Specialist Mathematics



Course Description

Specialist Mathematics provide for the study of various mathematical structures, reasoning and proof. The areas of study in Units 3 and 4 extend content from Mathematical Methods Units 3 and 4 to include rational and other quotient functions as well as other advanced mathematics topics such as logic and proof, complex numbers, vectors, differential equations, kinematics, and statistical inference. They also provide background for advanced studies in mathematics and other STEM fields. In undertaking this unit, students are expected to be able to apply techniques, routines and processes involving rational, real and complex arithmetic, sets, lists, tables and matrices, diagrams, graphs, logic gates and geometric constructions, algorithms, algebraic manipulation, recurrence relations, equations and graphs, with and without the use of technology. They are expected to be able to construct proofs and develop and interpret algorithms to solve problems. They should have facility with relevant mental and by-hand approaches to estimation and computation. The use of numerical, graphical, geometric, symbolic and statistical functionality of technology for teaching and learning mathematics, for working mathematically, and in related assessment, is to be incorporated throughout each unit as applicable.

Course structure

Unit 1

Area of Study 1 – Algebra, number and structure

In this area of study students cover the development of formal mathematical notation, definition, reasoning and proof applied to number systems, graph theory, sets, logic, and Boolean algebra, and the development of algorithms to solve problems.

Area of Study 2 – Discrete mathematics

In this area of study students cover the study of sequences, series, and first-order linear difference equations, combinatorics, including the pigeon-hole principle, the inclusion-exclusion principle, permutations and combinations, combinatorial identities, and matrices.

Unit 2

Area of Study 1 – Data analysis, probability and statistics

In this area of study students cover the study of linear combinations of random variables and the distribution of sample means of a population, with the use of technology to explore variability of sample means.

Area of Study 2 – Space and measurement

In this area of study students cover trigonometry and identities, rotation and reflection transformations of the plane and vectors for working with position, shape, direction and movement in the plane and related applications.

Area of Study 3 – Algebra, number and structure

In this area of study students cover the arithmetic and algebra of complex numbers, including polar form, regions and curves in the complex plane and introduction to factorisation of quadratic functions over the complex field.

Area of Study 4 – Functions, relations and graphs

In this area of study students cover an introduction to partial fractions; reciprocal and inverse circular functions and their graphs and simple transformations of these graphs; locus definitions of lines, parabolas, circles, ellipses and hyperbolas and the cartesian, parametric and polar forms of these relations.

Unit 3 and 4

Area of Study 1 – Discrete mathematics: Logic and proof

In this area of study students cover the development of mathematical argument and proof. This includes conjectures, connectives, quantifiers, examples and counter-examples, and proof techniques including mathematical induction. Proofs will involve concepts from topics such as: divisibility, inequalities, graph theory, combinatorics, sequences and series including partial sums and partial products and related notations, complex numbers, matrices, vectors and calculus.

Area of Study 2 – Functions, relations and graphs

In this area of study students cover rational functions and other simple quotient functions, curve sketching of these functions and relations, and the analysis of key features of their graphs including intercepts, asymptotic behaviour and the nature and location of stationary points and points of inflection and symmetry.

Area of Study 3 – Algebra, number and structure

In this area of study students cover the algebra of complex numbers, including polar form, factorisation of polynomial functions over the complex field and an informal treatment of the fundamental theorem of algebra.

Area of Study 4 – Calculus

In this area of study students cover the advanced calculus techniques for analytical and numerical differentiation and integration of a broad range of functions, and combinations of functions; and their application in a variety of theoretical and practical situations, including curve sketching, evaluation of arc length, area and volume, differential equations and kinematics, and modelling with differential equations drawing from a variety of fields such as biology, economics and science.

Area of Study 5 – Shape and measurement

In this area of study students cover the arithmetic and algebra of vectors; linear dependence and independence of a set of vectors; proof of geometric results using vectors; vector representation of curves in the plane and their parametric and cartesian equations; vector kinematics in one, two and three dimensions; vector, parametric and cartesian equations of lines and planes.

Area of Study 6 – Data analysis, probability and statistics

In this area of study students cover the study of linear combinations of random variables and introductory statistical inference with respect to the mean of a single population, the determination of confidence intervals, and hypothesis testing for the mean using the distribution of sample means.

Entry and Recommendations

Mathematical Methods Units 1 and 2 and Specialist Mathematics Units 1 and 2, taken in conjunction, provide a comprehensive preparation for Specialist Mathematics Units 3 and 4. Study of Specialist Mathematics Units 3 and 4 also assumes concurrent study or previous completion of Mathematical Methods Units 3 and 4.

Students are required to be enrolled in Mathematical Methods to enrol in Specialist Mathematics.

Assessment

Satisfactory Completion

Demonstration of achievement of outcomes and satisfactory completion of a unit are determined by evidence gained through the assessment of a range of learning activities and tasks.

Level of Achievement

Units 1 and 2

- Coursework
 - \circ Assignments
 - o Tests
 - o Summary or review notes
 - o Modelling tasks
 - o Problem-solving tasks
 - o Mathematical investigations
 - \circ Examination

Units 3 and 4

- Unit 3 School-assessed Coursework: (20%)
- Unit 4 School-assessed Coursework: (20 %)
- Examination 1: (20 %)
- Examination 2: (40 %).

