School of Mathematics and Statistics

http://www.maths.usyd.edu.au/u/UG/JM

JUNIOR MATHEMATICS and STATISTICS

2017 Handbook

THE UNIVERSITY OF SYDNEY

Contents

1 Introduction

This handbook contains information relating to various aspects of studying mathematics at junior level at the University of Sydney. It includes a brief description of the content of each junior unit, and some advice on which units to choose. It also contains some information on assessment and administrative matters. If you have a question about junior mathematics, and cannot find the answer in this book, there are other sources of information.

Where to find out more:

- **The Junior Mathematics website:**

  `http://www.maths.usyd.edu.au/u/UG/JM`

- **The Frequently Asked Questions webpage:**

  `http://www.maths.usyd.edu.au/u/UG/JM/FAQ.html`

  If there is something you want to know, please check this page before you contact us.

- **The Student Services Office.**

  Carslaw room 520.

- **Phone: 9351 5787**

- **Email: firstyear@maths.usyd.edu.au**

  We expect that any emails written to us will be courteous, and will include your name and SID. We will not respond to anonymous emails.

- **The First Year Director.**

  Sharon Stephen, Carslaw room 525.

1.1 How we communicate with you

There are almost 3000 students doing a first year mathematics unit. When we have something to tell you we clearly cannot do so on an individual basis. You will have to take far more responsibility for seeking out information than you may have been used to doing at school. Here are the ways in which we communicate with you:

Announcements in lectures

Important announcements relating to all aspects of a unit of study are often made in lectures. You should listen carefully to all such announcements. If you do not attend lectures regularly then it is your responsibility to find out the content of any such announcements in the event that you were absent when they were made.

Web pages

The main page for Junior Mathematics is given above. Each unit has its own web page, linked to the main page. Many important announcements are made on these pages. These are accessible from the Learning Management System (LMS). It is essential that you check the main page, and the pages relevant to your enrolment, at least once a week.

Email
We will sometimes email you at your Unikey email address, either as an individual student, or as a member of a particular class. You should check for email sent to your Unikey address on a regular basis.

1.2 Junior units of study

Junior units are offered at four different levels: advanced, mainstream, fundamental and introductory. The level at which you study mathematics should be determined by your mathematical background and your ability.
As a general rule, if you have done HSC Mathematics Extension 2 then you should take advanced units; if you have done HSC Mathematics Extension 1 then you should take mainstream units; if you have done HSC Mathematics then you should take fundamental units. Later chapters in this book give more detailed advice as to which level you should choose.
Advanced, mainstream and fundamental units are all worth 3 credit points.

Advanced Units of Study in semester 1.

MATH1901 *Differential Calculus (Advanced)*

MATH1902 *Linear Algebra (Advanced)*

MATH1906 *Mathematics (Special Studies Program) A*

Advanced Units of Study in semester 2.

MATH1903 *Integral Calculus and Modelling (Advanced)*

MATH1905 *Statistics (Advanced)*

MATH1907 *Mathematics (Special Studies Program) B*

Mainstream Units of Study in semester 1.

MATH1001 *Differential Calculus*

MATH1002 *Linear Algebra*

Mainstream Units of Study in semester 2.

MATH1003 *Integral Calculus and Modelling*

MATH1004 *Discrete Mathematics*

MATH1005 *Statistics*

Fundamental Units of Study in semester 1.

MATH1011: *Applications of Calculus*

MATH1015: *Biostatistics*

Fundamental Units of Study in semester 2.

MATH1013: *Mathematical Modelling*

MATH1014: *Introduction to Linear Algebra*

MATH1111: *Introduction to Calculus* is a 6 credit point unit of study and is available only to students who have not done HSC Mathematics, HSC Mathematics Ext 1 or HSC Mathematics Ext 2 (or equivalent).

1.3 Students in the Faculty of Science

Science students are required to complete at least 12 credit points of mathematics and/or statistics. Most science students fulfill this requirement by taking 4 junior units of study.

Students with HSC Mathematics Extension 2 (or equivalent) will generally take MATH1901, MATH1902, MATH1903 and MATH1905.

Students with HSC Mathematics Extension 1 (or equivalent) will generally take MATH1001, MATH1002, MATH1003 and either MATH1004 or MATH1005.

Students with HSC Mathematics (or equivalent) will generally take MATH1011, MATH1015, MATH1013 and MATH1014. Students who are weak in calculus could consider substituting MATH1004 for MATH1013 in second semester.

Students who have not successfully completed calculus at school may enrol in MATH1111 in first semester, but require special permission. In second semester, students who successfully complete MATH1111 generally take two of MATH1013, MATH1014, MATH1004 and MATH1005. However, MATH1013 is only recommended if students achieve a credit or higher in MATH1111.

1.4 Students in the Faculty of Engineering

Engineering students are required to study mathematics in both first and second year. Different engineering departments have different requirements. Engineering students should consult the Engineering Handbook as to the requirements of individual engineering departments.
Most first year engineering students will take MATH1001, MATH1002, MATH1003 and MATH1005.
Engineering students with HSC Mathematics Extension 2 (or equivalent) may choose the advanced units MATH1901, MATH1902, MATH1903 and MATH1905.
Engineering students who do not have Mathematics Extension 1 (or equivalent) are strongly advised to do a Bridging Course before semester starts. Details of Bridging Courses are available from the Student Services Office (Carslaw room 520), or at `http://www.maths.usyd.edu.au/u/BC/`.

1.5 Students in the Faculties of Arts, Economics and Education

Junior mathematics units may be taken by students in these faculties. Consult the relevant Faculty Handbook for details.

1.6 Intermediate, Senior and Honours Units of Study

It is possible to proceed as far as Honours in any of the three disciplines: Pure Mathematics, Applied Mathematics or Mathematical Statistics. The School's intermediate and senior units of study are offered at two levels, advanced and mainstream. Intending Honours students are encouraged to select advanced units of study.
There are intermediate and senior units of study offered by the School of Mathematics and Statistics which complement specialised studies in other discipline areas. In particular, students who seek to

specialise in certain other Science discipline areas such as Physics and Computer Science, should bear in mind the requirement to complete intermediate mathematics units in their degree.

1.7 Advice on choice of junior mathematics units

Students intending to specialise in Pure Mathematics or Applied Mathematics should take four or five junior units. Students with the appropriate background should take advanced units, or Special Studies Units if invited to do so. It is important that one of the units MATH1903, MATH1907 or MATH1003 be selected: seek the advice of the Mathematics Student Services Office if you do not wish to do this.

