M1Maths

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Australian Years 11-12 General Mathematics

Table showing which M1Maths modules relate to each curriculum element

Unit 1 Topic 1 – Consumer arithmetic

Topic 2 – Algebra and Matrices

Topic 3 – Shape and measurement

Unit 2 Topic 1 – Univariate data analysis and the statistical method

Topic 2 – Applications of trigonometry

Topic 3 – Linear equations and their graphs

Unit 3 Topic 1 – Bivariate data analysis

Topic 2 – Growth and decay in sequences

Topic 3 – Graphs and networks

Unit 4 Topic 1 – Time series analysis

Topic 2 – Loans, investments and annuities

Topic 3 – Networks and decision mathematics

The syllabus element is in the left column and the relevant module is in the right column.

Unit 1 Topic 1 – Consumer arithmetic	
Applications of rates and percentages and use of spreadsheets	
review rates and percentages	N1-2 Fraction Meanings N2-3 Rates
calculate weekly or monthly wage from an annual salary, wages from an hourly rate including situations involving overtime and other allowances and earnings based on commission or piecework	

calculate payments based on government allowances and pensions	
prepare a personal budget for a given income taking into account fixed and discretionary spending	
compare prices and values using the unit cost method	
apply percentage increase or decrease in various contexts; for example, determining the impact of inflation on costs and wages over time, calculating percentage mark-ups and discounts, calculating GST, calculating profit or loss in absolute and percentage terms, and calculating simple and compound interest	N2-2 Fractions of Numbers
use currency exchange rates to determine the cost in Australian dollars of purchasing a given amount of a foreign currency, such as US$1500, or the value of a given amount of foreign currency when converted to Australian dollars, such as the value of €2050 in Australian dollars	
calculate the dividend paid on a portfolio of shares, given the percentage dividend or dividend paid per share, for each share; and compare share values by calculating a price-to-earnings ratio	
Use of spreadsheets	
use a spreadsheet to display examples of the above computations when multiple or repeated computations are required; for example, preparing a wage-sheet displaying the weekly earnings of workers in a fast food store where hours of employment and hourly rates of pay may differ, preparing a budget, or investigating the potential cost of owning and operating a car over a year	S3-1 Spreadsheets

Unit 1 Topic 2 – Algebra and matrices	
Linear and non-linear relationships	
substitute numerical values into linear algebraic and simple non-linear algebraic expressions, and evaluate	A1-5 Substitution
find the value of the subject of the formula, given the values of the other pronumerals in the formula	
use a spreadsheet or an equivalent technology to construct a table of values from a formula, including two-by-two tables for formulas with two variable quantities; for example, a table displaying the body mass index (BMI) of people of different weights and heights	S3-1 Spreadsheets
Matrices and matrix arithmetic	
use matrices for storing and displaying information that can be presented in rows and columns; for example, databases, links in social or road networks	N6-3 Matrices

recognise different types of matrices (row, column, square, zero, identity) and determine their size	N6-3 Matrices
perform matrix addition, subtraction, multiplication by a scalar, and matrix multiplication, including determining the power of a matrix using technology with matrix arithmetic capabilities when appropriate	N6-3 Matrices
use matrices, including matrix products and powers of matrices, to model and solve problems; for example, costing or pricing problems, squaring a matrix to determine the number of ways pairs of people in a communication network can communicate with each other via a third person	N6-3 Matrices

Unit 1 Topic 3 – Shape and measurement	
Pythagoras' Theorem	
review Pythagoras' Theorem and use it to solve practical problems in two dimensions and for simple applications in three dimensions	M3-1 Pythagoras
Mensuration	
solve practical problems requiring the calculation of perimeters and areas of circles, sectors of circles, triangles, rectangles, parallelograms and composites	M1-4 Length, Area and Volume 1 M2-3 Length, Area and Volume 2 M3-4 Length, Area and Volume 3 M4-1 Length, Area and Volume 4
calculate the volumes of standard three-dimensional objects such as spheres, rectangular prisms, cylinders, cones, pyramids and composites in practical situations; for example, the volume of water contained in a swimming pool	
calculate the surface areas of standard three-dimensional objects such as spheres, rectangular prisms, cylinders, cones, pyramids and composites in practical situations; for example, the surface area of a cylindrical food container	
Similar figures and scale factors	
review the conditions for similarity of two-dimensional figures including similar triangles	G2-6 Congruence G3-1 Similarity
use the scale factor for two similar figures to solve linear scaling problems	
obtain measurements from scale drawings, such as maps or building plans, to solve problems	G2-1 Maps and Scales
obtain a scale factor and use it to solve scaling problems involving the calculation of the areas of similar figures	G2-1 Maps and Scales G2-6 Congruence G3-1 Similarity
obtain a scale factor and use it to solve scaling problems involving the calculation of surface areas and volumes of similar solids	

