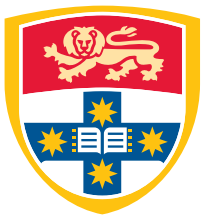
School of Mathematics and Statistics

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

JUNIOR MATHEMATICS and STATISTICS

2012 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.**

  David Easdown, Carslaw room 534.

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. 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, normal, 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 normal 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, normal 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*

Normal Units of Study in semester 1.

MATH1001 *Differential Calculus*

MATH1002 *Linear Algebra*

Normal 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, MATH1014, MATH1013 and MATH1015.
Students with only HSC General Mathematics or with only Year 10 mathematics will generally enrol in MATH1111 in semester 1. Special permission is required to enrol in MATH1111. Students enrolling in MATH1111 should discuss their choice of mathematics units for second semester with an adviser at enrolment.

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 normal. 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 normal units and normal 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 normal 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. A NSW UAI score of at least 90 is desirable. All students who wish to enrol in advanced units must consult one of the School of Mathematics and Statistics advisers during the enrolment period.

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.

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

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

References

James Stewart. *Calculus.* Brooks/Cole Publishing Company, 5th edition, 2003.

G P Monro. *Proofs and Problems in Calculus.* Carslaw, Sydney, Australia, 1996.

M Spivak. *Calculus.* W A Benjamin, Addison-Wesley world student edition, 1967.

Hughes-Hallett et al. *Calculus.* John Wiley and Sons Inc, 3rd edition, 2002.

G B Thomas and R L Finney. *Calculus and Analytic Geometry.* Addison Wesley, 9th edition, 1996.

Stanley I Grossman. *Calculus.* Harcourt Brace College Publishers, 5th edition, 1992.

R F C Walters and K Wehrhahn. *Calculus 1.* Carslaw, Sydney, Australia, 1989.

MATH1902 Linear Algebra (Advanced) **3 credit points**

Assumed background: HSC Mathematics Extension 2.

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 are an introduction to 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 proved, 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 an introduction to real and complex Jordan forms. Applications to web search engines will be discussed, time permitting.

Textbook

David Easdown. *A First Course in Linear Algebra.* Pearson, 2008.

References

Anton and Busby. *Contemporary Linear Algebra.* Wiley, USA.

Lay. *Linear Algebra and its Applications.* Pearson, USA.

Poole. *Linear Algebra: A Modern Introduction.* Thomson Brooks/Cole, USA.

Strang. *Linear Algebra and its Applications.* Thomson Brooks/Cole, USA.

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 2011, the extra topics were:

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.

Mathematics and Musical Scales
The Pythagorean scale is based on the frequency ratios 2:1 for the octave and 3:2 for a perfect fifth. Constructing all notes from these ratios leads to inconsistencies, which can be resolved using continued fractions, the theory of which we will develop.

Symmetries and Patterns in the Plane
What do we mean when we say that something is symmetric? We will begin by formulating a mathematical answer to this question. We will then describe and classify the symmetries of all repeating patterns in the plane, using beautiful ideas from both algebra and topology.
The special topics for 2012 are yet to be announced.

Course notes and references
As for MATH1901. Additional references will 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 Credit 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

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.

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.

References

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

J E Freund and G A Simon. *Modern Elementary Statistics.* Prentice Hall, USA, 9th edition, 1996.

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 2010, the extra topics were:

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.

Branching Processes

In these lectures we will investigate simple probability models known as Bienayme-Galton-Watson processes which are used to model the development of biological populations. In simple terms each individual in generation n independently "gives birth" to a random number of offspring according to some probability distribution to form generation n+1. Apart from biological applications these stochastic processes can be used to help understand random phenomena in many areas including neutron chain reactions in nuclear reactors, chemical chain reactions and cascade of defects in complcated computer networks.

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. The special topics for 2012 are yet to be announced.

Course notes and references

As for MATH1903. Additional references will be given in seminars.

3 Normal Units

3.1 Who should take normal units?

Normal 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. Normal units cover much the same material as advanced units, but less rigourously.

3.2 Assumed knowledge

The assumed knowledge for MATH1001, MATH1002 and MATH1004 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 these units after discussion with a mathematics adviser during enrolment.
The assumed knowledge for 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 normal units will need to do 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 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 normal 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 normal 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 normal 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 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 both written and oral form.

