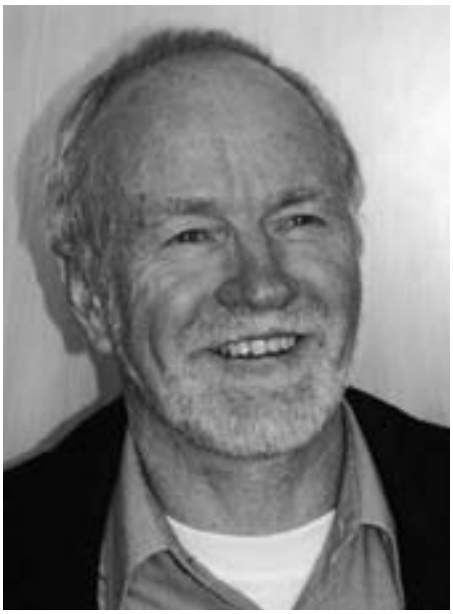
College of Engineering

UNIVERSITY OF CANTERBURY
Te Whare Wānanga o Waitaha
CHRISTCHURCH NEW ZEALAND

Mathematics and Statistics

08

Welcome to Mathematics and Statistics at UC



Mathematics and statistics are living subjects with new techniques and theories constantly being devised, tested and explored. The extensive use of computers in a wide range of academic areas has led to an increasing demand for statistical and mathematical analysis in many new and diverse fields.

It has been said that it is mathematics that offers the natural sciences a certain measure of security which, without mathematics, they could not hope to attain.

You will find our mathematics and statistics courses are aimed not only at those wishing to become specialists in these subjects, but also at students majoring in engineering, physics, computer science, biology, management and a host of other disciplines.

You will find our courses exciting, challenging, relevant and thoroughly up-to-date as all our lecturers are actively engaged in research in some aspect of mathematical and statistical science.

This handbook is provided to help you plan a course of study in mathematics or statistics. It will also assist you in choosing appropriate courses that complement studies in other disciplines.

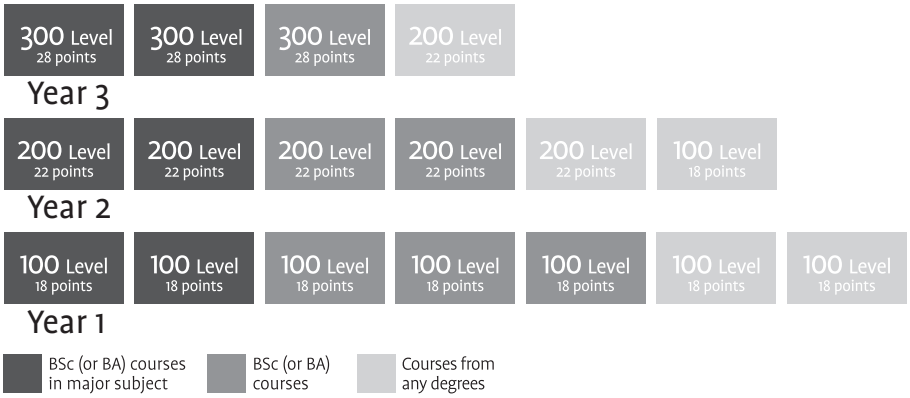
You should make the most of your opportunity at university to study subjects under the guidance of experts in our subject areas. I wish you enjoyment in your studies of the fascinating range of topics that we offer.

If you have further questions please contact us.

Professor David Wall
Head of Department

BSc/BA Degree structure

You can complete either a Bachelor of Science (BSc) or a Bachelor of Arts (BA) majoring either in mathematics or statistics. A BSc or BA consists of a minimum of 360 points taken over three years. Typically, the degree is made up of 144 points from 100-level courses, 132 points from 200-level courses and 84 points from 300-level courses. Of the 84 points at 300-level, at least 56 must be from your chosen major subject. Note that you can take 100-level courses in your 2nd year of study and 100- and 200-level courses in your 3rd year of study. For full details of the requirements, see the UC calendar regulations at right.



A typical programme for a BSc (or BA) majoring in either mathematics or statistics

The Erskine building, which houses the Department of Mathematics and Statistics

Calendar regulations

To qualify for the Degree of Bachelor of Arts:

(a) a candidate must pass courses having a minimum total value of 360 points.

(b) at least 254 of the 360 points must be from the Schedule to the Regulations for the Bachelor of Arts.

(c) the remaining 106 points may be for courses from any degree of the University. They will be subject to the Regulations of the other degree.

(d) at least 216 points must be for courses above 100-level.

(e) at least 84 points must be for courses at 300-level.

(f) at least 56 points of that 84 must be in a single subject and from the Schedule to the Regulations of the Bachelor of Arts.

To qualify for the Degree of Bachelor of Science:

(a) a candidate must pass courses having a minimum total value of 360 points.

(b) at least 254 points of the 360 must be from the Schedule to the Regulations for the Bachelor of Science.

(c) the remaining 106 points of the 360 may be for courses from any degree of the University. They will be subject to the Regulations of the other degree.

(d) at least 216 points must be for courses above 100-level.

(e) at least 84 points must be for courses at 300-level.

(f) at least 56 points of that 84 must be in a single subject from the Schedule to the Regulations for the Bachelor of Science or from a list of specified courses approved for the major requirement.

Students majoring in Mathematics must complete 44 points from MATH 210-299 or equivalent, and at least 56 points from MATH 310-399. Students majoring in Statistics must complete MATH 109 or MATH 199, 33 points from STAT 210-299 and 56 points from STAT 310-399.

Starting your degree in Mathematics or Statistics

There are many different pathways through mathematics and statistics. (See the section on Pathways through Mathematics and Statistics). Choose a programme that keeps your options open, particularly at the 100- and 200-level. Generally, business, industry and government want people who have a broad background in a variety of mathematical and statistical areas. Include other subjects in your degree to expand your knowledge of the applications of mathematics and statistics. Common choices include physics, computer science, biology, chemistry, management and economics.

Mathematics and statistics are in both the arts and science schedules. The Bachelor of Science (BSc) and Bachelor of Arts (BA) are three-year undergraduate degrees requiring a minimum of 360 points. For a first-year full-time student, a sensible number of points to take is about 126 (1.05 course weight).

If you are good at mathematics or statistics, seriously consider aiming for a BSc (Hons) or BA (Hons) degree, an extra one year's study after your BSc or BA. (See the section on Postgraduate Study). People with honours level qualifications in both mathematics and statistics are highly employable in commerce, industry and research institutes and it is sensible to include mathematics papers in your statistics degree and statistics papers in your mathematics degree, or consider the mathematics and statistics joint honours programme.

Mathematics major

Most students begin by taking the following core mathematics courses in their first year.

- MATH 108 (18 points) is a course in calculus and linear algebra. The calculus material follows on from NCEA level 3 calculus. MATH 108 is available as a first semester course, a second semester course and also as a whole year course. It is a prerequisite for the second core first year course:
- MATH 109 (18 points) builds on the linear algebra and calculus developed in MATH 108. It is available as a first semester course, a second semester course and as a summer course.

Together, these courses will let you into any 200-level mathematics course (with the exception of MATH 271, which has MATH 171 as a prerequisite).

Statistics major

Most students take the following courses in their first year.

- STAT 111 (18 points) is a full-year course designed to give students a sound basic knowledge of the subject and a good grounding in how statistics are used to tackle genuine problems. An alternative is STAT 112, which is the second semester equivalent of STAT 111.
- MATH 108 (18 points) – see above.

You will also need to take MATH 109, although you may do this in your second year. Together, STAT 111 and MATH 108 will let you into any 200-level statistics course.

Choosing the right course

Any student who meets standard university entrance requirements may enrol in any of the 100-level mathematics and statistics courses (except for MATH 109 which has MATH 108 as a prerequisite).

Students intending to take MATH 108 as a first or second semester course should have at least 15 points in NCEA Level 3 Mathematics with Calculus, including both the differentiation and integration achievement standards (or the equivalent Unit Standards).

The whole year version of MATH 108 is a good option for students who want to take the paper at a slower pace. We strongly advise that you have at least 12 points in NCEA Level 3 Mathematics with Calculus, including at least one of the differentiation and integration achievement standards (or the equivalent Unit Standards).

For STAT 111 (or STAT 112), it is important to do as well as possible in NCEA Level 3 subjects, especially the Statistics with Modelling and/or Mathematics with Calculus.

More detailed advice is available via the Prospective Students link at www.math.canterbury.ac.nz. We also recommend that students intending to take any of the MATH 108 offerings do the pre-entry self-assessment quiz, also available at this link.

The Department will consider allowing students direct entry into MATH 109 if they have a high level of achievement (mostly excellences and merits) in NCEA Level 3 Mathematics with Calculus. Each year, we also offer a few outstanding students direct entry into 200-level mathematics/statistics. Please contact the Department in person if you wish to discuss either of these options.

Other 100-level mathematics courses (all 18 points)

- MATH 101 is a whole year introductory course, emphasising applications of mathematics. It is particularly good for students who have not studied mathematics for some time, or who lack confidence in their mathematical skills. MATH 108 (possibly the whole year version) is the best follow up to this paper.
- MATH 115 is a whole year course designed particularly for computer science students. The discrete mathematics taught in this course is also useful for students majoring in mathematics.
- MATH 134 is a first semester course in logic that is taught jointly by mathematics and philosophy staff and is double-coded with PHIL 134. Some computer science students find it useful too.
- MATH 171 is a second semester course in mathematical modelling and simulation. It complements existing 100-level courses in the mathematical sciences, and is particularly recommended for students interested in applying mathematics to real-world problems.