Students who intend to specialise in Mathematical Statistics should take the following units:

- (MATH1001 or MATH1901 or MATH1906) and (MATH1002 or MATH1902)

and

- (MATH1003 or MATH1903 or MATH1907) and (MATH1005 or MATH1905)

Students who want Mathematics as a support for a major in another area have a wide range of choices. Some faculties, schools and departments prescribe and/or recommend mathematics units: refer to the appropriate handbooks or advisers. In general, take as many mathematics units as you can fit in; if you satisfy prerequisites, take advanced units rather than mainstream units and mainstream units rather than fundamental units. If you intend to take intermediate units in mathematics, take MATH1903 or MATH1003 or seek the advice of the Mathematics Student Services Office if you do not wish to do this.

Students who want Statistics as a support for a major in another area should take MATH1905 or MATH1005 or MATH1015. Students who wish (at a later stage) to take STAT3012 Applied Linear Models will also need to take MATH1902 or MATH1002.

Students who wish to specialise in Financial Mathematics should take the following units:

- (MATH1901 or MATH1001 or MATH1906) and (MATH1902 or MATH1002)

and

- (MATH1903 or MATH1003 or MATH1907) and (MATH1905 or MATH1005)

1.8 What to do before semester starts

Once you have your timetable, check whether classes start in week 1 or 2. All lectures start in week 1, and tutorials start in week 2.
It is not essential to buy textbooks for mathematics units of study before semester starts, but you may do so if you wish. For several junior units of study the text is a set of course notes written by lecturers within the School of Mathematics and Statistics. All such notes may be purchased from KOPYSTOP, 55 Mountain St Broadway. They are *not* available from the University Copy Centre. Textbooks which are not published by the School of Mathematics and Statistics will generally be available from the Co-op Bookshop on campus.

2 Advanced Units

2.1 Who should take advanced units?

Advanced units of study are designed for students who have both a strong background and a keen interest in mathematics, and who wish to study mathematics at a higher level. Advanced units are challenging but rewarding. They treat topics at a greater depth and with more mathematical rigour than do mainstream units.

2.2 Assumed knowledge

The assumed knowledge for advanced units is the NSW Mathematics Extension 2 HSC course (or equivalent). The depth of study required for that HSC course is similar to that needed for advanced units here. Students who achieved Band 4 in the NSW Extension 1 HSC course (or equivalent) and who are enthusiastic about mathematics may also consider advanced units, although they will be missing some background knowledge. All students who wish to enrol in advanced units must apply for Departmental Permission through Sydney Student.

> If you are interested in enrolling in Advanced units, you should try a self-assessment test at `http://www.maths.usyd.edu.au/u/UG/JM/MATH1901/`

2.3 Objectives of advanced units

In addition to extending and deepening students' knowledge in key areas of mathematics and statistics, and preparing students for later units in mathematics and statistics, the advanced units are designed to

- provide challenging and stimulating material for students with an interest in, and aptitude for, mathematics;
- give students an appreciation of the power and beauty of mathematics;
- provide an insight into the way in which professional mathematicians think about mathematics;
- develop a student's ability to reason mathematically;
- give students an appreciation of the need for rigour in mathematics.

2.4 Student outcomes

Students who successfully complete advanced units will:

- be able to think logically and rigorously about mathematical problems;
- demonstrate proficiency in the new skills introduced in this unit;
- demonstrate strong analytical, algebraic and numerical skills;
- be able to construct sound mathematical arguments;

- demonstrate an understanding of the concepts introduced in this unit;
- be able to learn additional mathematics independently;
- be able to use mathematical techniques to solve a wide range of problems;
- be able to express mathematical ideas coherently.

2.5 Special Studies Program (SSP) units

These units are offered to a relatively small group of talented and committed students. The two SSP units are MATH1906 and MATH1907. MATH1906 includes all the material in MATH1901 as well as special topics which are not available elsewhere in the Mathematics and Statistics programs. Students attend the MATH1901 lectures and complete all MATH1901 assessment tasks, but have their own seminar and tutorial. The special topics will be assessed by means of assignments.

Similarly MATH1907 has the same lectures as MATH1903 plus seminars on special topics. For the purposes of Science Faculty regulations, SSP units count as Advanced units.

Selection into MATH1906 and/or MATH1907 is based on interest in and commitment to mathematics, and on HSC (or equivalent) results. A NSW ATAR score of at least 98.5 and a score of 95% in Mathematics Extension 2 is generally expected, although students with lower scores and a serious commitment to mathematics may apply for selection. Students interested in obtaining entry to the Special Studies Program should enrol in MATH1901 (unless informed otherwise) and subsequently apply for entry into MATH1906. Details of how to apply will be available on the MATH1906 website `http://www.maths.usyd.edu.au/u/UG/JM/MATH1906/` by late January or early February.

2.6 Semester 1 Advanced Units

MATH1901 Differential Calculus (Advanced) 3 credit points

Assumed background: HSC Mathematics Extension 2, or Band 4 HSC Mathematics Extension 1.

Prohibition: May not be counted with MATH1111, MATH1001, MATH1011, MATH1906.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

This unit begins with complex numbers and functions of a complex variable, and then builds on the calculus content of HSC Mathematics Extension 1 and 2. The crucial concepts of limits and continuity are discussed rigorously and the idea of derivative is extended to functions of two variables. Topics covered include the following:

Complex Numbers. Definitions, addition and multiplication. Polar form, de Moivre's theorem, finding nth roots. Complex exponential function, representing complex functions of a complex variable.

Functions of one variable. Domain and range. Injective and surjective functions. Composition and inverse. The hyperbolic functions. Limits and the limit laws. Continuity. The intermediate value theorem. Differentiability. Rolle's theorem. The mean value theorem. L'Hôpital's rule. Taylor polynomials.

Functions of two variables. Curves and surfaces in space. Level curves. Limits and continuity. Partial derivatives. Tangent planes and linear approximations. Chain rule. Implicit differentiation. Directional derivatives and the gradient.

Course notes (available from Kopystop):

- J Henderson. *Lecture Notes for MATH1901 and MATH1906.* School of Mathematics and Statistics, University of Sydney.

