 and Unit 4.

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

## Externally set task

All students enrolled in the Mathematics Essential General Year 12 course will complete the externally set task developed by the Authority. Schools are required to administer this task in Term 2 at a time prescribed by the Authority.

### Externally set task design brief – Year 12

|                |                                                                                                                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|
| <b>Time</b>    | 50 minutes                                                                                                                      |
| <b>Format</b>  | Written                                                                                                                         |
|                | Conducted under invigilated conditions                                                                                          |
|                | Typically between four and eight questions                                                                                      |
|                | Questions may require students to refer to source material                                                                      |
| <b>Content</b> | The Authority informs schools during Term 3 of the previous year of the Unit 3 syllabus content on which the task will be based |

Refer to the *WACE Manual* for further information.

## Grading

Schools report student achievement in terms of the following grades:

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

The teacher prepares a ranked list and assigns the student a grade for the pair of units. The grade is based on the student's overall performance as judged by reference to a set of pre-determined standards. These standards are defined by grade descriptions and annotated work samples. The grade descriptions for the Mathematics Essential General Year 12 syllabus are provided in Appendix 1. They can also be accessed, together with annotated work samples, through the Guide to Grades link on the course page of the Authority website at [www.scsa.wa.edu.au](http://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.

## Appendix 1 – Grade descriptions Year 12

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| A | <b>Interpret the tasks and choose the maths</b><br>Identifies relevant information from multiple sources or within concentrated sources.<br>Chooses the appropriate mathematical and statistical investigation techniques to solve a range of problems in unstructured situations.                                                                                                                                                                                                                                             |
|   | <b>Apply mathematical knowledge to obtain a solution</b><br>Incorporates information from multiple sources and demonstrates a systematic approach to accurately solve multi-step problems, including those from unfamiliar situations.<br>Uses appropriate data collection techniques, and recognises and adjusts for sources of bias or inconsistencies in data.<br>Modifies calculated results or conclusions when conditions are changed.<br>Verifies the reasonableness of solutions and makes adjustments when necessary. |
|   | <b>Interpret and communicate</b><br>Uses accurate mathematical and statistical language and expressions to communicate methods and solutions to multi-step problems.<br>Accesses a comprehensive range of mathematical and statistical concepts to validate conclusions which are related to the original question or context.                                                                                                                                                                                                 |
| B | <b>Interpret the tasks and choose the maths</b><br>Identifies and links more than one piece of information.<br>Chooses the appropriate mathematical and statistical investigation techniques to solve problems in mostly familiar and sometimes unstructured situations.                                                                                                                                                                                                                                                       |
|   | <b>Apply mathematical knowledge to obtain a solution</b><br>Applies information and calculates mostly accurate solutions for multi-step problems.<br>Applies appropriate graphing techniques and determines appropriate scales based on the data.<br>Uses appropriate data collection techniques and recognises sources of bias or inconsistencies in data.<br>Incorporates some changed conditions when solving problems in familiar situations.<br>Checks calculated results and makes adjustments where necessary.          |
|   | <b>Interpret and communicate</b><br>Accesses a range of mathematical and statistical concepts to communicate solutions and justify conclusions which relate to the original question or context, including for some non-routine problems.                                                                                                                                                                                                                                                                                      |

|   |                                                                                                                                                                                                                                                                                                                                                                                                     |
|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| C | <p><b>Interpret the tasks and choose the maths</b><br/>Identifies relevant information and chooses the appropriate mathematics, or statistical concepts to solve a problem in straightforward or familiar situations.<br/>Plans the solution of real problems in Practical applications and Statistical investigations when an overview of the mathematical thinking process has been provided.</p> |
|   | <p><b>Apply mathematical knowledge to obtain a solution</b><br/>Applies information and calculates mostly accurate solutions for problems in familiar situations involving one or more steps.<br/>Applies appropriate graphing and data collection techniques.<br/>Rounds to an appropriate level for everyday contexts.<br/>Seldom checks results in the light of the original problem.</p>        |
|   | <p><b>Interpret and communicate</b><br/>Shows working, including intermediate steps and/or expressions entered into a calculator or spreadsheet.<br/>Provides short statements based on straightforward observations which are related to the original question or context.</p>                                                                                                                     |
| D | <p><b>Interpret the tasks and choose the maths</b><br/>Identifies some relevant information and sometimes chooses the appropriate mathematics, or statistical concepts to solve a problem in straightforward or familiar situations.</p>                                                                                                                                                            |
|   | <p><b>Apply mathematical knowledge to obtain a solution</b><br/>Applies information and calculates some accurate solutions for routine and practised problems with one or more steps.<br/>Uses appropriate graphing techniques with support.<br/>Rarely, checks results.</p>                                                                                                                        |
|   | <p><b>Interpret and communicate</b><br/>Shows limited working, including some intermediate steps and/or expressions entered into a calculator or spreadsheet.<br/>Provides short statements which may not be related to the original question or context.</p>                                                                                                                                       |
| E | <p>Does not meet the requirements of a D grade and/or has completed insufficient assessment tasks to be assigned a higher grade.</p>                                                                                                                                                                                                                                                                |