Unit 2 Topic 1 – Univariate data analysis and the statistical investigation process	
The statistical investigation process	
review the statistical investigation process; for example, identifying a problem and posing a statistical question, collecting or obtaining data, analysing the data, interpreting and communicating the results	S2-1 Data Collection
Making sense of data relating to a single statistical variable	
classify a categorical variable as ordinal, such as income level (high, medium, low), or nominal, such as place of birth (Australia, overseas), and use tables and bar charts to organise and display the data	S3-4 Data Types
classify a numerical variable as discrete, such as the number of rooms in a house, or continuous, such as the temperature in degrees Celsius	
with the aid of an appropriate graphical display (chosen from dot plot, stem plot, bar chart or histogram), describe the distribution of a numerical dataset in terms of modality (uni or multimodal), shape (symmetric versus positively or negatively skewed), location and spread and outliers, and interpret this information in the context of the data	S1-1 Data Displays 1 S3-2 Data Displays 2 S6-1 Data Distributions
determine the mean and standard deviation of a dataset and use these statistics as measures of location and spread of a data distribution, being aware of their limitations	S1-2 Data Summary S4-1 Quantiles and Spread
Comparing data for a numerical variable across two or more groups	
construct and use parallel box plots (including the use of the 'Q1 – 1.5 x IQR' and 'Q3 + 1.5 x IQR' criteria for identifying possible outliers) to compare groups in terms of location (median), spread (IQR and range) and outliers and to interpret and communicate the differences observed in the context of the data	S4-1 Quantiles and Spread
compare groups on a single numerical variable using medians, means, IQRs, ranges or standard deviations, as appropriate; interpret the differences observed in the context of the data; and report the findings in a systematic and concise manner	
implement the statistical investigation process to answer questions that involve comparing the data for a numerical variable across two or more groups; for example, are Year 11 students the fittest in the school?	S2-1 Data Collection

Unit 2 Topic 2 – Applications of trigonometry	
Applications of Trigonometry	
review the use of the trigonometric ratios to find the length of an unknown side or the size of an unknown angle in a right-angled triangle	M3-2 Trigonometry M5-4 Solving Triangles
determine the area of a triangle given two sides and an included angle by using the rule $Area = \frac{1}{2}\ ab \sin C$, or given three sides by using Heron's rule, and solve related practical problems	
solve problems involving non-right-angled triangles using the sine rule (ambiguous case excluded) and the cosine rule	
solve practical problems involving the trigonometry of right-angled and non-right-angled triangles, including problems involving angles of elevation and depression and the use of bearings in navigation	

Unit 2 Topic 3 – Linear equations and their graphs	
Linear Equations	
identify and solve linear equations	A1-5 to A3-3
develop a linear formula from a word description	A2-1 Writing Equations
Straight-line graphs and their applications	
construct straight-line graphs both with and without the aid of technology	A3-8 Linear Functions
determine the slope and intercepts of a straight-line graph from both its equation and its plot	
interpret, in context, the slope and intercept of a straight-line graph used to model and analyse a practical situation	
construct and analyse a straight-line graph to model a given linear relationship; for example, modelling the cost of filling a fuel tank of a car against the number of litres of petrol required	
Simultaneous linear equations and their applications	
solve a pair of simultaneous linear equations, using technology when appropriate	A4-3 Simultaneous Equations - Linear
solve practical problems that involve finding the point of intersection of two straight-line graphs; for example, determining the break-even point where cost and revenue are represented by linear equations	
Piecewise linear graphs and step graphs	
sketch piece-wise linear graphs and step graphs, using technology when appropriate	A5-10 Further Relations

interpret piece-wise linear and step graphs used to model practical situations; for example, the tax paid as income increases, the change in the level of water in a tank over time when water is drawn off at different intervals and for different periods of time, the charging scheme for sending parcels of different weights through the post	