References (available from the Co-op Bookshop):

- *(suitable for students in the main class)* Stewart, James. *Calculus.* Cengage Learning. 7th Edition, International Edition, 2012, ISBN 978-0-538-49884-5 or 8th Edition, Metric Version, 2015, ISBN 978-1-305-26672-8.
- *(suitable for students aiming for Honours in Pure Mathematics)* Spivak, Michael. *Calculus.* Cambridge University Press, corrected 3rd ed. 2006.

MATH1902 Linear Algebra (Advanced) 3 credit points

Assumed background: HSC Mathematics Extension 2, or Band 4 HSC Mathematics Extension 1.

Prohibition: May not be counted with MATH1002, MATH1012, MATH1014.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

This unit commences with four weeks on geometric vectors, as objects having magnitude and direction (including, for example, force and velocity). The basic operations with vectors are addition (described by the parallelogram rule and/or triangle rule), multiplication by real numbers (or scalars, as they are known in this subject), the scalar (or dot) product and the vector (or cross) product. Vectors may be used to describe the positions of points in the plane or in space, and this provides a simple method of proving several theorems of Euclidean geometry. It also leads to vector forms of the equations of lines and planes.

The remaining nine weeks form an introduction to matrix theoretical aspects of linear algebra. A system of simultaneous linear equations can be conveniently described by its coefficient matrix: the rectangular array of numbers that gives the coefficients of all the variables in all the equations. The system is then solved by means of elementary row operations on the matrix. This leads on to matrix algebra: rules for addition and multiplication of matrices, multiplication of matrices by scalars, and the basic properties of these operations. Further topics include invertible (or nonsingular) matrices, calculation of inverse matrices by means of elementary row operations, and expressing an invertible matrix as a product of elementary matrices. Determinants are introduced using an inductive formula, and a cascade of surprising properties are carefully examined, setting the stage for the final part of the course, which introduces the theory of eigenvalues and eigenvectors. The Fundamental Theorem of Algebra is proved using a modification of Newton's Method from calculus, and the course ends with a discussion of diagonalisation and, time permitting, an introduction to real and complex Jordan forms. Applications to web search engines may be discussed, time permitting.

Textbook (available from the Co-op Bookshop):

- Easdown, David. *A First Course in Linear Algebra.* Pearson Education, 3rd ed. 2010.

MATH1906 Mathematics (Special Studies Program) A. 3 credit points

Assumed knowledge: HSC Mathematics Extension 2.

Entry is by invitation.

Prohibition: May not be counted with MATH1111, MATH1001, MATH1011, MATH1901.

Classes: 2 lectures, 1 seminar and 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes, assignments, classwork.

Students in MATH1906 attend the same lectures and complete the same assessments as for MATH1901, but have their own seminar and tutorial.

In addition to all the topics for MATH1901, some special topics are discussed in the seminar. In 2016, the following extra topics were offered:

Maps of the world
The globe cannot be mapped onto a plane without distortion. We look at map projections of the world and study their properties like for instance area and angle distortions. We discuss suitability of some maps for navigation and other purposes.

A model study of cardiac arrhythmia
Cardiac arrhythmia denote any conditions in which the electrical activity of the heart is irregular. Some arrhythmias are life-threatening that can cause cardiac arrest and sudden death. We will introduce a mathematical model of cardiac electrical activity using a discrete dynamical systems approach to understand what causes and controls their dynamics.

Fractals
Many objects in nature can be modelled by fractals. Fractal sets or images have the property that if we look at them under a microscope, using larger and larger magnifications, we continue to see similar features at all scales. Examples of fractals include biology (blood vessel patterns, structure and development of plants), physics (statistical mechanics, dynamical systems), computer science (image compression, compression for multimedia), engineering (image encoding, antennae, signal processing), and chemistry (pattern-forming alloy solidification). We will look at a number of fractals and discuss how to generate them. We will also study some of their surprising properties.

Course notes and references:
As for MATH1901. Additional references may be given in seminars.

2.7 Semester 2 Advanced Units

MATH1903 Integral Calculus and Modelling (Advanced). 3 credit points

Assumed background: MATH1901, or HSC Mathematics Ext 2, or Band 4 HSC Mathematics Ext 1, or Distinction in MATH1001.

Prohibition: May not be counted with MATH1003, MATH1013, MATH1907.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

Integral Calculus. This part of the course puts the notion of the Riemann integral onto a solid footing and builds on the introduction to integration given at highschool level. We rigorously prove the Fundamental Theorem of Calculus, thereby establishing an extremely powerful connection between the Integral Calculus and the Differential Calculus from last semester (MATH1901). A

wide range of applications will be discussed, from computing areas, lengths, volumes and surface areas to showing that π is irrational.

This part of the course also contains an introduction to sequences and series, and a careful study of Taylor polynomials and Taylor series. This is a beautiful area of mathematics, with many remarkable formulae and theorems. There are also extensive applications of this theory in applied mathematics. This material will be built on in later courses, such as MATH2963 (Real and Complex Analysis) and MATH3969 (Measure Theory and Fourier Series).

Topics covered include: Riemann sums; the definition of the Riemann integral; The Fundamental Theorem of Calculus; analysis of functions defined by integrals; area problems; volume problems; surface area problems; lengths of graphs and curves; classification of discontinuities; improper integrals; tests for convergence of integrals; definition of sequences and series; tests for convergence of sequences and series; Taylor polynomials; Taylor's Theorem; Taylor series. There will also be a brief review of integration techniques: change of variables (including hyperbolic substitutions); partial fractions; integration by parts; reduction formulas.

Material from this central course will arise again and again throughout your mathematics program, for example in the Vector Calculus component of MATH2961, in the analysis courses MATH2963 and MATH3964, and in the differential equations courses MATH2965 and MATH3978.

Differential equations and modelling. Introduction to differential equations (order, degree, linearity). Separable equations of first order. Applications to population problems, disease transmission, chemical reactions, radioactive decay, velocity and acceleration, inverse square law of gravitation, etc.

Linear equations of first order and integrating factors. Applications to population problems, mixing problems, heat conduction, electrical circuits, etc.

Other classes of first-order equations. Change of variable in a differential equation. Exact differential equations and integrating factors.

Linear equations of second order. Introductory theory, case of constant coefficients, coupled first-order equations, nonhomogeneous terms, method of undetermined coefficients. Applications to predator-prey models, arms race, electrical circuits, radioactive decay in two stages, elastic springs, damping, forced vibrations and resonance, etc.

Course notes (available from Kopystop):

- Dullin, Luckock and Parkinson. *Course Notes for MATH1903.* School of Mathematics and Statistics, University of Sydney.