3.5 Semester 1 Normal 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 binimial series.

Course notes

Lecture Notes for MATH1001. School of Mathematics and Statistics, University of Sydney, 2003.

References

James Stewart. *Calculus.* Brooks/Cole Publishing Company, 4th edition, 1999.
Hughes-Hallett et al. *Calculus.* John Wiley and Sons Inc, 3rd edition, 2002.
Stanley I Grossman. *Calculus.* Harcourt Brace College Publishers, 5th edition, 1992.
G P Monro. *Proofs and Problems in the Calculus.* Carslaw, Sydney, Australia, 1996.
R F C Walters and K Wehrhahn. *Calculus 1.* Carslaw, Sydney, Australia, 1989.
Adrian Banner. *The Calculus Lifesaver.* Princeton University press, 2007.

MATH1002 Linear Algebra — 3 credit points

Assumed knowledge: HSC Mathematics Extension 1

Prohibition: May not be counted with MATH1902 or MATH1012.

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 normal to planes in space; planes normal to lines in space; lines normal 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

David Easdown. *A First Course in Linear Algebra.* Pearson, 2008.

References

Anton and Busby. *Contemporary Linear Algebra.* Wiley, USA.
Lay. *Linear Algebra and its Applications.* Pearson, USA.
Poole. *Linear Algebra: A Modern Introduction.* Thomson Brooks/Cole, USA.
Strang. *Linear Algebra and its Applications.* Thomson Brooks/Cole, USA.

3.6 Semester 2 Normal Units

MATH1003 Integral Calculus and Modelling **3 credit points**

Assumed knowledge: HSC Mathematics Extension 2 or MATH1001 or MATH1901.
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

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

References

James Stewart. *Calculus.* Brooks/Cole Publishing Company, 4th edition, 1999.
Hughes-Hallett et al. *Calculus.* John Wiley and Sons Inc, 3rd edition, 2002.
G B Thomas and R L Finney. *Calculus and Analytic Geometry.* Addison Wesley, 9th edition, 1996.
Stanley I Grossman. *Calculus.* Harcourt Brace College Publishers, 5th edition, 1992.
R F C Walters and K Wehrhahn. *Calculus 1.* Carslaw, Sydney, Australia, 1989.

MATH1004 Discrete Mathematics — 3 credit points

Assumed knowledge: HSC Mathematics Extension 1.
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 K G Choo and D E Taylor. *Introduction to Discrete Mathematics.* Longman Cheshire, Australia, 1995.
Reference P F Dierker and W L Voxman. *Discrete Mathematics for Computer Scientists.* Harcourt-Brace-Jovanovic, San Diego, CA, USA, 1986.

MATH1005 Statistics — 3 credit points

Assumed knowledge: HSC Mathematics.
Prohibition: May not be counted with MATH1905, MATH1015, STAT1021 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 M C Phipps and M P Quine. *A Primer of Statistics.* Prentice Hall, Australia, 4th edition, 2001.
Reference J E Freund and G A Simon. *Modern Elementary Statistics.* Prentice Hall, USA, 9th edition, 1996.

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 choose normal 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 will need to do 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.
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
Course Notes for Applications of Calculus. School of Mathematics and Statistics, University of Sydney.

References
Adler. *Modelling the Dynamics of Life.* 2nd edition, Brooks/Cole Publishers, USA, 2005.
Adrian Banner. *The Calculus Lifesaver.* Princeton University press, 2007.
Bittinger, Brand and Quintanilla. *Calculus for the Life Sciences.* Pearson, 2006.
Cohen & Henle. *Calculus: the Language of Change.* Jones and Bartlett Publishers, USA, 2005.
Hughes-Hallett et al. *Calculus.* John Wiley and Sons Inc, 3rd edition, 2002.

MATH1015 Biostatistics **3 credit points**

Assumed knowledge: HSC Mathematics.
Prohibition: May not be counted with MATH1005, MATH1905, STAT1021 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
Rosner, Peiris, Chan, Marchev. *MATH1015: Biostatistics.* Custom version for the University of Sydney. CENGAGE Learning.