## Appendix 2 – Glossary

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

### Unit 3

#### Measurement

##### Capacity

Capacity versus volume. Volume refers to the space taken up by an object itself, while capacity refers to the amount of a liquid or other pourable substance a container can (or does) hold.

##### Clark's formula

A formula used to calculate the dosage of medicine for children aged 2-17 years (general) when given only the adult dose.

$$\text{Dosage for children (general formula)} = \text{adult dosage} \times \frac{\text{weight (in kg)}}{70}$$

##### Fried's formula

A formula used to calculate the correct dose of medication for a child aged 1-2 years when given only the adult dose.

$$\text{Dosage for children (1–2 years)} = \text{adult dosage} \times \frac{\text{age (in months)}}{150}$$

##### Young's formula

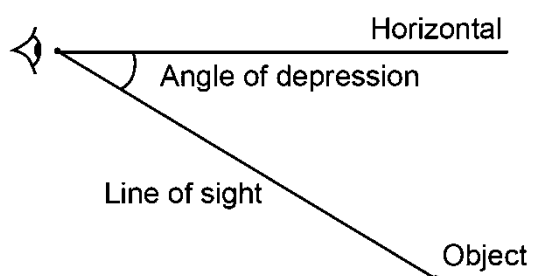
A formula used to calculate the dose of medication for a child under 12 years of age when given only the adult dose.

$$\text{Dosage for children (2–12) years} = \text{adult dosage} \times \frac{\text{age (in years)}}{\text{age (in years)} + 12}$$

#### Scales, plans and models

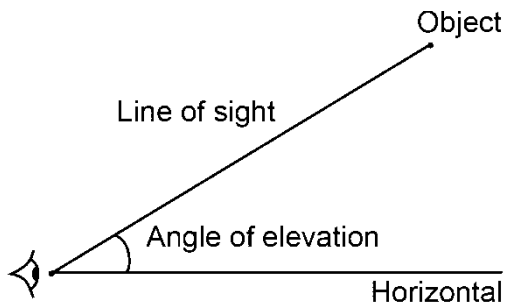
##### Angle of depression

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.



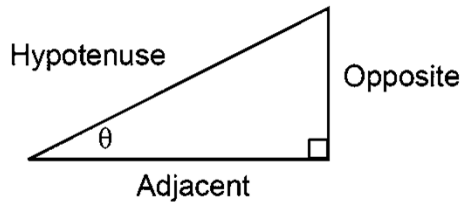
**Angle of elevation**

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.

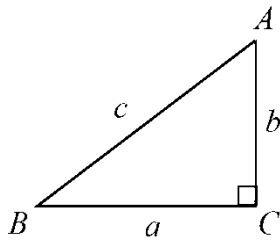
**Cosine ratio**

In any right-angled triangle,

$$\cos \theta = \frac{\text{adjacent}}{\text{hypotenuse}} \text{ where } 0^\circ < \theta < 90^\circ$$

**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. In symbols,  $c^2 = a^2 + b^2$

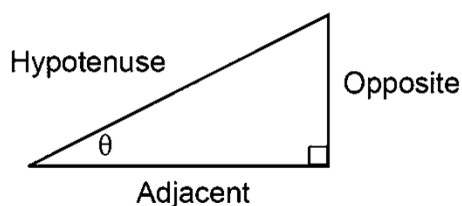


The converse: If  $c^2 = a^2 + b^2$  in a triangle ABC, then  $\angle ACB$  is a right angle.

**Sine ratio**

In any right-angled triangle,

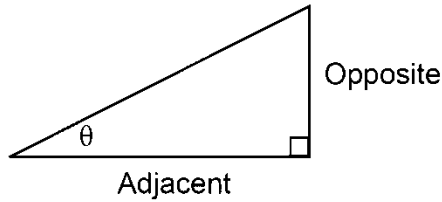
$$\sin \theta = \frac{\text{opposite}}{\text{hypotenuse}} \text{ where } 0^\circ < \theta < 90^\circ$$



**Tangent ratio**

In any right-angled triangle,

$$\tan \theta = \frac{\text{opposite}}{\text{adjacent}} \text{ where } 0^\circ < \theta < 90^\circ$$

**Graphs in practical situations****Break-even point**

The break-even point is the point at which revenue begins to exceed the cost of production.