References: as for MATH1901.

MATH1905 Statistics (Advanced) 3 credit points

Assumed knowledge: HSC Mathematics Extension 2, or Band 4 HSC Mathematics Extension 1.

Prohibition: May not be counted with MATH1005, MATH1015, STAT1021 or ECMT1010.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

Data Analysis. Histograms, stem-leaf displays. Introduction to a statistical computer package. Quartiles, box-plots. Transformations for symmetry. Summary statistics. Bivariate data: correlation; regression.

Probability. Introduction. Probability rules. Bayes theorem. Integer valued random variables. Binomial and Poisson distributions. Expectation. Variance. Probability generating functions. Introduction to continuous random variables. Normal distribution, use of statistical tables. Sampling distributions. The Central Limit Theorem. Normal approximation to the binomial.

Inference. Tests for hypotheses about proportions. Sign test (a non-parametric test). Normal test for hypotheses about the population mean. One and two sample t-tests. Confidence intervals for the population mean and proportions. Chi-squared tests: goodness of fit. Two way contingency tables.

Textbook (available from the Co-op Bookshop):

- Phipps, M.C. and Quine, M.P. *A Primer of Statistics*. Prentice Hall, Australia, 4th ed. 2001.

MATH1907 Mathematics (Special Studies Program) B. 3 credit points

Qualifying: Distinction in MATH1906 or by invitation.

Prohibition: May not be counted with MATH1003, MATH1013, MATH1903.

Classes: 2 lectures, 1 seminar and 1 tutorial per week.

Assessment: One 1.5 hour examination, assignments, classwork.

Students in MATH1907 attend the same lectures and complete the same assessments as for MATH1903, but have their own seminar and tutorial.

In addition to all the topics for MATH1903, some special topics are discussed in the seminar. In 2016, the following extra topics were offered:

Coxeter groups (An introduction to group theory)
The quest to understand symmetries is a driving force in all of mathematics and science. In this module we introduce the mathematical framework called "group theory" used for studying symmetries. To keep things concrete we will focus on the class of "Coxeter groups". These groups encapsulate the notion of "reflection symmetry", and as a result they have applications in many parts of mathematics (both pure and applied) and science. We will use some linear algebra and combinatorics to develop some of the beautiful theory of these groups.

The visualisation of high dimensional data
High dimensional data refers to data anywhere from a few dozen to many thousands of dimensions and they are found in many disciplines including finance, medicine and biology. These include next generation sequencing where a large number of measurements are produced simultaneously. We will examine some modern techniques that enable us to visualise high-dimensional data and enable to better formulate questions and refine modelling strategies.

Conformal transformations in fluid dynamics
Transformations are a powerful tool used in many areas of pure and applied mathematics to simplify the solution of a problem. We will consider conformal transformations to solve problems in fluid dynamics by working in the complex plane. Specifically, in solving Laplace's equation for velocity potential, complicated boundary conditions may be converted to simple boundary conditions. Another fascinating example is finding the flow past an aerofoil using the Joukowski transformation, enabling the lift force to be calculated.

Course notes and references:
As for MATH1903. Additional references may be given in seminars.

3 Mainstream Units

3.1 Who should take mainstream units?

Mainstream Units of Study are designed for students who have both the necessary background and interest in mathematics, and who want to study mathematics beyond junior units, or need to do so in order to satisfy degree requirements. Mainstream units cover much the same material as advanced units, but less rigourously.

3.2 Assumed knowledge

The assumed knowledge for MATH1001 is NSW HSC Mathematics Extension 1 (or equivalent). Students who have done well in the equivalent of 2-Unit Mathematics at the NSW HSC may consider enrolling in MATH1001 after discussion with a mathematics adviser during enrolment.
The assumed knowledge for MATH1002, MATH1004 and MATH1005 is NSW HSC Mathematics.
The assumed knowledge for MATH1003 is MATH1001 or NSW HSC Mathematics Extension 2.
Students who have only NSW HSC Mathematics but are required to enrol in MATH1001 should complete a bridging course in February. Details of Bridging Courses are available from the Student Services Office, or from mathematics advisers at enrolment.
Students with a Distinction or High Distinction in MATH1001 or MATH1002 are encouraged to discuss the possibility of enrolling in one of the second semester advanced units with the First Year Director.

3.3 Objectives of mainstream units

In addition to extending students' knowledge in key areas of mathematics and statistics, and preparing students for later units in mathematics and statistics, the mainstream units are designed to

- give students an appreciation of the power and beauty of mathematics;
- demonstrate the application of mathematics to a wide variety of physical problems;
- develop a student's ability to reason mathematically;
- give students an appreciation of the need for rigour in mathematics.

3.4 Student outcomes

Students who successfully complete mainstream units will:

- be able to think logically and rigorously about mathematical problems;
- demonstrate strong analytical, algebraic and numerical skills;
- be able to follow and extend mathematical arguments;
- have gained a greater appreciation of mathematics and its applications;
- be able to use mathematical techniques to solve a wide range of problems;
- be able to express mathematical ideas coherently in written and oral form.

3.5 Semester 1 Mainstream Units

MATH1001 Differential Calculus — 3 credit points

Assumed knowledge: HSC Mathematics Extension 1.

Prohibition: May not be counted with MATH1111, MATH1011, MATH1901, MATH1906.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

This unit begins with a brief introduction to complex numbers, and then builds on the calculus content of HSC Mathematics Extension 1, focusing on the ideas underpinning the calculus, and exploring the calculus of functions of two variables. Topics covered include the following:

Complex Numbers. Definitions, addition and multiplication. Geometric representation, Argand diagram, modulus and argument, conjugates. Solving quadratics. Polar form, de Moivre's theorem.

Functions of two variables. Curves and surfaces in space. Level curves. Parametric representations. Tangent planes to surfaces. Partial derivatives. Differentials. Chain rule. Continuity and differentiability. Critical points. Directional derivatives and the gradient. Limits and continuity.

Taylor polynomials and Taylor series. Approximations using Taylor polnomials. The remainder term. Euler's formula. The binomial series.

Course notes (available from Kopystop):

- *Lecture Notes for MATH1001.* School of Mathematics and Statistics, University of Sydney, 2017.

Reference (available from the Co-op Bookshop):

- Stewart, James. *Calculus.* Cengage Learning. 8th Ed. 2015.