References
C. J. Wild and G. A.F. Seber. *Chance encounters : a first course in data analysis and inference*. John Wiley, New York, 2000.
Freund & Simon. *Modern Elementary Statistics*. Prentice Hall, USA, 9th ed, 1996.
Phipps & Quine. *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 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
Leon Poladian. *Mathematical Modelling.* School of Mathematics and Statistics, University of Sydney.

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
David Poole. *Linear Algebra: A Modern Approach.* Custom version for MATH1014. Cengage Learning.

References
Anton and Busby. *Contemporary Linear Algebra.* Wiley, USA.
Lay. *Linear Algebra and its Applications.* Pearson, USA.
Strang. *Linear Algebra and its Applications.* Thomson Brooks/Cole, USA.

5 Introduction to Calculus

5.1 Who should take this unit?

This unit of study is available only to those students who have not completed a calculus course at school. Students with only 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 and other disciplines;
- 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:

- understand the concept of a function;
- understand the key concepts of calculus;
- be able to differentiate and integrate a range of functions;
- be able to use ideas and techniques from calculus to solve problems;

MATH1111 Introduction to Calculus **6 credit points**

Assumed knowledge: At least Year 10 Mathematics.
Prohibition: May not be counted with MATH1011 or MATH1001 or MATH1901 or MATH1906. Students with HSC Mathematics or HSC Mathematics Extension 1 or HSC Mathematics Extension 2 (or equivalent) are prohibited from enrolling in this unit.
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. Applications of calculus in other science disciplines are emphasised.

Textbook
Hughes-Hallett et al. *Calculus: Single Variable.* 5th edition, Wiley, 2009.

Reference book
Adrian Banner. *The Calculus Lifesaver.* Princeton University press, 2007.

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. At each lecture, the lecturer will provide you with a text reference. It is more important to listen, and to try to follow the material being presented, than it is to take notes.
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. Tutorial exercise sheets should be downloaded from the unit website. You will gain maximum benefit from a tutorial if you have attempted the 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. Solutions to tutorial exercises will be posted on the relevant unit web page.
A record of your tutorial attendance is kept. You must 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 3 weeks 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 issued in the first week of lectures.

7.1 Grades

There are four grades of pass in all the mathematics units and the marks associated with these are uniform throughout the University. The grades and associated scaled marks are: Pass (50-64), Credit (65-74), Distinction (75-84) and High Distinction (85-100).
The proportions of candidates with a particular grade will depend on the quality of the candidature (measured by the distribution of ATARs or the distribution of previous university mathematics marks) and the level of difficulty of the unit.

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.
To facilitate the collection and return of assignments, you are asked to adhere to the following guidelines :
Solutions to assignments should be written in pen (not pencil), on lined paper, using one side of the paper only, with plenty of space left for corrections by the markers. Your name and SID must be written on each page. Pages on which no name or SID is written will not be marked. Your solutions should be *stapled* to a manilla folder, on the cover of which you should write in block letters your name, faculty and SID. (Paper clips are unsuitable as they catch on other folders and are pulled off.) To aid the return of assignments, please place the first letter of your family name in the centre of the front of your folder, writing it very large.

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 Honesty in Coursework" policy (available on the University website). The following extract from that policy should be noted: "Failure to comply with the University's standards for academic honesty may lead to failure in the work submitted or failure overall in the unit of study."
You must sign a cover sheet, declaring that your assignment is all your own work, and attach it to your assignment before submission.
Late assignments are generally not accepted. Please see Section 8.2.

7.3.1 Submission and return of assignments

At the western end of the verandah on Carslaw Level 3 (that is, the end closest to Eastern Ave) there are locked metal boxes for the submission of first year assignments, and open metal pigeonholes to which marked assignments are returned. When submitting an assignment you must ensure that you submit it in the correct place. Assignments that are submitted in the incorrect place will not be collected.

7.4 Quizzes

Almost all junior units of study will have quizzes as part of the assessment. These will usually be conducted in a regular tutorial period by the tutor. You must 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 will 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.
Under no circumstances will information about examinations (e.g., dates, results) be given out over the phone, by FAX or by email.