Pathways through Mathematics and Statistics

A degree from the University of Canterbury is highly flexible and allows you to design a personal course to meet your needs. You can do either a Bachelor of Science (BSc) or a Bachelor of Arts (BA) with a mathematics or statistics major. Set out below are possible courses of study but they are suggestions only and staff will be happy to advise you.

To complete a degree with mathematics as a major subject, you will need at least 56 points from MATH 310-399, supported by 44 points from MATH 210-299. In order to satisfy these requirements, you will need to take MATH 108 and MATH 109. For a degree with statistics as a major subject, you will need at least 56 points from STAT 310-399, supported by 33 points from STAT 210-299, and MATH 108 and MATH 109. However, it is always better to have a broader background in your major, so we strongly recommend that you take more than this absolute minimum of papers.

It is essential for a mathematics or statistics major that you take the core courses in your chosen major subject at each level, and that you supplement these with courses chosen according to your interests in mathematics, statistics and other subject areas.

Core Mathematics

Year 1 MATH 108, MATH 109

Year 2 MATH 264 or (MATH 261 and MATH 262), and MATH 254 or (MATH 251 and MATH 252), and MATH 243

- At the 100-level your core study in mathematics will be the techniques of calculus and linear algebra.
- At the 200-level the core courses cover calculus, linear algebra and analysis.
- At the 300-level your courses are chosen from MATH 310 - MATH 399.

Core Statistics

Year 1 STAT 111 (or STAT 112), MATH 108
Year 2 MATH 109, STAT 212, STAT 214, STAT 222 and/or STAT 224
Year 3 STAT 312, STAT 313, STAT 315, STAT 316

- At the 100-level your core study in statistics will give you a sound basic knowledge of the subject and a good grounding in how statistics are applied to tackle genuine problems.
- At the 200-level the core courses cover statistical distribution, inference and probability.
- At the 300-level your courses become more specialised and depend on where your interests lie.

Although most of these core courses are not required to major in mathematics or statistics, we recommend that all majors take them. This will also help ensure that you have the appropriate prerequisites to take a wide range of more specialised courses which may be chosen from the following areas:

Applied Mathematics, Physical Sciences and Engineering

The applied mathematician is more concerned with how to use mathematics than with how to develop mathematics for its own sake. As well as the traditional areas of mathematical physics and numerical analysis, "applied mathematics" means mathematical biology, modelling of problems in industry, fluid dynamics and meteorology, approximation and optimisation, discrete applied mathematics (including coding theory), and mathematical economics. If you are interested in applied mathematics, the physical sciences or engineering, you will probably find the following courses of most interest to you.

Year 1 MATH 171
Year 2 MATH 271, MATH 282
Year 3 MATH 333, MATH 342, MATH 352, MATH 353, MATH 361, MATH 363, MATH 371, MATH 381

It is very important for students going on in applied mathematical subjects to have a sound background in pure mathematics as well.

Pure Mathematics

The pure mathematician is attracted by the intrinsic fascination and beauty of mathematics, and by a desire to test the limits of mathematical techniques, rather than a desire to apply it to the outside world. Pure mathematics – dealing with abstractions in algebra, analysis, geometry and many other areas of mathematics – is a stimulating and rewarding pursuit in its own right. If you are interested in pure mathematics, you will probably find the following courses of most interest to you.

Year 1 MATH 115, MATH 134
Year 2 MATH 221, MATH 222, MATH 231
Year 3 MATH 321/322, MATH 324, MATH 333, MATH 334, MATH 336, MATH 342, MATH 352, MATH 361

Much of pure mathematics, however, originates with problems in the sciences and other areas such as economics. It is extremely valuable for all pure mathematicians to have some understanding of applied mathematics.

Statistics for Mathematics Majors

Everyone should consider taking some statistics in their degree programme. Even if you do not intend to become a statistician, you will be faced with statistical information in all walks of life. Look at the papers. Look at the stock market. Watch television or listen to the radio. Often you will come across comments of a statistical or probabilistic nature. Do some statistics so that you learn to interpret uncertain data in an intelligent way! The statistics courses of most interest to many mathematicians include:

Year 1 STAT 111 (or STAT 112)
Year 2 STAT 212, STAT 214, STAT 218, STAT 222, STAT 224
Year 3 STAT 316

Computer Science

Many mathematics majors have a strong interest in computer science. In this case, we recommend you take options from amongst the following courses.

Year 1 MATH 115, MATH 134, STAT 111 (or STAT 112)
Year 2 MATH 221, MATH 231, STAT 218
Year 3 MATH 321/322, MATH 324, MATH 333, MATH 334, MATH 335, MATH 336, STAT 313

Biomathematics

Biomathematics applies methods from mathematics, statistics and computer science to solve biological problems and is an area of applied mathematics that has shown enormous growth in the past decade.

There are three main areas of biomathematics:

- Computational biology/bioinformatics is the study of genetics, protein structure and evolution. It has applications to medicine and drug design. It requires a sound knowledge of discrete mathematics, computer science and statistics.
- Biological modelling studies population dynamics and cellular processes. It has applications to ecology, epidemiology and medicine. It requires a sound knowledge of calculus, computer science and statistics.
- Biostatistics/bioinformetrics is the statistical analysis of populations. It has applications to ecology, forestry and population genetics. It requires a sound knowledge of statistics.

If you are interested in biomathematics, you should take a broad mixture of mathematics, statistics and biology courses. Mike Steel is the director of our Biomathematics Research Centre, and you can see him, Jennifer Brown or David Wall if you are interested in finding out more about this exciting area of applied mathematics and statistics.

Commerce

Mathematics and statistics are used extensively in many areas of commerce; for example, finance, accounting, management science, operations research and marketing. Commerce students may be particularly interested in the following courses.

Year 1 MATH 108, STAT 111
Year 2 STAT 218, STAT 222, STAT 224
Year 3 STAT 315, STAT 317

Biology

It is good to have some mathematics and statistics in your biology degree, especially for students considering postgraduate study.

Year 1 MATH 108, STAT 111
Year 2 STAT 218, STAT 222, STAT 224
Year 3 STAT 312, STAT 315, STAT 317

Postgraduate study

The Department has a successful postgraduate programme for Honours, Masters and PhD degrees. Apart from the UC Scholarships, we may be able to offer some additional financial assistance in the form of part-time tutoring positions, and fees scholarships (at the NZ resident rate).

Calendar regulations

BSc/BA (Hons) Mathematics

MATH 449 (project) and eight courses chosen from MATH 401-490 and STAT 401-490 (other than MATH /STAT 449). One of the eight courses must normally be MATH 443 if the student has not been credited with MATH 343 previously. Normally at least six courses will be chosen from the MATH course list.

Prereq: (1) 44 points from MATH 210 299 (Note: Students will normally be expected to take MATH 243, *and* either MATH 254 or 264); *and*

(2) 56 points from MATH 310-399; *and*

(3) an additional 28 points from MATH 310-399 or STAT 310-399 or other approved courses.

BSc/BA (Hons) Statistics

STAT 449 (project) and eight courses chosen from STAT 401-490 and MATH 401-490 (other than STAT /MATH 449). One of the eight courses must be STAT 464 if the student has not been credited with STAT 214 previously. Normally at least six courses will be chosen from the STAT course list.

Prereq: (1) MATH 109 or MATH 199; *and*

(2) 33 points from STAT 210-299; *and*

(3) 56 points from STAT 310-399; *and*

(4) an additional 28 points from MATH 310-399 or STAT 310-399 or other approved courses.

Honours Degrees

The Honours degree is a one-year coherent programme of study, consisting of an honours project and eight 400-level courses. The assessment of the Class of Honours is based on overall performance in the programme. To enrol in Honours you need to be eligible to graduate with a BA or BSc (360 points) and have the appropriate prerequisites for entry into Honours. Final approval for entry is given by the Head of Department.

The Courses section outlines the proposed 400-level courses for 2008. The final decision on which courses are offered will depend on student demand and staff availability. However, in every year there will always be at least one course offered in analysis, algebra, discrete mathematics, functional analysis, differential equations and computational mathematics. Every statistics 300-level course is offered as a 400-level course and courses in generalised linear models and bioinformatics are offered each year. A broad range of honours projects for 2008 is listed on the department web page. This list is not exhaustive, and there is plenty of scope for other possible projects. Project supervision is by mutual agreement between the supervisor and student. It is expected that a student will have arranged their project by the end of the first week of term. Assessment is based on a written report (80%), which is to be handed in in September, and an oral or a poster presentation in early October (20%).

Specialised Honours programmes

In addition to the single honours degrees, there are a number of joint honours programmes that you can study to combine mathematics with another subject. To keep your options open to enter these courses you must ensure you study a broad base of courses at lower levels, especially the core mathematics courses, so that you have the appropriate prerequisites. For all joint honours programmes it is very important that you check the calendar regulations to ensure you are taking all the required courses. Some of the more relevant sections of the calendar are included below.

Mathematics and Statistics

You can do a joint degree in mathematics and statistics. This is a great thing to do and very marketable. You should start by taking the core mathematics and statistics courses; beyond that there is a range of suitable courses.

Mathematical Physics

The Department of Physics and Astronomy and the Department of Mathematics and Statistics offer a joint BSc (Hons) programme. This is aimed at students who are interested in both subjects and who do not wish to concentrate entirely on one at the expense of the other. As well as the core mathematics courses, you will probably be most interested in:

Year 1 MATH 171
Year 2 MATH 222, MATH 271
Year 3 MATH 322, MATH 342, MATH 361, MATH 363, MATH 371

The course coordinator for this programme is David Wiltshire (Physics), and you should seek advice from him or Ben Martin (Mathematics).

