



MATHEMATICS PATHWAYS

Subject Guide



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Mathematics allows for the exploration and growth in understanding the natural world and the interactions and relationships within. Our subjects provide the foundation for different pathways beyond secondary school. The knowledge and skills developed in Mathematical studies are interdisciplinary, as students will draw on these in their future academic pathways, personal and work lives. Mathematics provides both a framework for thinking and a means of symbolic communication that is powerful and concise. This allows students access to important ideas such as pattern recognition, algebra, functions and relations, logic, mathematical structure and working mathematically. These areas are essential concepts developed in the study of number, algebra measurement and geometry, statistics and probability.



MATHEMATICS PATHWAYS

Pathways Summary



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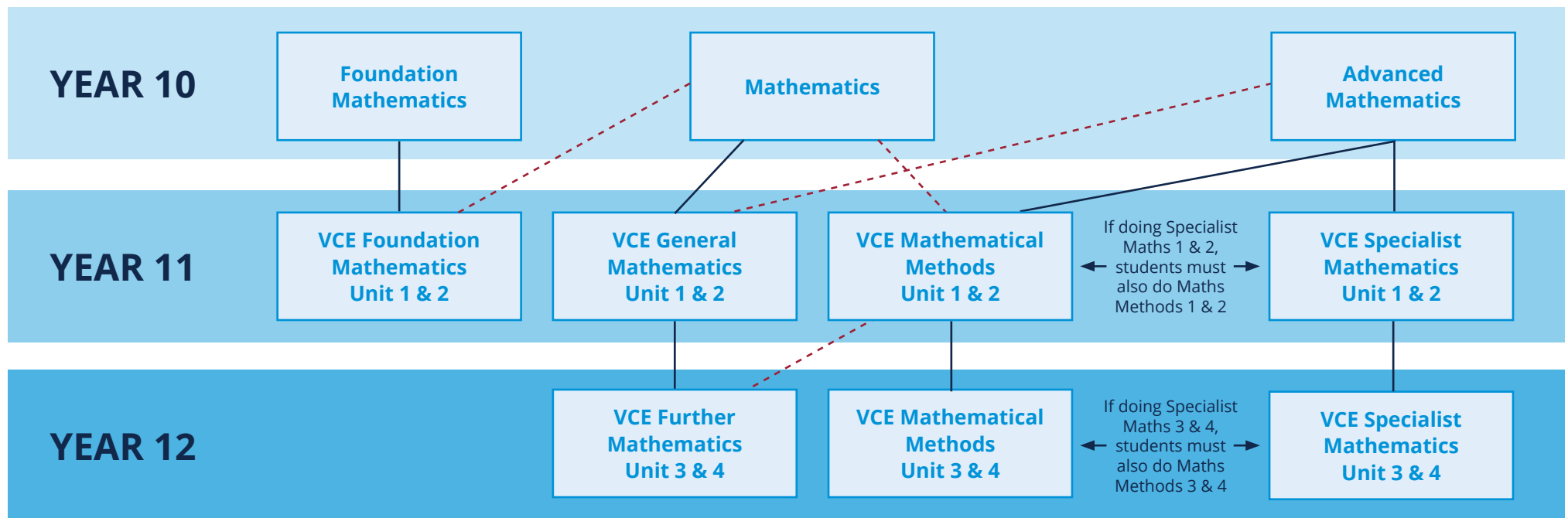


MATHEMATICS PATHWAYS

The diagram below shows the possible pathways and prerequisites for each subject from Year 10 to Year 12.



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Acceleration options are available for students should they meet the criteria.



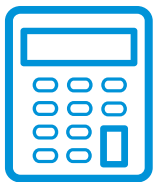
FOUNDATION MATHEMATICS



Foundation Mathematics provides for the continuing mathematical development of students entering VCE and who do not necessarily intend to undertake Unit 3 and Unit 4 studies in VCE Mathematics in the following year.

In Foundation Mathematics there is a strong emphasis on the use of mathematics in practical contexts encountered in everyday life in the community, at work and at study.

In Foundation Mathematics there is a strong emphasis on the use of mathematics in practical contexts encountered in everyday life in the community, at work and at study. The areas of study for Units 1 and 2 of Foundation Mathematics are 'Space, shape and design', 'Patterns and number', 'Data' and 'Measurement'. All four areas of study are to be completed over the two units.