8 Special consideration and special arrangements

Students who suffer serious illness or misadventure that may affect their academic performance may request that they be given special consideration in relation to the determination of their results.
Students who are experiencing difficulty in meeting assessment tasks due to competing essential community commitments may request that special arrangements be made in respect of any or all factors contributing to their assessment.
The Faculty of Science policies on these issues apply to all Mathematics and Statistics units of study. Information relating to these policies, including the Application Packs and instructions on how to apply, can be obtained from the Faculty of Science website.
Before applying for special consideration, please read the Faculty Policy, and the rest of this section, to determine whether or not you are eligible. Note that occasional brief or trivial illness will not generally warrant special consideration.

8.1 How to apply

Applications for special Consideration must be made within 5 working days of the date for which consideration is being sought.
Applications for special arrangements must be submitted at least seven days BEFORE the due date of the assessment or examination for which alternative arrangements are being sought.
The procedure is as follows.

- Obtain the application forms from the Faculty of Science website or from the Student Information Office of the Faculty of Science.
- Take the original paperwork, plus one copy for each piece of assessment for which consideration is being sought, to the Student Information Office of the Faculty of Science. Note that applications are to be lodged with the Science Faculty, regardless of the faculty in which you are enrolled. Your copies will be stamped at the Faculty Student Information Office.
- Take the stamped documentation to the Mathematics Student Services Office, Carslaw room 520 (opposite the lifts on Carslaw Level 5). Your personal information must be completed on all the forms, including the Academic Judgement form, before the form will be accepted.

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. Applications are considered in the light of your participation in the unit during the semester, and your academic record in mathematics.

8.2 Special consideration relating to assignments.

Applications for special consideration relating to assignments will not be accepted. Exemptions from submission of assignments are not generally granted.
If serious illness or misadventure during the period prior to the due date prevents you from submitting an assignment on the due date then you should do the following:

1. Contact the Mathematics Student Office (by phone or email, or in person) to request an extension. Unless there are exceptional circumstances you must do this *before* the due date.

2. If you are granted an extension, take your assignment to the Mathematics Student Office by the extended due date. (Do *not* put the assignment in the collection boxes.)

3. Submit some supporting documentation (for example, a medical certificate) when you hand in your assignment.

Late assignments will only be accepted if you have an approved extension, or in the following circumstance:
Should you be ill on the due date only, and unable to submit your assignment, then you may submit it the following day, accompanied by supporting documentation (for example, a medical certificate). In this case, your assignment should be taken to Mathematics Student Office. (Do *not* put the assignment in the collection boxes.)

8.3 Special consideration relating to quizzes.

If you miss a quiz due to illness or misadventure, then you must 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 your application for special consideration relating to missing a quiz is successful then a pro-rata mark for that quiz will be awarded, based on your final examination mark in the unit of study.

8.4 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 then your mark may be adjusted, or 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 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.
Students who have participated only minimally in the unit throughout the semester will not be granted supplementary exams.

8.5 Special consideration relating to attendance.

The Faculty policy applies. Note that special consideration will *not* be granted for brief illness or minor misadventure that causes you to miss a tutorial. Unless a quiz was held during the tutorial, applications for special consideration in such cases will not be accepted.

8.6 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. The Faculty of Science Special Arrangements Policy applies for all first year mathematics units. Note that an application for special arrangements must be made at least seven days *before* the date of the assessment concerned.

9 Additional information

9.1 Variation of enrolment

Any change of enrolment must be made before the HECS cut-off date in each semester. (These dates are usually within a month or so of the beginning of semester.) After the cut-off dates it is not possible to enrol in additional units, nor to withdraw from a unit without incurring HECS fees. Note that some faculties may have earlier dates after which it is not possible to enrol in additional units.
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 normal, 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 normal units have similar syllabuses, changing from one to the other is disruptive. If it is necessary to make such a change, try to change earlier rather than later. Because advanced and normal units have completely different syllabuses from fundamental units, changes to and from fundamental units are particularly difficult. In general, such a change 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 441, (Level 4).

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

Normal Units		
MATH1001 Differential Calculus	Thu & Fri	8am Th & 9am Fr or 11am
MATH1002 Linear Algebra	Mon & Tue or Mon & Wed	8am or 11am 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	Tue Wed & Thu	1pm 2pm

10.2 Semester 2

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

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

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 semester 1.