Mathematics and Philosophy

The interaction between mathematics and philosophy in the twentieth century has been far greater than at any previous time. The BSc (Hons) programme in mathematics and philosophy is designed for students with a highly creative mathematical ability whose interests in mathematics draw them towards foundational and philosophical issues. As well as the core mathematics courses you will probably be interested in:

Year 1 MATH 134
Year 2 MATH 208
Year 3 MATH 301, MATH 321, MATH 335, MATH 336, MATH 342, MATH 343, MATH 392

For more details about this programme contact Douglas Bridges (Mathematics) or Philip Catton (Philosophy). See also *www.phil.canterbury.ac.nz*.

Mathematics and Economics

A joint degree in mathematics and economics will allow you to combine these two subjects and leave university with an excellent preparation for a professional career. If you wish to study for a joint degree in mathematics and economics you must take a mixture of mathematics and statistics alongside the required economics papers. As well as the core mathematics papers, courses of most interest might include:

Year 1 STAT 111
Year 2 MATH 243, STAT 212, STAT 216, STAT 214
Year 3 MATH 343, MATH 353, MATH 361, MATH 363, STAT 315, STAT 317

For information about a joint degree in mathematics and economics talk to Douglas Bridges (Mathematics) or Seamus Hogan (Economics).

Calendar regulations

BSc (Hons) in Mathematics and Statistics

MATH 449 or STAT 449; and eight other courses chosen from MATH 401-490 and STAT 401-490 (other than MATH 449 or STAT 449). One of the eight courses must normally be MATH 443 if the student has not been credited with MATH 343 previously, and one of the eight courses must be STAT 464 if the student has not been credited with STAT 214 previously. At least three courses will be chosen from the MATH course list and at least three courses will be chosen from the STAT course list.

Prereq: (1) 44 points from MATH 210-299; *and*
(2) 33 points from STAT 210-299; *and*
(3) 98 points from MATH 310-399 *and* STAT 310-399, including at least 42 points from each of the MATH *and* STAT course lists.

BSc (Hons) in Mathematics and Philosophy

MPHI 450 and seven courses chosen from MATH 401-490 (other than MATH 449) and PHIL 431-470. One of the seven courses must normally be MATH 443 if the student has not been credited with MATH 343 previously. Normally two courses will be chosen from the PHIL course list and five courses from the MATH course list.

Prereq: (1) 44 points from MATH 210-299; *and*
(2) 84 points from MATH 310-399; *and*
(3) 44 points from PHIL 208, 209, 223, 233, MATH 208, 209; *and*
(4) 28 points from PHIL 301-399, MATH 308, 309.

BSc (Hons) in Mathematical Physics

MAPH 480 (Research Project) and six courses chosen from MATH 401-490 (other than MATH 449) and PHYS 401-450. Normally, at least three courses must be chosen from each of the PHYS course list and at least two from the MATH course list. The choice of courses is subject to the approval of the Course Coordinator. The Research Project is equivalent to two courses.

Prereq: (1) PHYS 221-224, 281, 282; *and*
(2) 44 points from MATH 251-269;
(3) 112 points PHYS 300-level *and* MATH 300-level courses chosen with the approval of the Course Coordinator

Note: Students will normally be expected to take: PHYS 310; at least 42 points from PHYS 311, 312, 314, 316, 318, 322, 326; 56 points from MATH 342, 343, 352, 353, 361, 362, 363, 371.

BSc (Hons) in Economics and Mathematics

Either:
ECON 480 plus eight additional half-courses in 400-level ECON or MATH , including at least three half-courses in ECON and at least four half-courses in MATH ; or

MATH 449 plus eight additional half-courses in 400-level ECON or MATH , including at least four half-courses in ECON and at least three half-courses in MATH .

Prereq: (1) ECON 201 and ECON 230; *and*
(2) STAT 212 and STAT 214; *and*
(3) 66 points from 200-level MATH , normally consisting of MATH 254, 264, 243; *and*
(4) 56 points from ECON 321, 322, 323, 324, 325, 326, 331, 332; *and*
(5) 56 points from 300-level MATH or STAT , normally consisting of MATH 343 *and*
42 points from MATH 352, 353, 361, 363 with up to 28 points of 300-level STAT .

BSC (Hons) in Computational and Applied Mathematics

CAMS 449 (project) and eight other approved courses chosen from MATH 401-490, MSCI 451-462 or STAT 401-490 (other than MATH /STAT 449). With the approval of the Programme Coordinator, candidates may substitute one or two courses from other subjects in an applications area.

Prereq: (1) 44 points from MATH 251, 252, 254, 261, 262, 264
(Note: It is recommended that candidates also include one of MATH 171, 271 or 282); *and*
(2) MATH 381; *and*
(3) 70 points from MATH 323, 346, 352, 353, 361, 362, 363, 371; *and*
(4) 44 points from other approved courses at 200-level or above (normally from CHEM, COSC, MATH , MSCI, PHYS, STAT or ENGINEERING courses).

Postgraduate Diploma in Science (PGDipSc)

This is a one year course which is equivalent to the first year of a Master's degree. It normally consists of eight 400-level papers. A completed PGDipSc can be substituted for part I of an MSc.

Calendar regulations

PGDipSc in Mathematics

Eight courses chosen from MATH 401-490 and STAT 401-490 (other than MATH / STAT 449). One of the eight courses must normally be MATH 443 if the student has not been credited with MATH 343 previously. Normally at least six courses will be chosen from the MATH course list. Not all courses will be offered in any one year.

Prereq: (1) 44 points from MATH 210-299; *and*
(2) 56 points from MATH 310-399; *and*
(3) an additional 28 points from MATH 310-399 or STAT 310-399 *or* other approved courses.

PGDipSc in Statistics

Eight courses chosen from STAT 401-490 and MATH 401-490 (other than STAT /MATH 449). One of the eight courses must be STAT 464 if the student has not been credited with STAT 214 previously. Normally at least six courses will be chosen from the STAT course list.

Prereq: (1) MATH 109 or MATH 199; and
(2) 33 points from STAT 210-299; *and*
(3) 56 points from STAT 310-399; *and*
(4) an additional 28 points from MATH 310-399 or STAT 310-399 *or* other approved courses.

Research Degrees

There are a number of active research groups in pure, applied and computational mathematics, in statistics, and in bioinformatics. The department also jointly supervises postgraduate students in conjunction with other departments or outside organizations, depending on the nature of the student's research topic. Information about possible research areas in the department may be found on the departmental website, or by talking to the department's postgraduate coordinator, or any academic staff member.

Master of Science (MSc) or Master of Arts (MA)

A Master's degree is a two-part degree. The first part consists of eight 400-level papers, and the second a research project which is presented as a thesis. Part II students are supervised by a senior supervisor who is a continuing academic staff member and at least one other supervisor.

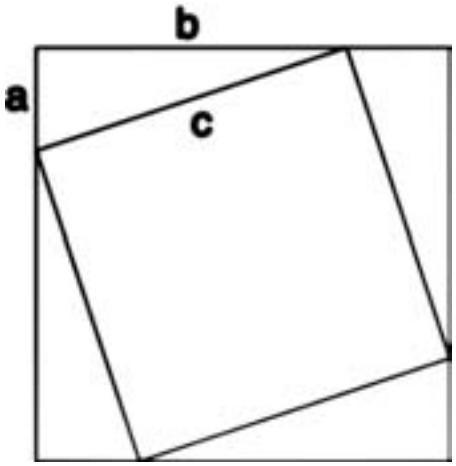
Students who are eligible to do a PGDipSc may enrol in the first part of a Master's degree. Students who have completed part I with an average grade of C+ or better, or who hold an appropriate Honours degree or PGDipSc, may enrol in part II once supervision has been arranged. Part II normally takes one year full time, but may take up to a maximum of two years. A Master's degree may be done part-time over a longer period. We almost always ask that you enrol for a BSc/BA (Hons) or PGDipSc in your first year.

Master's level papers in Engineering

Some of the department's 400-level papers are also offered as 600-level engineering mathematics (EMTH) papers. For more information please refer to the section on honours courses.

Doctor of Philosophy (PhD)

A PhD is a research degree that typically takes three years of study, but can take up to four. To enrol for a PhD, a student must have a BSc/ BA (Hons) with either first class honours, or second class honours, division one, or a Master's degree. The student works under the direction of a supervision team led by an academic staff member with whom they have a shared research interest. The results of the work are presented in thesis form.



An inspiring picture containing one of our students' favourite proofs

Current student profiles

Ryoko Ito (left) and Daniel Lond (right)

Daniel Lond

In my first year at UC, I chose an engineering intermediate year, planning to go on to electrical, but at the end of my first semester I knew mathematics and computer science were for me and made a couple of changes to my programme. I took the core courses MATH 108 and 109 and COSC 121 and 122 which were necessary to get into second year courses in MATH and COSC, while MATH 171 provided a link between the two because it involved programming to solve mathematical problems. I also took PHYS 111 as an interest subject.

In my second year, the maths papers I enrolled in included the 'core' calculus and linear algebra courses (MATH 254 and 264), and some very excellent (and fun!) pure papers (MATH 221, 222 and 231), providing a good introduction to actually proving things. I also took several COSC papers. This way I could move into just about any 300-level course in either discipline. At this stage I hadn't even decided my major yet – let alone whether I should choose pure or applied maths.

The way I saw things by the beginning of my third year, if I had a solid grounding in pure maths then I could teach myself all the applied maths and programming skills that I needed to know, so I chose MATH 321, 343, 352, 361 and 371. I talked to a lot of lecturers to help me choose suitable courses.