Unit 3 Topic 1 – Bivariate data analysis	
The statistical investigation process	
review the statistical investigation process; for example, identifying a problem and posing a statistical question, collecting or obtaining data, analysing the data, interpreting and communicating the results	S2-1 Data Collection
Identifying and describing associations between two categorical variables	
construct two-way frequency tables and determine the associated row and column sums and percentages	P2-2 Two-way Tables
use an appropriately percentaged two-way frequency table to identify patterns that suggest the presence of an association	P2-2 Two-way Tables
describe an association in terms of differences observed in percentages across categories in a systematic and concise manner, and interpret this in the context of the data	
Identifying and describing associations between two numerical variables	
construct a scatterplot to identify patterns in the data suggesting the presence of an association	S4-1 Linear Regression
describe an association between two numerical variables in terms of direction (positive/negative), form (linear/non-linear) and strength (strong/moderate/weak)	
calculate and interpret the correlation coefficient (r) to quantify the strength of a linear association	
Fitting a linear model to numerical data	
identify the response variable and the explanatory variable	S4-1 Linear Regression
use a scatterplot to identify the nature of the relationship between variables	
model a linear relationship by fitting a least-squares line to the data	
use a residual plot to assess the appropriateness of fitting a linear model to the data	
interpret the intercept and slope of the fitted line	S4-1 Linear Regression
use the coefficient of determination to assess the strength of a linear association in terms of the explained variation	
use the equation of a fitted line to make predictions	

distinguish between interpolation and extrapolation when using the fitted line to make predictions, recognising the potential dangers of extrapolation	
write up the results of the above analysis in a systematic and concise manner	Skills: Communicating
Association and causation	
recognise that an observed association between two variables does not necessarily mean that there is a causal relationship between them	S4-1 Linear Regression
identify possible non-causal explanations for an association, including coincidence and confounding due to a common response to another variable, and communicate these explanations in a systematic and concise manner	
The data investigation process	
implement the statistical investigation process to answer questions that involve identifying, analysing and describing associations between two categorical variables or between two numerical variables; for example, is there an association between attitude to capital punishment (agree with, no opinion, disagree with) and sex (male, female)? is there an association between height and foot length?	S2-1 Data Collection

Unit 3 Topic 2 – Growth and decay in sequences	
The arithmetic sequence	
use recursion to generate an arithmetic sequence	A6-2 Arithmetic Sequences
display the terms of an arithmetic sequence in both tabular and graphical form and demonstrate that arithmetic sequences can be used to model linear growth and decay in discrete situations	
deduce a rule for the nth term of a particular arithmetic sequence from the pattern of the terms in an arithmetic sequence, and use this rule to make predictions	
use arithmetic sequences to model and analyse practical situations involving linear growth or decay; for example, analysing a simple interest loan or investment, calculating a taxi fare based on the flag fall and the charge per kilometre, or calculating the value of an office photocopier at the end of each year using the straight-line method or the unit cost method of depreciation	
The geometric sequence	
use recursion to generate a geometric sequence	A6-3 Geometric Sequences
display the terms of a geometric sequence in both tabular and graphical form and demonstrate that geometric sequences can be used to model exponential growth and decay in discrete situations	

deduce a rule for the nth term of a particular geometric sequence from the pattern of the terms in the sequence, and use this rule to make predictions	
use geometric sequences to model and analyse (numerically, or graphically only) practical problems involving geometric growth and decay; for example, analysing a compound interest loan or investment, the growth of a bacterial population that doubles in size each hour, the decreasing height of the bounce of a ball at each bounce; or calculating the value of office furniture at the end of each year using the declining (reducing) balance method to depreciate	
Sequences generated by first-order linear recurrence relations	
use a general first-order linear recurrence relation to generate the terms of a sequence and to display it in both tabular and graphical form	
recognise that a sequence generated by a first-order linear recurrence relation can have a long term increasing, decreasing or steady-state solution	
use first-order linear recurrence relations to model and analyse (numerically or graphically only) practical problems; for example, investigating the growth of a trout population in a lake recorded at the end of each year and where limited recreational fishing is permitted, or the amount owing on a reducing balance loan after each payment is made	