FOUNDATION MATHEMATICS

FOCUS AREAS

Unit 1

Consists of 2 Areas of Study

1. Space, shape and design, and
2. Patterns and number

Content covered in Unit 1 includes:

- Geometric conventions and properties of shapes and objects
- Interpretation and use of plans, elevations, maps, models and diagrams
- Application and use of similarity and symmetry
- Interpretation and use of location, distance, direction and scale on diagrams, maps and plans
- Application of Pythagoras' theorem in practical situations
- Applications of integers, decimals, fractions, ratios, percentages and rates to solve practical problems
- Use and interpretation of formulas and algebraic expressions to describe relationships between variables and to model patterns.

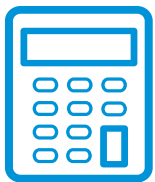
Unit 2

Consists of 2 Areas of Study

1. Space, shape and design, and
2. Patterns and number

Content covered in Unit 2 includes:

- Collection and representation of data in diagrammatic, tabular and graphical forms
- Interpretation of diagrams, charts, tables and graphs
- Use of measures of central tendency (averages) and spread to summarise and interpret data
- Comparison and interpretation of data sets
- Application and use of metric units and measures
- Interpretation and use of time and duration including time and date specifications, conventions, schedules, timetables and time zones.



FOUNDATION MATHEMATICS



OUTCOMES

Unit 1 & 2

Outcome 1: On completion of this unit the student should be able to use and apply a range of mathematical concepts, skills and procedures from selected areas of study to solve problems based on a range of everyday and real-life contexts.

Outcome 2: On completion of this unit the student should be able to apply mathematical procedures to solve practical problems in both familiar and new contexts and communicate their results.

Outcome 3: On completion of this unit the student should be able to select and use technology to solve problems in practical contexts.

ASSESSMENT

For each Unit 1 & 2 assessment consists of:

- Investigations and projects
- Assignments
- Tests of mathematical skills
- End-of semester examination.



GENERAL MATHEMATICS

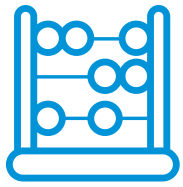


General Mathematics Units 1 and 2 offers a general course in mathematics covering a broad range of concepts to interest students and provide general preparation for employment and study of Further Mathematics Units 3 and 4.

General Mathematics has a strong emphasis on preparation for Further Mathematics Unit 3 & 4 and mathematic demands for everyday life in the community, at work and at study.

The areas of study are:

- Algebra and structure
- Arithmetic and number
- Discrete mathematics
- Geometry, measurement and trigonometry
- Graphs of linear and non-linear relations
- Statistics.



GENERAL MATHEMATICS

FOCUS AREAS

Unit 1

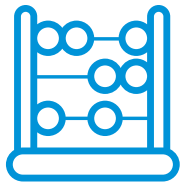
Content covered in Unit 1 includes:

- Display and describe categorical data distributions using frequency tables and bar charts
- Display and describe numerical data using histograms and stem plots
- Median, mean, range, interquartile range, standard deviation
- Linear functions and graphs
- Fitting a linear model to data
- Linear programming problems, feasible areas and optimal solution/s.

Unit 2

Content covered in Unit 2 includes:

- Measurement of length, angle, area, volume and capacity
- Pythagoras' theorem in two dimensions and application to practical problems
- Perimeter and areas of triangles, quadrilaterals, circles and composite shapes
- Volume and surface area of solids and practical applications
- Using trigonometry to find the length of an unknown side or the size of an unknown angle in a right-angled triangle
- The sine and cosine rules to solve practical problems involving non-right angled triangles
- Sequences and series
- Linear programming problems, feasible areas and optimal solution/s.



GENERAL MATHEMATICS



OUTCOMES

Unit 1 & 2

Outcome 1: On completion of this unit the student should be able to define and explain key concepts as specified in the selected content from the area of study, and apply a range of related mathematical routines and procedures.

Outcome 2: On completion of each unit the student should be able to select and apply mathematical facts, concepts models and techniques from the topics covered in the unit to investigate and analyse extended application in a range of contexts.

Outcome 3: On completion of this unit the student should be able to select and use numerical, graphical, symbolic and statistical functionalities of technology to develop mathematical ideas, produce results and carry out analysis in situations requiring problem-solving, modelling or investigative techniques or approaches.

ASSESSMENT

For each Unit 1 & 2 assessment consists of:

- Investigations and projects
- Assignments
- Tests of mathematical skills
- End-of semester examination.