Having earned a BSc, I could make a start on my honours courses. I took eight 400-level MATH courses and a research project on Elliptic Curve Cryptography. The courses tend to vary from year to year but there'll always be something interesting to do – I chose papers with a lot of analysis and linear algebra. I made sure that the first half of my honours programme was heavier than the second so that I could concentrate on writing up my research project in the second half. Pretty much straight after my exams I accepted a PhD scholarship with my honours supervisor Dr. Ben Martin and presently I'm happily working away in my office.

Ryoko Ito

I am currently studying towards a BSc (Hons) in Mathematics and Economics. I have done a combination of courses in pure and applied mathematics in my third year including MATH 342, 343, 352 and 363. This helped me discover that I personally find mathematics a very intriguing and curious subject. The economics aspect of my academic studies is very well complemented by the mathematics. I am doing well in economics partly because of my extensive knowledge of mathematics, which is a huge advantage. My future plans include studying towards a PhD, possibly overseas, and subsequently beginning my career armed with a strong education in mathematics, macroeconomics, microeconomics and econometrics. Mathematics proved useful in combination with other endeavours also when I did research on biological modeling during the summer holidays after graduating. I have never done any biology courses and have limited knowledge of the subject, but my knowledge of mathematics allowed me to finish the research and to do it well. Studying mathematics therefore has given me the opportunity to explore a subject with many possibilities that is both intellectually interesting and helpful towards future career plans.

Scholarships and prizes

The Department offers a range of scholarships and prizes to students studying mathematics or statistics each year.

Undergraduate scholarships and prizes

UC Emerging Leaders' Scholarships: Category D – 2x scholarships at $3500 each towards tuition fees for first year students enrolled in mathematics and/or statistics at level 100 or 200. Contact the Scholarships office for application details.

John McMillan Scholarship in Economics and Mathematics: Up to two scholarships are awarded annually, to eligible students enrolling in a BSc degree, majoring in Mathematics and Economics and studying subjects consistent with the course of study for the combined BSc Honours degree in Economics and Mathematics (see p7). Each scholarship is tenable for one year and covers the full first-year tuition fee. Contact the Scholarships Office for application details.

Department Scholarships: You do not need to apply for the undergraduate scholarships.

Number of scholarships that may be offered each year:

Level	Full fees for MATH /STAT courses	Up to $1,000 for a MATH / STAT courses
200	2	4
300	2	4
400	3	8

1. All scholarships are available to students who are majoring in mathematics or statistics and are doing: (a) at least 66 points of MATH or STAT or other approved courses at 200-level; or (b) at least 84 points of MATH or STAT or other approved courses at 300-level; or (c) at least six MATH or STAT or other approved courses at 400-level.
2. The scholarships will pay for MATH or STAT courses only and at the domestic rate.
3. Holders of 300-level or 400-level scholarships will normally be expected to do some tutoring or marking for the department, for which they will receive additional remuneration.

Summer scholarships

Scholarships of up to $3000 are available for students who have taken 200-level, 300-level or 400-level courses in mathematics or statistics to do a summer research project (MATH /STAT 305, MATH /STAT 491). The application deadline for these scholarships is normally some time in August for projects commencing in November/ December.

Other prizes

The following prizes are awarded annually for excellence in mathematics or statistics:

- *Cook Memorial Prize:* For final Honours students ($1200).
- *Page Memorial Prizes:* Two prizes at level 300 ($500 each).
- *Peter Bryant Memorial Prizes:* One prize each at levels 100 and 200 ($500 each).
- *Brent Wilson Prize:* For applied mathematics at level 300 ($500).
- *Gordon Petersen Prize:* For pure mathematics at level 200 ($500).
- *Statistics New Zealand Prize:* For statistics at level 300 ($300).

Postgraduate scholarships

These postgraduate scholarships will be offered on the basis of:

(a) the student's potential, as demonstrated by their performance at the Honours level, and,

(b) the length of time since the named supervisor last supervised a postgraduate student with a departmental scholarship.

These scholarships will pay full fees at the domestic rate plus up to $6000 per year, for one year in the case of a Master's scholarship, and for up to three years in the case of a Doctoral scholarship. This amount may be reduced if the student accepts another scholarship. Holders of departmental postgraduate scholarships will normally be expected to do some tutoring or marking for the department, for which they will receive additional remuneration.

Other awards

- Statistics New Zealand Maori and Pacific Islands Scholarships: To assist a Maori and a Pacific Islander to attend university and obtain a statistics or mathematics undergraduate qualification ($3,500 per year for up to 3 years).
- J. Connal Scholarships: For BA students who excel in Latin, English, French, history or mathematics level 200. ($400 per year for 2 years). No application required.
- Lord Rutherford Memorial Research Fellowship: For outstanding merit and promise in physics, chemistry or mathematics at the postgraduate level ($20,000 per year for 2 years).
- Sims Empire Scholarship: For outstanding merit and promise in physics, chemistry, mathematics or medicine at the postgraduate level for study in Great Britain ($15,000 per year for 2 years).
- Professor C. C. Farr Memorial Scholarship: For students who are enrolled in an honours or postgraduate degree in physics and/or astronomy and/or mathematical physics ($500 per annum). No application required.

For details on applications for these awards, or if you have any questions, please contact the Scholarships Office:

Web: www.canterbury.ac.nz/scholarships

Email: scholarships@canterbury.ac.nz

The Scholarships Office also has a file on Māori and Pacific Island Scholarships. An increasing number of these are available in science and commerce in particular.

Tutoring Work

There are opportunities for senior undergraduate and postgraduate students in mathematics or statistics to undertake paid tutoring work for our undergraduate courses. This can involve taking tutorial classes and supervising labs of around 20 students and is a great way to develop teaching skills and earn some extra money.

Career opportunities

Graduates with Bachelor's degrees are employed as analysts, engineers, teachers, modellers, programmers, bankers, meteorologists, statisticians and auditors. According to a 2005 graduate employment survey undertaken for the New Zealand Vice-Chancellors' Committee, nearly 50% of mathematics/statistics graduates do further study. Of those employed, 42% are in business services, 21% are in manufacturing and retail, 13% are in service industries, 10% are in government, health and community services, and 5% are in education. The average beginning salary for 2004 graduates in full-time employment in 2005 was around $38,500.

Employers include computer companies, banks and insurance companies, tertiary institutions, telecommunications companies, investment companies, the energy industry, market research companies, transportation companies, Statistics New Zealand and the retail industry.

Many employers want people who have a broad background in mathematics, statistics, computation and science. They value the ability to think precisely and reason logically; these are skills you will develop from your mathematical studies. While some jobs require specific mathematical or statistical skills, many employers will hire mathematicians and statisticians because of their general problem-solving abilities and their capacity for abstract thought: they want bright people they can train. Growth areas include financial mathematics and computing combined with mathematics. There is a severe shortage of people with statistical knowledge.

Potential employers

Government Organisations

Government Communications Security Bureau
– cryptography, signal processing, systems analysis.

Land Transport Safety Authority of New Zealand – traffic modelling.

The Treasury
– economic forecasting and analysis.

Ministry of Education
– statistical analysis.

Ministry of Fisheries
– fisheries management, ecological modelling, analysis.

Ministry of Health
– statistical analysis, epidemiological modelling.

Ministry of Social Development
– statistical analysis.

Accident Compensation Corporation
– statistical analysis.

Royal New Zealand Navy
– signal processing, systems analysis.

Statistics New Zealand
– statistical analysis (e.g., of housing, trade, health).

Environment Canterbury
– resource management, modelling.

Ministry of Research, Science and Technology – policy development and analysis.

Department of Conservation
– ecological statistics, possum control, modelling of invasive species.

Canterbury District Health Board
– modelling of disease processes.

Crown Research Institutes

Industrial Research Limited
– communications and signal processing, geothermal modelling, robotics.

National Institute of Water & Atmosphere Ltd (NIWA)
– oceanography, fisheries management, ecological modelling.

Commerce and Industry

Meteorological Service of New Zealand
– fluid mechanics, modelling.

Orion
– network analysis.

Pacific Edge Biotechnology Ltd
– biomathematics, biotechnology, bioinformatics, computational biology.

CES Communications
– cryptography.

Rodgers & Partners Ltd
– business consultancy and analysis.

Tower Managed Funds Investments Ltd
– actuarial analysis.

Weyerhaeuser NZ
– logistics co-ordination.

Education Institutes

School mathematics teacher
– mathematics, statistics.

University teaching and research
– technicians, tutors, research assistants, lecturers.

Department staff

Research strengths

In pure mathematics, there are particularly strong researchers working in combinatorics, the foundations of mathematics, algebra, geometry, harmonic analysis, the potential theory of differential operators, and group theory.

The applied mathematics group has strengths in applied nonlinear differential equations, dynamical systems, computational mathematics, discrete mathematics and mathematical modelling. Applications include biological and physical systems, and biomedical, chemical and electrical engineering.

The statistics group has strong research interests in applied statistics, with particular applications in ecology, forestry, medicine and econometrics.

Members of the department are engaged in research in a number of fields within mathematics and statistics. Within the department we have a research centre, the Biomathematics Research Centre, and staff are members of many other research groups including the Allan Wilson Centre for Molecular Ecology and Evolution, the Centre for Bioengineering and the Centre for Mathematics in Industry. We have strong links to other departments, especially to biology, commerce, computer science, engineering and physics.

Academic staff and research interests

Rick Beatson: Mathematics, statistics and fast algorithms for fitting spatial data. Radial basis functions. Visualisation. Applications to laser scanner and geophysical data. Neural networks, Kriging and Cross Validation.