MATH1002 Linear Algebra — 3 credit points

Assumed knowledge: HSC Mathematics or MATH1111.

Prohibition: May not be counted with MATH1902, MATH1012, MATH1014.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

Vectors. Addition: parallelogram rule and/or triangle rule. Examples: position vectors of points in space, velocities, forces, displacements. Geometry using vectors. Vectors in the plane and space. Cartesian representation. Polar forms. Scalar or dot product. Projection. Vector or cross product. Application to trigonometry. Lines mainstream to planes in space; planes mainstream to lines in space; lines mainstream to lines in the plane.

Linear Algebra. Solving systems of linear equations by row reducing augmented matrix. Completely reduced matrices. Addition and multiplication of matrices. Multiplication by a scalar. Matrix algebra, identity matrix, inverse matrices. Solving linear equations using inverse matrices. Elementary matrices, finding inverses by row reduction. Expressing a non singular matrix and its inverse as products of elementary matrices. Determinants: expanding by the top row. Rules for evaluating determinants. Effect of elementary row operations. Determinant of: a product of two square matrices; the inverse of a matrix; scalar product of a matrix. Eigenvectors, eigenvalues. The Leslie population model.

Textbook (available from the Co-op Bookshop):

- Easdown, David. *A First Course in Linear Algebra.* Pearson Education. 3rd ed. 2010.

3.6 Semester 2 Mainstream Units

MATH1003 Integral Calculus and Modelling — 3 credit points

Assumed knowledge: HSC Mathematics Extension 1 or MATH1001 or MATH1901 or Credit in MATH1011 or Distinction in MATH1111.

Prohibition: May not be counted with MATH1903, MATH1013, MATH1907.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

Integration. In this section of the unit the definite integral is defined as a limit of a Riemann sum, and the Fundamental Theorem of Calculus is discussed. The logarithm function is defined as an integral, and the exponential function as its inverse. Applications of integration, such as determining areas and volumes by slicing, are studied. New techniques of integration are introduced: trigonometric and hyperbolic substitution; integration by parts; partial fractions.

Differential equations and modelling. An introduction to the use of first and second order differential equations to model a variety of scientific phenomena. Mathematical modelling is a process by which mathematical relationships are proposed between physical quantities, based on empirical data and existing theories. Differential equations are used to model such phenomena as radioactive decay, population growth, disease transmission, chemical reactions, free fall with air resistance, motion of a mass on a spring.
Types of differential equations studied include: first order separable (including logistic), first order linear and second order homogeneous linear. Systems of two first order linear equations are also studied.

Course notes (available from Kopystop):

- N R O'Brian, C J Durrant and D J Galloway. *Integral Calculus and Modelling.* School of Mathematics and Statistics, University of Sydney.

Reference (available from the Co-op Bookshop):

- Stewart, James. *Calculus.* Cengage Learning. 7th Edition, International Edition, 2012, ISBN 978-0-538-49884-5 or 8th Edition, Metric Version, 2015, ISBN 978-1-305-26672-8.

MATH1004 Discrete Mathematics — 3 credit points

Assumed knowledge: HSC Mathematics or MATH1111.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

This unit is an introduction to fundamental aspects of discrete mathematics, an area of mathematics which deals with "things that come in chunks that can be counted." Topics covered include the following:

Sets. Functions. Counting principles. Ordered selections. Unordered selections. The inclusion-exclusion principle. Multinomial coefficients. Boolean expressions. Karnaugh maps. Logic. Digital Logic. Mathematical induction. Generating functions. Linear recurrence relations. Graphs and trees.

Textbook (available from the Co-op Bookshop):

- Choo, K.G. and Taylor, D.E. *Introduction to Discrete Mathematics.* Addison Wesley Longman Australia, 1998.

MATH1005 Statistics 3 credit points

Assumed knowledge: HSC Mathematics or MATH1111.

Prohibition: May not be counted with MATH1905, MATH1015, STAT1021, STAT1022, ENVX1001, BUSS1020 or ECMT1010.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

This unit is divided into three sections as detailed below. Tutorials are conducted in computer laboratories where students may make use of R, a powerful and freely available statistical computing environment.

Data Analysis. Histograms, stem-leaf displays. Quartiles, box-plots. Summary statistics. Bivariate data: correlation; regression.

Probability. Introduction. Probability rules. Integer random variables, binomial distribution. Expectation. Variance. Introduction to continuous random variables. Normal distribution. Use of statistical tables. Sampling distributions. The Central Limit Theorem. Normal approximation to the binomial.

Inference. Tests for hypotheses about proportions. Sign test (a non-parametric test). Normal test for hypotheses about the population mean. One and two sample t-tests. Confidence intervals for the population mean and for proportions. Chi-squared tests: goodness of fit.

Textbook (available online):

- Freedman, D., Pisani, R. and Purves, R. Statistics 4e Norton E-Text, 2007.

4 Fundamental Units

4.1 Who should take fundamental units?

Fundamental units are designed for students whose major interest lies outside mathematics, but who require mathematics and statistics to support the study of other scientific disciplines. In general, students who take fundamental units will not be interested in studying mathematics after first year. Students who wish to continue studying mathematics after first year, or who are enrolled in a degree program which requires intermediate mathematics, should aim for at least credits in fundamental junior units or choose mainstream junior units.

4.2 Assumed knowledge

HSC Mathematics (or equivalent) is the assumed knowledge for all fundamental units. Students who wish to enrol in fundamental units without the assumed knowledge should complete a Bridging Course in February. Details of Bridging Courses are available from the Student Services Office, or from mathematics advisers at enrolment.

4.3 Objectives of fundamental units

The fundamental units are designed to:

- illustrate ways in which students' existing mathematical knowledge can be applied to problems that arise in the life sciences;
- demonstrate applications of mathematics and statistics;
- give students an appreciation of mathematics as vital to all scientific disciplines.

4.4 Student outcomes

Students who successfully complete fundamental units will:

- demonstrate proficiency in the new skills introduced through this unit;
- communicate mathematical ideas coherently both orally and in writing;
- use a variety of mathematical techniques to solve problems;
- be able to choose an appropriate mathematical model to describe certain situations.

4.5 Semester 1 Fundamental Units

MATH1011 Applications of Calculus **3 credit points**

Assumed knowledge: HSC Mathematics.

Prohibition: May not be counted with MATH1111, MATH1001, MATH1901, MATH1906, BIOM1003 or ENVX1001.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

Functions and Modelling. The use of polynomial, exponential, periodic and logarithmic functions to model data, including the scaling of data using log-log and semi-log transformations.