FURTHER MATHEMATICS



Further Mathematics Units 3 and 4 are designed to be widely accessible and comprise a combination of core and a selection of two from four possible modules across a range of application contexts. They provide general preparation for employment or further study, where data analysis, recursion and number patterns are important.

Further Mathematics consists of two areas of study, a compulsory Core area of study to be completed in Unit 3 and the Applications area of study to be completed in Unit 4. The Core comprises 'Data analysis' and 'Recursion and financial modelling'. The Applications comprises two modules to be completed in their entirety, from a selection of four possible modules: 'Matrices', 'Networks and decision mathematics', 'Geometry and measurement' and 'Graphs and relations'.

The areas of study consists of

- 'Data analysis' (comprises 40% of the content to be covered),
- 'Recursion and financial modelling' (comprises 20% of the content to be covered),
- Two selected modules (comprises 20% of the content to be covered).



FURTHER MATHEMATICS



FOCUS AREAS

Unit 3

In Unit 3 Further Mathematics, a compulsory Core area of study will be completed. The Core comprises 'Data Analysis' and 'Recursion and financial modelling'.

Content covered in Core - 'Data analysis' includes:

- representation of data – frequency tables, stem plots, box plots, histograms
- five-number summary and box plots
- mean and standard deviation
- correlation coefficient; least squares line; time series data and its analysis
- calculate the coefficient of determination, r^2 , and interpret in the context of the association
- construct a residual analysis to test the assumption of linearity
- identify key qualitative features of a time series plot.

Content covered in Core - 'Recursion and financial modelling' includes:

- concept of first order linear recurrence and its use in generating the terms in a sequence
- concepts of financial mathematics including simple and compound interest, nominal and effective interest rates
- concept of a recurrence relation to determine the depreciating value of an asset.



FURTHER MATHEMATICS

FOCUS AREAS

Unit 4

Two modules selected from the following four Matrices, Networks, Geometry and Measurement, or Graphs and relations. Models to be confirmed on commencement of Unit 3.

Content covered in 'Matrices' includes:

- represent information in a matrices and complete elementary matrix operations
- construct a transition matrix
- construct a transition matrix to model transitions in a population.

Content covered in Networks includes:

- construct graphs, digraphs and networks and their matrix
- recognize and solve a variety of problems including minimum connector problem, flow problems and shortest path problem.
- recognize that a problem is an example of the matching problem and solve it by inspection or using the Hungarian algorithm
- solve scheduling problems by using critical path analysis.

Content covered in 'Geometry and measurement' includes:

- Surface and volume of spheres, cylinders, cones, pyramids and prisms, and their composites
- Solving right and non-right-angled triangles, including the sine rule, and their applications to solving practical problems in two and three dimensions
- Arc length of a sector of a circle, and the areas of segments and sectors with practical applications
- Use of trigonometry and Pythagoras' theorem in two and three dimensions to solve problems involving the solution of right-angled triangles within a sphere.

Content covered in 'Graphs and relations' includes:

- Straight-line graphs, line segment graphs and step graphs and their use to model and analyse practical situations
- Simultaneous linear equations in two unknowns and their use to model and analyse practical situations including break-even analysis, where cost and revenue functions are linear
- Non-linear graphs, coordinates of points of intersection for applications such as break-even analysis with non-linear cost and revenue.



FURTHER MATHEMATICS



OUTCOMES

Outcome 1: On completion of this unit the student should be able to define and explain key concepts as specified in the selected content from the area of study, and apply a range of related mathematical routines and procedures.

Outcome 2: On completion of each unit the student should be able to select and apply mathematical facts, concepts models and techniques from the topics covered in the unit to investigate and analyse extended application in a range of contexts.

Outcome 3: On completion of this unit the student should be able to select and use numerical, graphical, symbolic and statistical functionalities of technology to develop mathematical ideas, produce results and carry out analysis in situations requiring problem-solving, modelling or investigative techniques or approaches.

ASSESSMENT

- Unit 3 School-assessed Coursework: 20 per cent
(Combined total of application task and modelling task)
- Unit 4 School-assessed Coursework: 14 per cent
(Two tasks a Modelling and problem-solving task)
- Units 3 and 4 Examination 1: 33 per cent
- Units 3 and 4 Examination 2: 33 per cent.



MATHEMATICAL METHODS



Mathematical Methods is completely prescribed and extend the study of simple elementary functions to include combinations of these functions, algebra, calculus, probability and statistics, and their applications in a variety of practical and theoretical contexts. They also provide background for further study in, for example, science, humanities, economics and medicine.