Arno Berger: Dynamical systems. Ergodic theory. Applied probability and stochastic processes. Stability and bifurcation theory. Classical mechanics. Symmetry and scaling.

Douglas Bridges: Constructive foundations of analysis, topology, algebra, and physics. Computability and complexity. Mathematical economics.

Bob Broughton: Mathematical education, numerical mathematics.

Jennifer Brown: Ecological statistics, environmental monitoring, animal population assessment, sampling theory, experimental design.

Qui Bui: Fourier analysis. Wavelet analysis. Weighted functions spaces. Littlewood-Paley theory.

Ian Coope: Nonlinear optimisation. Linear algebra and applications. Scientific and statistical computing. Computational mathematics.

John Hannah: Abstract and linear algebra. Mathematics education. History of mathematics.

Mark Hickman: Symmetries of differential equations. Invariance under groups. Algebraic computing. Dynamical systems.

Alex James: Modelling of problems in combustion and ecology including larval fish growth and the role of environmental stochasticity.

Dominic Lee: Computational, Bayesian and nonparametric statistics, with applications in medical research, bioinformatics, signal processing and image processing.

Ben Martin: Group theory. Quantum mechanics. Cryptography.

Clemency Montelle: History and philosophy of mathematics. Ancient mathematical astronomy and modelling. Mathematical texts in Greek, Latin, Sanskrit, Arabic, and Cuneiform.

Rua Murray: Dynamical systems. Ergodic theory. Numerical effects in dynamics. Approximation theory.

Mike Plank: Mathematical biology. Modelling problems in biology, ecology and engineering, including cardiovascular disease and kidney function.

Chris Price: Numerical, non-smooth and global optimisation.

Marco Reale: Econometrics. Time Series. Graphical Modelling.

Peter Renaud: Functional analysis. Ergodic theory. Cryptography. Clifford algebras. Quantum Mechanics.

Raazesh Sainudiin: Statistical inference of stochastic processes embedded within stochastically evolving networks. Statistical decision problems in population genetics, phylogenetics and ecological genetics.

Carl Scarrott: Spatial statistics, extreme value methods and spectral analysis with application to problems in industry, environment and other sciences.

Charles Semple: Combinatorics, computational complexity and computational biology.

Mike Steel: Discrete and stochastic models, bioinformatics, theoretical biology and evolutionary genetics.

Günter Steinke: Geometry. Topology. Groups. Combinatorics.

Bill Taylor: Probability, with emphasis on discrete probability processes and the connection between probability and logic.

David Wall: Mathematical biology. Applied dynamical systems. Mathematical wave theory. Inverse problems. Computational mathematics.

Neil Watson: Partial differential equations and potential theory.

Phil Wilson: Mathematical modelling in biology and industry. Multiscale information transfer and emergent phenomena. Philosophy and communication of mathematics.

Postdoctoral and research staff

Britta Basse
Iris Loeb
Richard Penny
Frank Lad
Bob Long
Bhalchandra Thatte

Technical staff

Paul Brouwers - Technician
Steve Gourdie – Senior Technician
Allen Witt – Senior Programmer/Analyst

Administrative staff

Julie Daly
Pauline Auger
Sarah Vincent

Senior tutors and teaching staff

Liz Ackerley
Irene David
Jacqui Nokes
Jane Clucas
Pam Hurst
David Robinson

Help and advice

If you have any problems, you are always welcome to approach any member of staff for help. Academic staff and course administrators have two designated office hours per week during which they are happy to assist students. You may prefer to arrange an appointment by e-mail or by asking the lecturer after class or by leaving a message at reception.

The course web pages are also a valuable source of information. The 'Undergraduate Students' page has further details:

www.math.canterbury.ac.nz/php/undergraduate/

Please remember that staff members are always willing to help with genuine problems, but we won't know you have a problem unless you tell someone.

Course changes and advice

If you would like advice about planning your course of study to match your career goals, please contact the student advisor at the College of Engineering, the College of Science or the College of Arts.

For specific academic programme advice, any of the course advisors listed below will help you decide which course best suits your needs.

Mathematics: Alex James, John Hannah
Statistics: Jennifer Brown
Honours: Jennifer Brown, Rick Beatson
Postgraduates: Chris Price

Personal tutors

If you list mathematics or statistics as a major subject then you will be assigned an academic staff member from the department as your personal tutor for the duration of your studies at UC. Your personal tutor is there to advise and support you with all sorts of academic and non-academic problems. He or she can offer advice on things like:

- choice of courses,
- applications for financial assistance,
- worries about exams,
- any problems you might have with deadlines.

You should feel free to turn to him or her at any time for advice and help.

Problems and complaints

- Depending on the problem, people to contact to get matters sorted out are your lecturers, course coordinators or administrators, tutors or class representatives. They may be able to provide help, or direct you to other places where you can seek support. Names and contact details of your class representatives are on the course web pages and the 'Undergraduate Students' webpage.
- For further advice contact the departmental grievance committee through the coordinator, Günter Steinke or through the Education Coordinator in the Student Union building.

Preparation courses

If you intend to enrol in one of the core mathematics courses, MATH 101 or 108, or core statistics courses, STAT 111 or 112, and feel that your background is inadequate, then the preparation courses that are run in January/February may be for you. These courses are advertised in the *Enrolment Handbook* and in the *Student Guide*. For more information see **www.math.canterbury.ac.nz/courses/summer.**

Frequently asked questions

How do I find out about my course?

All our courses have webpages containing course information which you should familiarise yourself with. You will be expected to access the course webpage regularly to download course material and look for news items. Course links are on the 'Undergraduate Students' page:

www.math.canterbury.ac.nz/php/undergraduate/

Some of the courses have course readers which contain material such as tutorial questions, lecture notes, formula sheets and tables etc, and all course details.

What if I have difficulty with the course material?

For help with this, you can see your lecturer during her/his office hours, you can ask your tutor in a tutorial, or you can go along to the help classes, where available. The course webpage or course news will contain details. Make sure you have specific questions to ask and that you have first worked at the problem yourself.

How do I organise my tutorials?

Many mathematics and statistics courses cater for very large numbers of students so tutorials are available at a number of times during the week. Tutorial enrolment is mainly done online and you can choose a time to suit your other commitments. You will be informed of how to do this during the first lecture. However, tutorial enrolment is often on a first-come first-served basis and if you leave enrolling until the last minute you may find the group you want is full. In exceptional circumstances, the course administrator will help find a time.

What do I do if I'm sick and miss an assessment?

Personal circumstances can cause you to miss a test or exam, or impair your performance in them. Look in the *University Calendar* or the *Enrolment Handbook* for the regulations concerning aegrotats, but you should also see the lecturer in charge of the course.

Do I need to attend tutorials?

No single element of any course is strictly compulsory. However, the importance of tutorials cannot be over-emphasised and many courses assign a percentage (typically 5%) of the assessment to tutorial attendance, preparation and/or participation. If you do not participate in tutorials, then you will have great difficulty passing the tests and examinations. **You should regard tutorial attendance as compulsory if you plan to succeed**.

What if I can't understand the material even after seeking help?

Some people may need additional help even after all formal means of support have been tried. Some people take more than one attempt to pass a paper. A list of private tutors is available from our reception, if you need individual help.