Unit 3 Topic 3 – Graphs and networks	
The definition of a graph and associated terminology	
explain the meanings of the terms: graph, edge, vertex, loop, degree of a vertex, subgraph, simple graph, complete graph, bipartite graph, directed graph (digraph), arc, weighted graph, and network	G4-2 Networks
identify practical situations that can be represented by a network, and construct such networks; for example, trails connecting camp sites in a National Park, a social network, a transport network with one-way streets, a food web, the results of a round-robin sporting competition	
construct an adjacency matrix from a given graph or digraph	
Planar graphs	
explain the meaning of the terms: planar graph, and face	G4-2 Networks
apply Euler's formula, $v + f - e = 2$, to solve problems relating to planar graphs	
Paths and cycles	
explain the meaning of the terms: walk, trail, path, closed walk, closed trail, cycle, connected graph, and bridge	G4-2 Networks

investigate and solve practical problems to determine the shortest path between two vertices in a weighted graph (by trial-and-error methods only)	
explain the meaning of the terms: Eulerian graph, Eulerian trail, semi-Eulerian graph, semi-Eulerian trail and the conditions for their existence, and use these concepts to investigate and solve practical problems; for example, the Königsberg Bridge problem, planning a garbage bin collection route	
explain the meaning of the terms: Hamiltonian graph and semi-Hamiltonian graph, and use these concepts to investigate and solve practical problems; for example, planning a sight-seeing tourist route around a city, the travelling-salesman problem (by trial-and-error methods only)	

Unit 4 Topic 1 – Time series analysis	
Describing and interpreting patterns in time series data	
construct time series plots	S3-4 Data Types
describe time series plots by identifying features such as trend (long term direction), seasonality (systematic, calendar-related movements), and irregular fluctuations (unsystematic, short term fluctuations), and recognise when there are outliers; for example, one-off unanticipated events	
Analysing time series data	
smooth time series data by using a simple moving average, including the use of spreadsheets to implement this process	
calculate seasonal indices by using the average percentage method	
deseasonalise a time series by using a seasonal index, including the use of spreadsheets to implement this process	
fit a least-squares line to model long-term trends in time series data	
The data investigation process	
implement the statistical investigation process to answer questions that involve the analysis of time series data	

Unit 4 Topic 2 – Loans, investments and annuities	
Compound Interest Loans and Investments	
use a recurrence relation to model a compound interest loan or investment, and investigate (numerically or graphically) the effect of the interest rate and the number of compounding periods on the future value of the loan or investment	N4-1 Compound Interest S3-1 Spreadsheets

calculate the effective annual rate of interest and use the results to compare investment returns and cost of loans when interest is paid or charged daily, monthly, quarterly or six-monthly	
with the aid of a calculator or computer-based financial software, solve problems involving compound interest loans or investments; for example, determining the future value of a loan, the number of compounding periods for an investment to exceed a given value, the interest rate needed for an investment to exceed a given value	N4-1 Compound Interest
Reducing balance loans (compound interest loans with periodic repayments)	
use a recurrence relation to model a reducing balance loan and investigate (numerically or graphically) the effect of the interest rate and repayment amount on the time taken to repay the loan	
with the aid of a financial calculator or computer-based financial software, solve problems involving reducing balance loans; for example, determining the monthly repayments required to pay off a housing loan	S3-1 Spreadsheets
Annuities and perpetuities (compound interest investments with periodic payments made from the investment)	
use a recurrence relation to model an annuity, and investigate (numerically or graphically) the effect of the amount invested, the interest rate, and the payment amount on the duration of the annuity	
with the aid of a financial calculator or computer-based financial software, solve problems involving annuities (including perpetuities as a special case); for example, determining the amount to be invested in an annuity to provide a regular monthly income of a certain amount	S3-1 Spreadsheets

Unit 4 Topic 3 – Networks and decision mathematics	
Trees and minimum connector problems	
explain the meaning of the terms tree and spanning tree; identify practical examples	
identify a minimum spanning tree in a weighted connected graph either by inspection or by using Prim's algorithm	
use minimal spanning trees to solve minimal connector problems; for example, minimising the length of cable needed to provide power from a single power station to substations in several towns	

Project planning and scheduling using critical path analysis (CPA)	
construct a network to represent the durations and interdependencies of activities that must be completed during the project; for example, preparing a meal	
use forward and backward scanning to determine the earliest starting time (EST) and latest starting times (LST) for each activity in the project	
use ESTs and LSTs to locate the critical path(s) for the project	
use the critical path to determine the minimum time for a project to be completed	
calculate float times for non-critical activities	
Flow networks	
solve small-scale network flow problems including the use of the 'maximum-flow minimum- cut' theorem; for example, determining the maximum volume of oil that can flow through a network of pipes from an oil storage tank (the source) to a terminal (the sink)	
Assignment problems	
use a bipartite graph and/or its tabular or matrix form to represent an assignment/ allocation problem; for example, assigning four swimmers to the four places in a medley relay team to maximise the team's chances of winning	
determine the optimum assignment(s), by inspection for small-scale problems, or by use of the Hungarian algorithm for larger problems	