Mathematical Methods extends the introductory study of simple elementary functions of a single real variable, to include combinations of these functions, algebra, calculus, probability and statistics, and their applications in a variety of practical and theoretical contexts.

The areas of study consists of

- Functions and graphs
- Calculus
- Algebra
- Probability and statistics

Concepts are developed in complexity and students will encounter sophisticated problem types presented within a context.



MATHEMATICAL METHODS

FOCUS AREAS

Unit 1

Unit 1 Mathematical Methods is the study of simple algebraic functions. Students will be expected to be able to apply techniques, routines and processes involving rational and real arithmetic, sets, algebraic manipulation, equations and graphs with and without technology.

Content covered in Unit 1 includes:

- review of coordinate geometry – equations and graphs of straight lines, finding the distance between points; develop equations and systems of simultaneous equations
- relations and functions including domain and range and inverse functions
- graphs of power functions including hyperbola, truncus, square root graph and transformations of these graphs; graphs of cubic and quartic graphs; apply transformations - reflection, dilation, translations - to basic functions including the use of matrices

- substitution and manipulation of expressions, including factorisation; solving polynomial equations numerically, graphically and algebraically
- average and instantaneous rates of change; interpretation of graphs with respect to change
- addition rule for probability; mutually exclusive events; conditional probability; random experiments.



MATHEMATICAL METHODS

FOCUS AREAS

Unit 2

The focus of Unit 2 Mathematical Methods is the study of simple transcendental functions and the calculus of simple algebraic functions.

Content covered in Unit 2 includes:

- circular functions – sine, cosine and tangent as functions; exact values; symmetry properties; graphs and applications; exponential functions; logarithmic functions
- index laws and logarithm laws
- solution of exponential and logarithmic equations
- solution of equations involving sine, cosine and tangent using exact values, including the use of inverse functions
- differentiating by first principles
- finding derivatives of simple power functions and polynomial functions
- applications of differentiation including stationary points, points of inflection, solving maximum and minimum problems and solving simple problems involving straight-line motion
- addition and multiplication principles for counting
- combinations and selections
- applications to probability.

Unit 3

The focus for Unit 3 Mathematical Methods is in the study areas of 'Functions and graphs', 'Algebra' and the application of derivatives and differentiation from the 'Calculus' area of study.

Content covered in Unit 3 includes:

- graphs and identification of key features of graphs of power functions, exponential functions, logarithmic functions and circular functions; graphs of polynomial functions; transformations to graphs of functions and the inverse transformation; hybrid functions
- solving equations including exponential, logarithmic and circular functions, simple systems of equations including cases where no solution or an infinite number of solutions exist
- composite functions, average and instantaneous rates of change; tangents to a graph of a functions and the derivative function
- derivatives of polynomial functions using rules; derivatives of exponential, logarithmic and circular functions
- application of differentiation to graph sketching and identification of key features of graph, including stationary points, intervals where graph is strictly increasing or decreasing, identifying maximum or minimum values over and interval and application to solving problems.



MATHEMATICAL METHODS



FOCUS AREAS

Unit 4

The focus for Unit 4 Mathematical Methods is on the applications of anti-differentiation and discrete and continuous random probability distributions.

Content covered in Unit 4 includes:

- anti-derivatives of polynomial functions
- indefinite integral
- fundamental theorem of calculus
- properties of anti-derivatives
- application of integration, including calculating the area of a region under a curve and between curves.
- statistical inference for sample proportions
- discrete random variables, including interpretation and use of mean, variance and standard deviation
- binomial distribution and normal distribution
- continuous random variables including interpretation and use of mean, variance and standard deviation.



MATHEMATICAL METHODS



OUTCOMES

Outcome 1: On completion of this unit the student should be able to define and explain key concepts as specified in the selected content from the area of study, and apply a range of related mathematical routines and procedures.

Outcome 2: On completion of each unit the student should be able to select and apply mathematical facts, concepts models and techniques from the topics covered in the unit to investigate and analyse extended application in a range of contexts.

Outcome 3: On completion of this unit the student should be able to select and use numerical, graphical, symbolic and statistical functionalities of technology to develop mathematical ideas, produce results and carry out analysis in situations requiring problem-solving, modelling or investigative techniques or approaches.

ASSESSMENT

Mathematical Methods Unit 1 & 2

- Investigations and projects
- Assignments
- Tests of mathematical skills
- End-of semester examination.