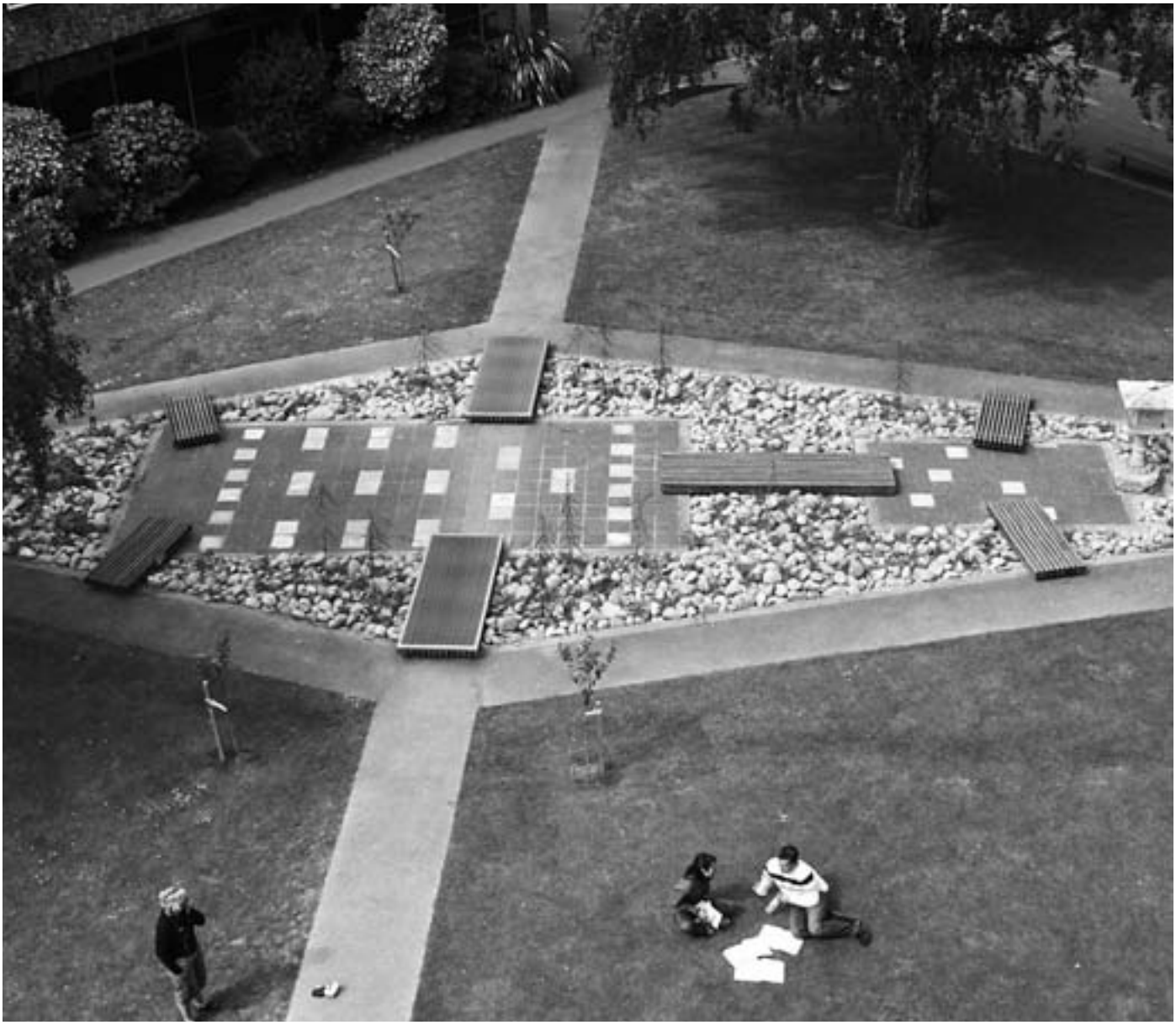
Department facilities

The Department of Mathematics and Statistics has modern, well equipped teaching and research computer laboratories, classrooms and meeting rooms.

The computing facilities include cutting edge 64-bit Windows systems, as well as Linux and UNIX operating systems. The labs are fitted out with fully networked terminals designed to satisfy the performance demands of modern mathematical and statistical computing applications. Four computer labs in the basement of the building service all our undergraduate courses. These are complemented by two fully equipped labs on level 4 for our advanced honours and postgraduate students. These facilities have extended opening hours and are equipped with fast and reliable printing services.

Research students have computer access provided in their departmental office. The departmental computing facilities can be accessed remotely from any computer with a broadband or network connection on or off campus, so you don't even need to be physically in the building. The building itself has full wireless coverage.

A complete range of mathematical and statistical computing software is provided, along with all the usual IT packages. The leading technical computer languages in mathematics and statistics, MATLAB and 'R', are available, along with Maple for symbolic algebra. Other statistical computing is provided by SAS and Statistica.



The Bridges of Friendship Garden. The paths and bridges embody the famous Kōnigsberg bridges problem. The problem is to find a path around all the bridges that crosses each bridge exactly once (without going around the far ends of the diamond), or to prove that it can't be done. The layout of bridges is from the Prussian town of Kōnigsberg

100-level courses

MATH 101

Introductory Mathematics with Applications **18 points**

MATH 101-08W (C)

Introduction to calculus, trigonometry and algebra. Emphasis on setting up mathematical models of problems, solving them and interpreting the solutions. Applications to the physical, life and earth sciences as well as to commerce and the humanities.

Restrictions: MATH 104, MATH 105, MATH 106, MATH 107, MATH 108, MATH 109, MATH 171

Enquiries: Pamela Hurst

MATH 108

Mathematics 1C **18 points**

MATH 108-08S1 (C)
MATH 108-08S2 (C)
MATH 108-08W (C)

Introduction to the ideas, techniques and applications of linear algebra and calculus.

Restrictions: MATH 104, MATH 105, MATH 106

Enquiries: Department of Mathematics and Statistics reception

MATH 109

Mathematics 1D **18 points**

MATH 109-08S1 (C)
MATH 109-08S2 (C)
MATH 109-07SU2 (C)

Extension of the calculus and linear algebra introduced in MATH 108.

Prerequisites: MATH 106 or MATH 108 or (a high grade in MATH 101 with Head of Department approval).
Restrictions: MATH 104, MATH 105, MATH 107.

Enquiries: Günter Steinke (semester two course); Bill Taylor (semester one course); Irene David (summer course).

MATH 115

Discrete Mathematics 1 **18 points**

MATH 115-08W (C)

Discrete mathematics is that part of mathematics not involving limit processes. It includes logic, the integers, finite structures, sets and networks.

Enquiries: Bill Taylor

MATH 134

Logic and Computability **18 points**

MATH 134-08S1 (C)
MATH 134-08SU1 (C)
Introduction to logic and computability.

Restrictions: PHIL 134, PHIL 144, MATH 144
Enquiries: Douglas Bridges

MATH 171

Mathematical Modelling and Computation **18 points**

MATH 171-08S2 (C)

An introduction to mathematical modelling and simulation via case studies using standard computer packages. Structured programming for mathematical problem solving.

Recommended Preparation: MATH 108, currently enrolled in or have completed MATH 105 or MATH 109

Restrictions: EMTH 171
Enquiries: Alex James

MATH 199

AIMS - Advancing in Mathematical Sciences **36 points**

MATH 199-08W (C)

This course is designed for secondary school students who may gain direct entry into level 200 university courses from school. It gives you the opportunity to study stimulating and interesting work while at school, and will prepare you well for second year mathematics.

Prerequisites: Subject to approval of the Head of Department.

Enquiries: Liz Ackerley

STAT 111

Statistics 1 **18 points**

STAT 111-08W (C)

Using statistics in real life situations. Emphasis on actual problems and real data sets. Introduction to Excel.

Restrictions: STAT 112, STAT 131
Enquiries: Carl Scarrott

STAT 112

Statistics 1 **18 points**

STAT 112-08S2 (C)

Using statistics in real life situations. Emphasis on actual problems and real data sets. Introduction to Excel.

Restrictions: STAT 111, STAT 131
Enquiries: Marco Reale

200-level courses

MATH 208

Logic A **22 points**

MATH 208-08S1 (C)

Prerequisites: Any 18 points in Philosophy or Mathematics or Computer Science.
Restrictions: PHIL 225, PHIL 246, PHIL 346, PHIL 208, PHIL 308, MATH 308

Enquiries: Douglas Bridges

MATH 221

Algebra and Cryptography **11 points**

MATH 221-08S1 (C)

The algebraic structure of integers and polynomials. Rings and finite fields. Introduction to cryptography.

Prerequisites: MATH 104 or MATH 105 or MATH 106 or MATH 107 or MATH 108 or MATH 109 or MATH 115 or MATH 199

Restrictions: MATH 211, MATH 315

Enquiries: Peter Renaud

MATH 222

Groups and Symmetry **11 points**

MATH 222-08S2 (C)

An introduction to the methods of abstract algebra via the study of symmetries and permutations.

Prerequisites: MATH 104 or MATH 105 or MATH 106 or MATH 107 or MATH 108 or MATH 109 or MATH 115 or MATH 199
Restrictions: MATH 211

Enquiries: Ben Martin

MATH 231

Discrete Methods **11 points**

MATH 231-08S2 (C)

An introduction to graph theory, a central area of discrete mathematics in which many real world problems can be interpreted and solved.

Prerequisites: MATH 104 or MATH 105 or MATH 106 or MATH 107 or MATH 108 or MATH 109 or MATH 115 or MATH 199
Restrictions: MATH 215

Enquiries: Charles Semple

MATH 243

Analysis 2 **11 points**

MATH 243-08S1 (C)

This course gives a deeper understanding of the real number system, calculus and limits.

Prerequisites: MATH 104 or MATH 105 or MATH 107 or MATH 109 or MATH 199
Restrictions: MATH 212

Enquiries: Arno Berger and Qui Bui

MATH 251

Linear Systems **11 points**

MATH 251-08S1 (C)

Introduction to linear algebra. Linear systems, numerical solution of large linear systems, vector spaces, linear transformations.

Prerequisites: MATH 104 or MATH 105 or MATH 107 or MATH 109 or MATH 199
Restrictions: MATH 204, MATH 217, MATH 254, EMTH 203, EMTH 204

Enquiries: Mark Hickman

MATH 252

Matrix Algebra 2 **11 points**

MATH 252-08S2 (C)

Eigenvalues and eigenvectors, inner product spaces, orthogonality, quadratic forms, complex spaces.

Prerequisites: MATH 104 or MATH 105 or MATH 107 or MATH 109 or MATH 199
Restrictions: MATH 204, MATH 217, MATH 254, EMTH 203, EMTH 204

Enquiries: Arno Berger

MATH 254

Linear Algebra 2 **22 points**

MATH 254-08S2 (C)

An accelerated course in linear algebra. Linear systems, complex vector spaces, linear transformations, eigenvalues and eigenvectors, inner product spaces, orthogonality, quadratic forms, numerical solution of large linear systems.

Prerequisites: B+ or better in (MATH 104 or MATH 105 or MATH 107 or MATH 109 or MATH 199).
Restrictions: MATH 204, MATH 217, MATH 251, MATH 252, EMTH 203, EMTH 204

Enquiries: Peter Renaud

MATH 261

Multivariate Calculus **11 points**

MATH 261-08S1 (C)

An extension of the ideas of differentiation and integration to multivariate functions and to vector valued functions.

Prerequisites: MATH 104 or MATH 105 or MATH 107 or MATH 109 or MATH 199
Restrictions: MATH 204, MATH 218, MATH 219, MATH 264, EMTH 201, EMTH 202, EMTH 204, EMTH 210

Enquiries: Mike Plank

MATH 262

Differential Equations and Transforms **11 points**

MATH 262-08S2 (C)

An introduction to second order ordinary differential equations. Laplace transforms, Fourier series, Complex functions.