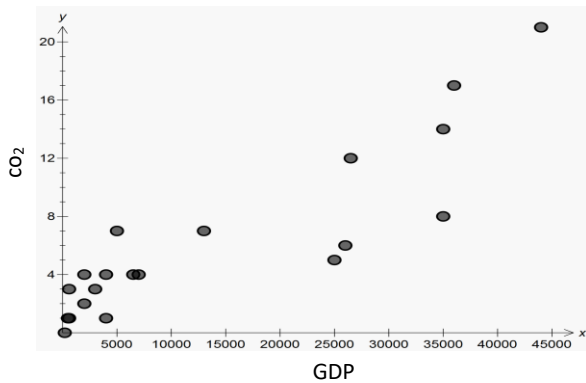
**Data collection****Association**

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.

**Bivariate data scatter plot**

A two-dimensional data plot using Cartesian co-ordinates to display the values of two variables in a bivariate data set.

For example, the scatterplot below displays the CO<sub>2</sub> emissions in tonnes per person (CO<sub>2</sub>) plotted against gross domestic product per person in \$US (GDP) for a sample of 24 countries in 2004. In constructing this scatterplot, GDP has been used as the independent variable.



**Causality**

A relationship between an independent and a dependent variable is said to be causal if the change in the independent variable actually causes a change in the dependent 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.

Possible explanations for an observed association between an independent and a dependent variable include:

- the independent variable is actually causing a change in the dependent variable
- 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 dependent variable; this is known as confounding
- there is no causation, the association is explained by at least one other variable that is associated with both the independent and the dependent variable; this is known as a common response
- the dependent variable is actually causing a change in the independent variable.

**Census**

A population is the complete set of individuals, objects, places etc. that we want information about.

A census is an attempt to collect information about the whole population.

**Independent variable**

When investigating relationships in bivariate data, the independent variable is the variable used to explain or predict a difference in the dependent variable.

For example, 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 dependent variable and time is the independent variable.

**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 independent variable that are outside the range of the original data. Extrapolation is a dangerous process as it can sometimes lead to quite erroneous predictions.

**Population**

A population is the complete set of individuals, objects, places etc. that we want information about.

**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 independent variable that lie within the range of the original data. See also extrapolation.

**Sample**

A sample is part of a population. It is a subset of the population, often randomly selected for the purpose of estimating the value of a characteristic of the population as a whole.

## Unit 4

### Probability and relative frequencies

#### Array

An array is an ordered collection of objects or numbers.

#### Law of large numbers

The basic justification for statistical sampling is that the distribution which is obtained from a random sample tends to resemble the distribution of the population from which it was drawn. The tendency increases as the size of the sample increases. This tendency of distributions of random samples to resemble the distribution of their parent population more closely as sample size increases is called the law of large numbers.

#### Relative frequency

Relative frequency is given by the ratio,  $\frac{f}{n}$  where  $f$  is the frequency of occurrence of a particular data value or group of data values in a data set and  $n$  is the number of data values in the data set.

#### Sample

See Unit 3.

#### Sample space

A sample space is the set of all possible outcomes of a chance experiment. For example, the set of outcomes (also called sample points) from tossing two heads is { HH, HT, TH, TT }, where H represents a 'head' and T a 'tail'.

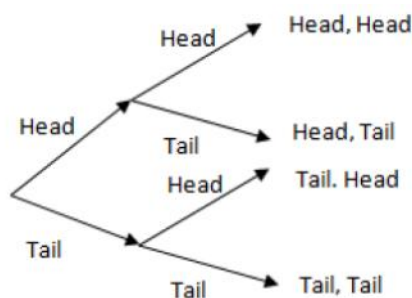
#### Simulation

A simulation is an experiment which imitates the chance behavior of some phenomenon.

#### Tree diagram

A tree diagram is a diagram that can be used to enumerate the outcomes of a multi-step random experiment.

The diagram below shows a tree diagram that has been used to enumerate all of the possible outcomes when a coin is tossed twice. This is an example of a two-step random experiment.



## Loans and compound interest

### Simple interest

Simple interest is the interest accumulated when the interest payment in each period is a fixed fraction of the principal. For example, if the principle  $P$  earns simple interest at the rate of  $r\%$  per period, then after  $t$  periods the accumulated simple interest is

$$\text{Interest} = \frac{P \times r \times t}{100}$$

### Compound interest

The interest earned by investing a sum of money (the principal) is compound interest if each successive interest payment is added to the principal for the purpose of calculating the next interest payment.

### 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.