Optimisation. The use of differential calculus to find and classify critical points, and hence find local and global maxima and minima of functions of one variable. Partial derivatives and maxima/minima of functions of two variables. Absolute and relative growth rates. Word problems and applications.

Integral calculus. Finite sums, indefinite and definite integrals, improper integrals of infinite type, word problems and applications.

Course notes (available from Kopystop):

- *Course Notes for Applications of Calculus.* School of Mathematics and Statistics, University of Sydney.

Extra References (available from the Co-op Bookshop):

- Briggs, W., Cochrane, L. and Gillett, B. *Calculus for Scientists and Engineers.* Pearson Education, 2013.
- Stewart, James. *Calculus.* Cengage Learning. 7th Edition, International Edition, 2012, ISBN 978-0-538-49884-5 or 8th Edition, Metric Version, 2015, ISBN 978-1-305-26672-8.

MATH1015 Biostatistics **3 credit points**

Assumed knowledge: HSC Mathematics.

Prohibition: May not be counted with MATH1005, MATH1905, STAT1021, STAT1022, BIOM1003, ENVX1001, BUSS1020 or ECMT1010.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

Overview of statistical analysis.

Introduction to R, a freely available statistical computer package.

Descriptive statistics : measures of location (mean, median); measures of spread (standard deviation, variance, interquartile range). Graphical summaries (histograms, boxplots). Shapes of distributions.

Simple probability and an introduction to random variables. The binomial random variable to model discrete data and the normal random variable as a model for continuous data.

Sampling distributions. The Central Limit Theorem.

Introduction to statistical inference. The p-value. 1-sample tests for hypotheses about the mean (the z-test and the t-test). The paired t-test.

Confidence intervals for the population mean.

2-sample t-tests.

Tests of hypotheses about proportions. Confidence intervals for the population proportions. Contingency tables, Chi-squared goodness of fit tests for testing agreement between frequency data and models.

Linear regression. Fitting a straight line to a scatter plot. Correlation. Assessing the regression line.

Textbook (available from the Co-op Bookshop):

- MATH1015 Biostatistics - Custom Publishing for The University of Sydney, Cengage Learning (2011). Compiled by Shelton Peiris, Jennifer Chan and Dobrin Marchev.

Reference (available from the Co-op Bookshop):

- Phipps, M.C. and Quine, M.P. *A Primer of Statistics.* Prentice Hall, Australia, 4th ed. 2001.

4.6 Semester 2 Fundamental Units

MATH1013 Mathematical Modelling 3 credit points

Assumed knowledge: HSC Mathematics or at least a credit in MATH1111.

Prohibition: May not be counted with MATH1003, MATH1903, MATH1907.

Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

In this course students are introduced to the most common mathematical tools used to model systems exhibiting various types of growth or decay and interactions such as cooperation and competition. Authentic examples are drawn from a wide variety of disciplines including biology, medicine, economics and sociology. Emphasis is placed on concepts such as equilibrium and stability. Students learn how to construct, interpret and solve simple differential equations and recurrence relations. Specific techniques include separation of variables, partial fractions and first and second order linear equations with constant coefficients. Students are also shown how to iteratively improve approximate numerical solutions to equations.

Course notes (available from Kopystop):

- Poladian, Leon. *Mathematical Modelling.* School of Mathematics and Statistics, University of Sydney 2011.

References: as for MATH1011

MATH1014 Introduction to Linear Algebra 3 credit points

Assumed knowledge: HSC Mathematics or MATH1111.

Prohibition: May not be counted with MATH1012, MATH1002, MATH1902.
Classes: 2 lectures, 1 tutorial per week.

Assessment: One 1.5 hour examination, quizzes and assigned work.

This unit is an introduction to linear algebra and its applications. Linear algebra and calculus are the two central themes of undergraduate mathematics. Linear algebra is the study of vectors, vector spaces, linear maps, and systems of linear equations. It has extensive applications in the natural sciences and the social sciences, since nonlinear models can often be approximated by linear ones. In this unit, students will be introduced to the basic tools and techniques that are used in linear algebra. Topics covered include:

Geometry and Algebra of Vectors. Length and angle, lines and planes. Modular arithmetic and codes.

Linear equations. Systems of linear equations, Gaussian and Gauss-Jordan elimination. Resource allocation and network analysis.

Matrices and Linear Algebra. Matrix operations, matrix algebra, invertible matrices. Leslie population models and Markov chains.

Eigenvalues, Eigenvalues and Determinants. Introduction to eigenvalues and eigenvectors, determinants. Application to population models and Markov chains.

Textbook (available from the Co-op Bookshop):

- Easdown, David. *A First Course in Linear Algebra.* Pearson Education. 3rd ed. 2010.

5 Introduction to Calculus

5.1 Who should take this unit?

This unit of study is available only to those students who have not successfully completed a calculus course at school. Students with HSC General Mathematics or only Year 10 Mathematics are eligible to enrol in this unit. Permission must be sought from the School of Mathematics and Statistics in order to enrol. The unit is offered only in semester 1.

5.2 Objectives

This unit is designed to:

- provide students with a clear understanding of the ideas of calculus;
- build a solid foundation for subsequent courses in mathematics;
- demonstrate the power of the calculus as a tool for solving problems in science and engineering.

5.3 Student outcomes

Students who successfully complete this unit will:

- have fluency in manipulating functions and translating ideas into mathematics;
- understand the key concepts of calculus;
- have fluency in differentiating and integrating a range of functions;
- be able to use ideas and techniques from calculus to solve problems;
- have sufficient mathematical literacy to approach other first year mathematics or statistics units of study with confidence.

MATH1111 Introduction to Calculus **6 credit points**

Students with HSC Mathematics or HSC Mathematics Extension 1 or HSC Mathematics Extension 2 (or equivalent) are prohibited from enrolling in this unit.

Assumed knowledge: At least Year 10 Mathematics.

Prohibition: May not be counted with MATH1011, MATH1001, MATH1901, MATH1906 or ENVX1001.

Classes: 3 lectures, 2 tutorials per week.

Assessment: One 2 hour examination, quizzes and assigned work.

This unit is an introduction to differential and integral calculus. Topics covered include: elementary functions; differentiation of the elementary functions; differentiation using the product, quotient and chain rules; optimisation and modelling; basic integration techniques; co-ordinate geometry in three dimensions. The historical development of calculus and applications of calculus in other science disciplines are emphasised.