Mathematical Methods Unit 3 and 4

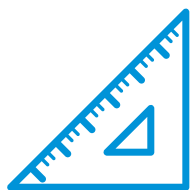
- Unit 3 School-assessed Coursework: 17 per cent (Application Task)
- Unit 4 School-assessed Coursework: 17 per cent (total combined Modelling and Problem Solving task)
- Units 3 and 4 Examination 1: 22 per cent
- Units 3 and 4 Examination 2: 44 per cent.



SPECIALIST MATHEMATICS



Specialist Mathematics provide a course of study for students who wish to undertake an in-depth study of mathematics, with an emphasis on concepts, skills and processes related to mathematical structure, modelling, problem solving and reasoning. This study has a focus on interest in the discipline of mathematics and investigation of a broad range of applications, as well as development of a sound background for further studies in mathematics and mathematics related fields. In undertaking these units, students are expected to be able to apply techniques, routines and processes involving rational, real and complex arithmetic, sets, lists and tables, diagrams and geometric constructions, algebraic manipulation, equations, graphs, differentiation, anti-differentiation and integration and inference with and without the use of technology.



SPECIALIST MATHEMATICS

FOCUS AREAS

Unit 1

Specialist Mathematics Unit 1 provides a course of study for students who wish to undertake an in-depth study of mathematics, with an emphasis on concepts, skills and processes related to mathematical structure, modelling, problem solving and reasoning.

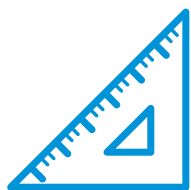
Content covered in Unit 1 includes:

- Definition and properties of natural numbers and rational numbers
- Sequences and series including arithmetic and geometric sequences
- Definition and properties of complex numbers
- Proofs of Pythagoras' theorem, properties of quadrilaterals, interior angles and angle sums of polygons
- Proof of circle theorems.

Unit 2

Content covered in Unit 2 includes:

- Vectors in a plane, simple vector algebra, application of vectors to geometric proofs
- Loci and algebra
- Boolean algebra, the algebra of sets and propositional logic
- kinematics
- graphical modelling and numerical analysis of position-time and velocity-time
- random experiments and use of simulation to generate a sample space
- random variables for discrete distributions.



SPECIALIST MATHEMATICS

FOCUS AREAS

Unit 3

In Unit 3 Specialist Mathematics the focus will be on skills from 'Functions and graphs' as well as a selection of topics from 'Algebra', 'Calculus' and 'Vectors'.

It is assumed that students have familiarity with the key knowledge and skills from Mathematical Methods Units 1 and 2 and Specialist Mathematics Units 1 and 2.

Content covered in Unit 3 includes:

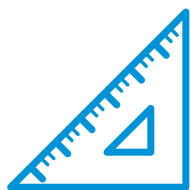
- Graphs of inverse circular functions, reciprocal functions, rational functions, the absolute value function, including the key features of graphs including intercepts, asymptotic behaviour and location and nature of stationary points
- Complex numbers
- Derivatives of inverse circular functions
- Second derivatives and their application to the analysis of graphs of functions
- Related rates of change
- techniques of anti-differentiation and the evaluation of definite integrals.

Unit 4

In Unit 4 of Specialist Mathematics the remaining content from the 'Algebra', 'Calculus' and 'Vectors' areas of study and the content from 'Mechanics' and 'Probability and statistics' will be studied.

Content covered in Unit 4 includes:

- Inertial mass, momentum, force, weight, action and reaction
- Equations of motion using absolute units
- Motion of a body
- Sample means
- Simulation of repeated random sampling
- Determination of confidence intervals
- Hypothesis testing for a population mean.



SPECIALIST MATHEMATICS



OUTCOMES

Outcome 1: On completion of this unit the student should be able to define and explain key concepts as specified in the selected content from the area of study, and apply a range of related mathematical routines and procedures.

Outcome 2: On completion of each unit the student should be able to select and apply mathematical facts, concepts models and techniques from the topics covered in the unit to investigate and analyse extended application in a range of contexts.

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ASSESSMENT

Specialist Mathematics Unit 1 & 2

- Investigations and projects
- Assignments
- Tests of mathematical skills
- End-of semester examination.

Specialist Mathematics Unit 3 and 4

- Unit 3 School-assessed Coursework: 17 per cent (Application Task)
- Unit 4 School-assessed Coursework: 17 per cent (Total combined Modelling and Problem Solving task)
- Units 3 and 4 Examination 1: 22 per cent
- Units 3 and 4 Examination 2: 44 per cent.