Prerequisites: MATH 104 or MATH 105 or MATH 107 or MATH 109 or MATH 199
Restrictions: MATH 204, MATH 218, MATH 219, MATH 264, EMTH 201, EMTH 202, EMTH 204, EMTH 210

Enquiries: Mark Hickman

MATH 264

Multivariate Calculus and Differential Equations **22 points**

MATH 264-08S1 (C)

An accelerated course in calculus of several variables, vector fields and ordinary differential equations.

Prerequisites: B+ or better in (MATH 104 or MATH 105 or MATH 107 or MATH 109 or MATH 199).
Restrictions: MATH 204, MATH 218, MATH 219, MATH 261, MATH 262, EMTH 201, EMTH 202, EMTH 204, EMTH 210, EMTH 264

Enquiries: John Hannah

MATH 271

Mathematical Modelling and Computation 2 **11 points**

MATH 271-08S2 (C)

Use of the package MATLAB including matrix algebra, user-defined functions, surface plotting. Numerical methods including solutions of systems of linear equations, solution or ordinary differential equations and systems of equations, approximation techniques. Modelling projects.

Prerequisites: ((MATH 171 or EMTH 171 or MATH 280 or MATH 281 or MATH 282) and (EMTH 201 or EMTH 202 or EMTH 204 or EMTH 210 or MATH 261 or MATH 264)) or (a high grade in (MATH 104 or MATH 105 or MATH 107 or MATH 109 or MATH 199) and Head of Department approval).
Restrictions: MATH 266, EMTH 271

Enquiries: John Hannah and Mike Plank

MATH 282

Introduction to Scientific Computing **11 points**

MATH 282-08SU1 (C)

Introduction to the mathematical software package, MATLAB, which integrates technical computation, graphics, visualisation, and programming. Limited entry. See Limitation of Entry regulations.

Prerequisites: MATH 104 or MATH 105 or MATH 199
or MATH 107 or MATH 109
Restrictions: MATH 280, MATH 281

Enquiries: Bob Broughton

STAT 212

Statistical Distributions **11 points**

STAT 212-08S1 (C)

Distribution and densities, expectations, moments and MGF, discrete distributions, continuous distributions, sampling distributions.

Prerequisites: (MATH 104 or MATH 105 or MATH 106 or MATH 107 or MATH 108 or MATH 109 or MATH 199) and (STAT 111 or STAT 112 or STAT 131).
Restrictions: STAT 221, STAT 223, STAT 231

Enquiries: Department of Mathematics and Statistics reception

STAT 214

Statistical Inference **11 points**

STAT 214-08S2 (C)

Point estimation, confidence intervals, hypothesis testing, likelihood, linear models, regression and analysis of variance.

Prerequisites: (STAT 111 or STAT 112) and MATH 108
Restrictions: STAT 221

Enquiries: Dominic Lee

STAT 216

Probability **11 points**

STAT 216-08S1 (C)

Combinatorial probability, distribution theory, Markov chains and stochastic systems.

Prerequisites: STAT 111 or STAT 112 or MATH 108
Restrictions: STAT 231, MATH 223

Enquiries: Bill Taylor

STAT 218

Computational Methods in Statistics **11 points**

STAT 218-08S2 (C)

Computational techniques, exploratory data analysis and statistical inference.

Prerequisites: STAT 111 or STAT 112 or MATH 108 or MATH 115 or MATH 171

Enquiries: Raazesh Sainudiin

STAT 222

Applied Statistics **11 points**

STAT 222-08S1 (C)

A practical introduction to commonly used statistical practices. The emphasis is on real data and the application of statistical techniques.

Prerequisites: STAT 111 or STAT 112 or STAT 131
Restrictions: FORE 222, FORE 210, STAT 220

Enquiries: Marco Reale

STAT 224

Regression Modelling **11 points**

STAT 224-08S2 (C)

Regression models are the most widely used statistical tools for examining the relationships among variables. This course will provide a practical introduction to the fundamentals of regression modelling.

Prerequisites: STAT 111 or STAT 112 or STAT 131
Restrictions: FORE 224, FORE 210, STAT 220

Enquiries: Carl Scarrott

300-level courses

MATH 301

Mathematics in Perspective **14 points**

MATH 301-08S1 (C)

Topics in the history, philosophy, directions and culture of mathematics including significant results from the past and an outline of some major areas of progress in the 20th century.

Prerequisites: 36 points in Mathematics or Statistics or Engineering Mathematics at 100 level, and 44 points from the BA or BSc Schedule at 200 level in Mathematics, Statistics, Engineering Mathematics, related subjects, or other subjects with good grades, as approved by the Head of Department.

Enquiries: John Hannah and Clemency Montelle

MATH 305

Mathematics Project **14 points**

MATH 305-07SU2(C)

This 150 hour course provides students with an opportunity to develop mathematical or statistical research skills to extend and strengthen their understanding of an area of mathematics or statistics.

Prerequisites: 44 points from MATH 210-299, and approval of Head of Department.
Restrictions: STAT 305

Enquiries: Alex James and Ben Martin

MATH 322

Group Theory **14 points**

MATH 322-08S1 (C)

An introduction to groups, including applications to enumeration and geometry.

Prerequisites: MATH 221 or MATH 222 or (MATH 254 or EMTH 204 with Head of Department approval)
Restrictions: MATH 311

Enquiries: Günter Steinke

MATH 324

Cryptography 2 **14 points**

MATH 324-08S2 (C)

This course deals with the mathematical ideas underlying modern cryptography, including algebra, number theory and probability theory.

Prerequisites: MATH 221 and a further 11 points from MATH 210-299.

Enquiries: Ben Martin

MATH 333

Coding Theory **14 points**

MATH 333-08S1 (C)

An introduction to the mathematics underlying communication codes, in particular linear codes.

Prerequisites: 22 points from MATH 221, MATH 222, MATH 231, MATH 251, MATH 252, MATH 254, EMTH 203, EMTH 204 or 22 points at 200 level Maths with Head of Department approval.
Restrictions: MATH 315

Enquiries: Charles Semple

MATH 334

Combinatorics **14 points**

MATH 334-08S2 (C)

Modern combinatorics and discrete mathematics with an emphasis on design theory.

Prerequisites: 22 points from MATH 221, MATH 222, MATH 231, MATH 251, MATH 252, MATH 254, EMTH 203, EMTH 204 or 22 points at 200 level Maths with Head of Department approval.
Restrictions: MATH 315

Enquiries: Günter Steinke

MATH 336

Foundations of Mathematics **14 points**

MATH 336-08S2 (C)

An introduction to the philosophy of mathematics, classical and intuitionistic logic, set theory, and Gōdel's theorems.

Prerequisites: 22 points from MATH 221-282 or EMTH 200-204 or EMTH 210-271; or approval of Head of Department.

Enquiries: Douglas Bridges

MATH 342

Applications of Complex Variables **14 points**

MATH 342-08S2 (C)

Application of complex variable theory in the physical and engineering sciences. Contour integration. Conformal mappings.

Prerequisites: (22 points from MATH 219, MATH 264, EMTH 204) or (MATH 261 and MATH 262) or MATH 243 or EMTH 202
Restrictions: MATH 319

Enquiries: Chris Price

MATH 343

Metric, Normed and Hilbert Spaces **14 points**

MATH 343-08S1 (C)

An introduction to those parts of modern analysis essential for many aspects of pure and applied mathematics, physics, economics and finance.

Prerequisites: (MATH 243 or MATH 264 or EMTH 202 or EMTH 204) or (22 points from MATH 200 or EMTH 200 as approved by the Head of Department).
Restrictions: MATH 312

Enquiries: Qui Bui

MATH 352

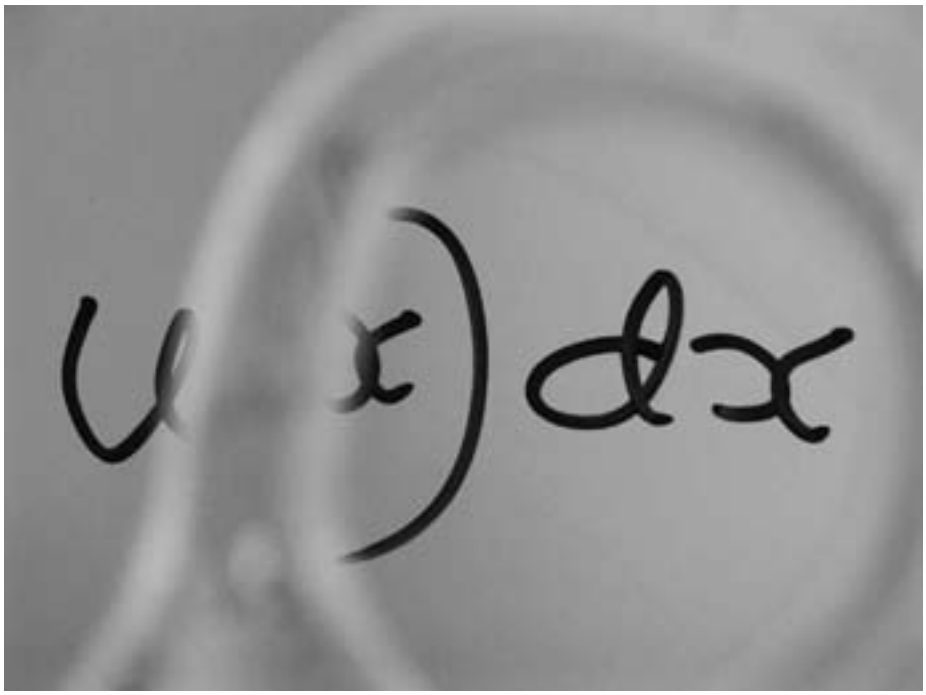
Applied Matrix Algebra A **14 points**

MATH 352-08S1 (C)

Introduction to computational optimisation and the associated linear algebra.