Interactive Electronic Study Plan (access and details to be announced):

- Perkal, Narwin. *MyMathLab Global, Australia/New Zealand Edition.* Pearson Education, 2012.

Textbook (available from the Co-op Bookshop):

- Anton, H., Biven, I. and Davis, S. *Calculus Early Transcendentals Single Variable.* 10th ed. Wiley, 2012.

6 Classes

All junior units of study require attendance at both lectures and tutorials. The number of classes in any particular unit is given in previous sections.

6.1 Lectures

The content of a unit of study is delivered via lectures. In most junior units the size of the lecture class is very large, and the pace at which material is delivered is usually quicker than you will have encountered at school. Lecturers may provide you with text references during lectures. It is important to listen, and to try to follow the material being presented, and take abbreviated notes rather than comprehensively write down everything.
You are expected to attend lectures. If you do not attend lectures you will not only miss the material presented, but you may miss important announcements. Remember that it is your responsibility to find out the content of any such announcements in the event that you were absent when they were made.

6.2 Tutorials

Mathematical skills and understanding cannot be acquired passively, for example by attendance at lectures alone. On the contrary, it is essential that you work through as many relevant problems as possible by yourself. Tutorials are small classes in which you are expected to work through some set exercises, either on your own or with a group of students. Question sheets and solutions will be available from the unit website. You will gain maximum benefit from a tutorial if you have attempted the pre-tutorial exercises before the actual tutorial, since you will then be able to ask the tutor for help with any exercises that cause you difficulties. Tutors are present in tutorials to help you work through the exercises, and not to merely provide you with solutions.
A record of your tutorial attendance is kept. You should attend the tutorial to which you have been assigned on your timetable. When you attend your first tutorial you should check that your name is *typed* onto your tutor's roll. Timetable changes can be made during the first week of semester through MyUni.

6.3 Consultations

If you are having any difficulties understanding the mathematical content of a unit you are strongly encouraged to consult your lecturer. All lecturers in junior mathematics units will have a scheduled consultation hour. Consultation hours will be announced early in the semester. Tutors may also be on duty to answer any questions. Check the unit of study website for details.

7 Assessment

In general, assessment in junior mathematics units will be based on tasks to be completed during the semester as well as the end of semester exam. Precise details of the assessment procedures in each unit will be included in a "Unit Information Sheet" which will be made available online by the first week of lectures.

7.1 Grades

Final grades in mathematics units of study are returned within one of the following bands:

> *High Distinction (HD), 85–100:* representing complete or close to complete mastery of the material; *Distinction (D), 75–84:* representing excellence, but substantially less than complete mastery; *Credit (CR), 65–74:* representing a creditable performance that goes beyond routine knowledge and understanding, but less than excellence; *Pass (P), 50–64:* representing at least routine knowledge and understanding over a spectrum of topics and important ideas and concepts in the course.

A student with a passing or higher grade should be well prepared to undertake further studies in mathematics. Students hoping to continue with advanced units of study should be aiming for credits or higher grades.

7.2 Examinations

Each junior mathematics unit has an examination during the University examination period at the end of the semester in which the unit is offered. The dates of the exam period, and information concerning the exam timetable, can be found at:
`http://sydney.edu.au/current_students/student_administration/examinations`
As soon as they become available final examination timetables, examination rooms and seat numbers are posted on the web. Students are advised to check the timetable carefully. Proof of identity is required at *all* examinations. Late in the semester further information relating to examinations will be posted on the unit of study websites.

7.3 Assignments

Assignments are set and marked in order to give you extra practice, and to provide you with feedback on how you are handling the material.
Some collaboration between students on assignments is encouraged, since it can be a real aid to understanding. Thus it is legitimate for students to discuss assignment questions at a general level, provided everybody involved makes some contribution. However, if an assignment is to count as part of the assessment in a unit of study, then you must produce your own individual written solution. Copying someone else's assignment, or allowing your assignment to be copied by someone else, is academic dishonesty and will be dealt with as such according to the University's "Academic Dishonesty and Plagiarism in Coursework" policy (available on the University website).
Late assignments are generally not accepted. Please see Section 8.1.

7.3.1 Submission and return of assignments

The assignments must be submitted electronically in Turnitin (a text-based similarity detecting software), via the Learning Management System (Blackboard) site by the deadline. Your submission should include your name, SID, tutorial day, time, room and Tutor's name. Your assignment will be marked with useful comments and feedback, which you can view online from the LMS (Blackboard) site after the Feedback date, given on the Unit Information Sheet.

7.4 Quizzes

Almost all junior units of study may have quizzes as part of the assessment. These will usually be conducted in a regular tutorial period by the tutor. You should attempt any quiz in the tutorial in which you are officially enrolled. You are enrolled in a tutorial class if and only if your name is *typed* onto the roll for that class.

If you have a legitimate reason for being unable to sit the quiz in the tutorial in which you are enrolled then you may apply, at the Mathematics Student Services Office, to sit the quiz at a different time.

Please note: Your quiz mark may not be recorded if you sit a quiz in a tutorial in which you are not enrolled, unless you have been given permission to do so by the Student Services Office.

7.5 Results

Your final result in each unit will be posted on the University of Sydney's web site and later you will receive notice of examination results by mail. If you have a concern about your results, contact the Student Services Office.

8 Special consideration and special arrangements

While studying at the University of Sydney, a student may need to apply for special consideration or special arrangements as follows:
Special Consideration may be granted where well-documented illness, injury or misadventure occurs to the student (or someone the student has carers responsibility for) during semester or the exam period.
Longer term health or emotional issues are best managed with adjustments to course assessments as part of an Academic Plan developed in discussion between the student and Disabilities Service.
Special Arrangements may be granted for certain personal circumstances - for example the birth of a child, or religious or cultural commitments - or for essential community commitments - for example compulsory legal absence (e.g. Jury duty), elite sporting or cultural commitments (representing the University, state or country), or Australian Defence Force or Emergency Service commitments (e.g. Army Reserve).
Further information on eligibility, document requirements and how to apply is available at `http://sydney.edu.au/science/cstudent/ug/forms.shtml#special_consideration`. Applications must be made using the University's formal online application process no later than three (3) working days after the assessment occurrence or due date (unless a reasonable explanation for a delay is provided).
When completing the online application, ensure you choose an Assessment Category and Type that matches the description of the assessment given in the Unit Outline.
Students should not submit an application of either type if

- there is no assessment associated with a missed class, or
- there is a reasonable opportunity to make up any work you missed.

Note that occasional brief or trivial illness will not generally warrant special consideration.
Note that an application for special consideration or special arrangements is a request only, and not a guarantee that special consideration will be granted or special arrangements made.

8.1 Special consideration relating to assignments.

Requests for simple extensions of time for assessments should be made to the unit of study coordinator (First Year Director) in the first instance. Extensions longer than one week are generally not possible. You may still be directed to apply for Special Consideration or Special Arrangements as outlined above. Late assignments will only be accepted if you have an approved extension.

8.2 Special consideration relating to quizzes.

If you miss a quiz due to illness or misadventure, then you should go to the Mathematics Student Services Office as soon as possible afterwards. Arrangements may be made for you to sit the quiz at another time. If that is not possible then you may be eligible to apply for Special Consideration if the *bettermark principle* does not apply.
If your application for Special Consideration relating to missing a quiz is successful then you gain exemption from the quiz and the credit is transferred to the final examination.

Most units of study now use a *bettermark principle*, so that credit for a missed quiz is automatically transferred to the exam, in which case there is no need to apply for Special Consideration.

8.3 Special consideration relating to end-of-semester examinations.

If you believe that your performance on an exam was impaired due to illness or misadventure during the week preceding the exam, then you should apply for Special Consideration. If your application is

successful you may be offered the opportunity to sit a supplementary exam. Please note that illness or misadventure during the week preceding the exam is not usually an acceptable reason for missing an exam.
If you miss an exam due to illness or misadventure on the day of the exam then you should apply for Special Consideration. If your application is successful you will be granted the opportunity to sit a supplementary examination.

8.4 Special consideration relating to attendance.

The University policy is that all students should attend at least 80 per cent of timetabled classes in their respective units of study. Attendance is monitored in tutorials, but no marks are allocated for attendance, except where it is incorporated in some scheduled assessed activity. Applications for Special Consideration or for Special Arrangements for absences that do not involve a scheduled assessed activity are not necessary.

8.5 Jury duty, military service, national sporting and religious or cultural commitments.

Students who will miss an assessment due to commitments such as these may apply for special arrangements to be made, as detailed above.

9 Additional information

9.1 Variation of enrolment

Any variation to enrolment must be made before the relevant HECS cut-off date in each semester (some time in March for first semester, and some time in August for second semester).
After the cut-off dates it may not be possible to enrol in additional units, nor to withdraw from a unit without incurring HECS fees. Note that it is generally not possible to enrol in additional units of study after the end of the second week of each semester.
It is your responsibility to make any desired changes to your enrolment before the relevant dates. This includes changing the level at which you are studying mathematics, for example from advanced to mainstream, or vice versa. You are strongly advised to consult the Director of First Year Studies if you wish to make such a change. Even though advanced and mainstream units have similar syllabuses, changing from one to the other may be disruptive. If it is necessary to make such a change, try to change earlier rather than later. Because advanced and mainstream units have completely different syllabuses from fundamental units, changes to and from fundamental units may be even more disruptive. In general, such changes should not be made after the end of the second week of each semester.

9.2 Mathematics Learning Centre

Students who have difficulties with current course work as a result of inadequate understanding of the assumed knowledge for the unit of study may find that the Mathematics Learning Centre can help.
The Mathematics Learning Centre can be of particular assistance if you:

–are a mature age student,
–have not studied mathematics for some years,
–were educated interstate or overseas,
–did not study mathematics at the appropriate level at school.

The Mathematics Learning Centre offers advice about supplementary work needed and has self-study materials, in a variety of forms, which students can use. Small classes or one-to-one assistance are provided where needed. The Mathematics Learning Centre also helps students to improve their study skills. The Mathematics Learning Centre Office is Carslaw Room 177, (Level 1).

9.3 Sydney University Mathematical Society

ΣUMS (pronounced sums) is an informal group, organised by students, that aims to promote interest in mathematics. Every mathematics student is automatically a member. ΣUMS organises talks by mathematicians, an annual problem solving competition and various other events such as the ΣUMS musical. Everybody is very welcome to attend and be involved. Contributions to the ΣUMS newsletter (ΣUMS+Plus) are also welcome.

9.4 Sydney University Science Association

The University of Sydney Science Society, SciSoc, is the undergraduate society for students in the Science Faculty at the University of Sydney. All students enrolled in Science at the University of Sydney are automatically members of SciSoc. Part of the mission of SciSoc is to provide a form of social support for Science students.

9.5 Fire alarms and evacuation procedures

If you are in a building and the fire alarm sounds, then you must evacuate the building immediately. You should familiarise yourself with the evacuation procedures from any rooms in which you have classes.

10 Lecture Timetable

10.1 Semester 1

Advanced Units		
MATH1901 Differential Calculus (Adv)	Thu & Fri	8am
MATH1902 Linear Algebra (Adv)	Mon & Tue	11am
MATH1906 Mathematics (SSP) A	Thu & Fri Tue	8am 4pm

Mainstream Units		
MATH1001 Differential Calculus	Thu & Fri	8am or 11am
MATH1002 Linear Algebra	Mon & Tue	8am or 11am

Fundamental Units		
MATH1011 Applications of Calculus	Thu & Fri	8am or 11am
MATH1015 Biostatistics	Mon & Tue	8am or 11am

Introductory Unit		
MATH1111 Introduction to Calculus	Wed Fri	4–5pm 3–5pm

Note: This timetable was correct at the time of printing. It is possible that changes may be made before the start of first semester.

10.2 Semester 2

Advanced Units		
MATH1903 Integral Calculus and Modelling (Adv)	Thu & Fri	8am
MATH1905 Statistics (Adv)	Mon & Tue	11am
MATH1907 Mathematics (SSP) B	Thu & Fri Tues	8am 4pm

Mainstream Units		
MATH1003 Integral Calculus and Modelling	Thu & Fri	8am or 11am
MATH1004 Discrete Mathematics	Wed & Thu	1pm
MATH1005 Statistics	Mon & Tue	8am or 11am or 1pm

Fundamental Units		
MATH1014 Introduction to Linear Algebra	Mon & Tue	10am or 11am
MATH1013 Mathematical Modelling	Thu & Fri	8am or 11am

Note: This timetable was correct at the time of printing. It is possible that changes may be made before the start of second semester.