Prerequisites: MATH 251 or MATH 252 or MATH 254 or EMTH 203 or EMTH 204.
Recommended Preparation: MATH 280 or MATH 281 or MATH 282 or MATH 271
Restrictions: MATH 317

Enquiries: Chris Price



MATH 353

Applied Matrix Algebra B **14 points**

MATH 353-08S2 (C)

Introduction to the theory and application of eigensystems and the associated linear algebra.

Prerequisites: MATH 252 or MATH 254 or EMTH 203 or EMTH 204.
Recommended Preparation: (MATH 251 or MATH 352) and (MATH 271, MATH 280, MATH 281 or MATH 282)
Restrictions: MATH 317

Enquiries: Bob Broughton

MATH 361

Partial Differential Equations **14 points**

MATH 361-08S1 (C)

An introduction to the methods of solution for partial differential equations and to their applications.

Prerequisites: 22 points from MATH 219, MATH 261, MATH 262, MATH 264, EMTH 202, EMTH 204
Restrictions: MATH 314, MATH 318, MATH 319

Enquiries: Mark Hickman

MATH 363

Dynamical Systems **14 points**

MATH 363-08S2 (C)

An introduction to nonlinear systems, the use of linearisation techniques and bifurcation theory.

Prerequisites: 22 points from MATH 219, MATH 261, MATH 262, MATH 264, EMTH 202, EMTH 204.

Recommended Preparation: MATH 252, MATH 254 or EMTH 203
Restrictions: MATH 318

Enquiries: Department of Mathematics and Statistics reception

MATH 371

Vector Calculus and Modelling **14 points**

MATH 371-08S1 (C)

Applications of calculus in solving applied problems in science and engineering. Techniques for modelling and solving physical continuous systems.

Prerequisites: MATH 219 or MATH 264 or MATH 261 or MATH 262 or EMTH 202 orEMTH 204.
Restrictions: MATH 318

Enquiries: David Wall

MATH 376

Applied Stochastic Modelling **14 points**

MATH 376-08S2 (C)

Theory and applications of Markov processes. Applications to population dynamics, queuing and reliability.

Prerequisites: (11 points from STAT 212, STAT 214, STAT 216 and a further 11 points from STAT 210-299) and (MATH 109 or MATH 199).
Recommended Preparation: STAT 212, STAT 216, and 11 points from MATH 252, MATH 254, MATH 261, MATH 262, MATH 264, EMTH 202, EMTH 203, EMTH 204
Restrictions: STAT 316

Enquiries: Department of Mathematics and Statistics reception

MATH 381

Advanced Scientific Computing **14 points**

MATH 381-08S2 (C)

The use of advanced MATLAB routines for numerical methods in a range of topics including: the solution of nonlinear algebraic equations; systems of ordinary differential equations; two-point boundary value problems; partial differential equations; nonlinear optimization; numerical integration; numerical approximation.

Prerequisites: (MATH 261 or MATH 262 or MATH 264 or EMTH 202 or EMTH 204) and (MATH 266 or MATH 271 or MATH 280 or MATH 282)
Restrictions: MATH 366, MATH 367

Enquiries: David Wall

STAT 305

Statistics Project **14 points**

STAT 305-07SU2 (C)

This 150 hour course provides students with an opportunity to develop mathematical or statistical research skills to extend and strengthen their understanding of an area of mathematics or statistics.

Prerequisites: 33 points from STAT 210-299, and approval of Head of Department.
Restrictions: MATH 305

Enquiries: Alex James and Ben Martin

STAT 312

Sampling Methods **14 points**

STAT 312-08S1 (C)

Sampling techniques and designs. Special sampling designs for surveys of animal populations.

Prerequisites: 11 pts from STAT 212, STAT 214, STAT 222, STAT 224 and a further 11 pts from STAT 210 to STAT 299.

Enquiries: : Department of Mathematics and Statistics reception

STAT 313

Computational Statistics **14 points**

STAT 313-08S2 (C)

Data analysis and statistical inference based on permutation methods, EDF methods, bootstrap and resampling methods, kernel methods and Markov chain methods.

Prerequisites: (11 points from STAT 212, STAT 214, STAT 222, STAT 224 and a further 11 points from STAT 210-299) and MATH 108.
Recommended Preparation: STAT 218 and (MATH 109 or MATH 199).

Enquiries: Dominic Lee

STAT 314

Bayesian Inference **14 points**

STAT 314-08S1 (C)

Estimation and testing from the Bayesian viewpoint.

Prerequisites: (11 points from STAT 212, STAT 214 and a further 11 points from STAT 210-299) and (MATH 109 or MATH 199).

Recommended Preparation: STAT 212 and STAT 214
Enquiries: Dominic Lee

MATH 406 students on a field trip measuring insect honeydew production in Ashley Forest.

STAT 315

Multivariate Statistical Methods **14 points**

STAT 315-08S2 (C)

Detailed study of multivariate methods. Application of multivariate methods, test statistics and distributions.

Prerequisites: 11pts from STAT 212, STAT 214, STAT 222, STAT 224 and a further 11 pts from STAT 210 to STAT 299.
Recommended Preparation: MATH 252 or MATH 254

Enquiries: Carl Scarrott

STAT 316

Applied Stochastic Modelling **14 points**

STAT 316-08S2 (C)

Theory and applications of Markov processes. Applications to population dynamics, queuing and reliability.

Prerequisites: (11 points from STAT 212, STAT 214, STAT 216 and a further 11 points from STAT 210-299) and (MATH 109 or MATH 199).

Recommended Preparation: STAT 212, STAT 216 and 11 points from MATH 252, MATH 254, MATH 261, MATH 262, MATH 264, EMTH 202, EMTH 203, EMTH 204
Restrictions: MATH 376

Enquiries: Department of Mathematics and Statistics reception

STAT 317

Time Series Methods **14 points**

STAT 317-08S1 (C)

Analysis of sequentially collected data including data modelling and forecasting techniques.

Prerequisites: (11 points from STAT 212, STAT 214, STAT 222, STAT 224 and a further 11 points from STAT 210-299, ECON 211, MSCI 210) and (MATH 109 or MATH 199).
Recommended Preparation: 11 pts from MATH 251, MATH 252, MATH 254 and 11 pts from MATH 271, MATH 282, STAT 216

Enquiries: Department of Mathematics and Statistics reception

STAT 392

Special Topic: Data Mining **14 points**

STAT 392-08S2 (C)

Prerequisite: (STAT 111 or STAT 112 or STAT 131) and 22 points at 200-level in a relevant area.

Enquiries: Marco Reale

400-level courses

The semesters indicated for these courses are listed as a guide only. The courses may be offered in either semester 1 or semester 2 depending on demand.

MATH 401

Dynamical Systems 1 **15 points**
MATH 401-08S2 (C)
Enquiries: Michael Plank

MATH 405

Bioinformatics **15 points**
MATH 405-08S1 (C)
Enquiries: Mike Steel

MATH 406

Mathematical Models in Biology **15 points**
MATH 406-08S1 (C)
Enquiries: Alex James

MATH 407

Moving Frames and Exterior Differential Systems **15 points**
MATH 407-08S1 (C)
Enquiries: Mark Hickman

MATH 408

Financial Mathematics **15 points**
MATH 408-08S1 (C)
Enquiries: Ian Coope

MATH 409

Cryptography **15 points**
MATH 409-08S2 (C)
Enquiries: Ben Martin

MATH 410

Approximation Theory 1 **15 points**
MATH 410-08S2 (C)
Enquiries: Rick Beatson

MATH 412

Unconstrained Optimization **15 points**
MATH 412-08S1 (C)
Enquiries: Chris Price and Ian Coope

MATH 420

Hilbert Spaces **15 points**
MATH 420-08S2 (C)
Enquiries: Arno Berger

MATH 425

Fourier Transformations and Distribution Theory **15 points**
MATH 425-08S2 (C)
Enquiries: Qui Bui

MATH 426

Differential Geometry **15 points**
MATH 426-08S1 (C)
Enquiries: Günter Steinke

MATH 427

Lie Groups and Lie Algebras **15 points**
MATH 427-08S1 (C)
Enquiries: Günter Steinke

MATH 429

Combinatorics **15 points**
MATH 429-08S1 (C)
Enquiries: Charles Semple

MATH 431

Algebra and Symbolic Computation **15 points**
MATH 431-08S2 (C)
Enquiries: John Hannah

MATH 432

Foundations of Mathematics **15 points**
MATH 432-08S2 (C)
Enquiries: Douglas Bridges

MATH 433

Mathematics in Perspective **15 points**
MATH 433-08S1 (C)
Enquiries: John Hannah

MATH 437

Representation Theory **15 points**
MATH 437-08S1 (C)
Enquiries: Ben Martin

MATH 438

Measure and Integration **15 points**
MATH 438-08S2 (C)
Enquiries: Douglas Bridges

MATH 439

Fields and Commutative Rings **15 points**
MATH 439-08S1 (C)
Enquiries: Günter Steinke

MATH 441

Mathematical Economics **15 points**
MATH 441-08S2 (C)
Enquiries: Douglas Bridges

MATH 442

Wavelet and Data Compression **15 points**
MATH 442-08S2 (C)
Enquiries: Peter Renaud

MATH 443

Metric, Normed and Hilbert Spaces **15 points**
MATH 443-08S1 (C)
Enquiries: Qui Bui

MATH 449

Project **30 points**
MATH 449-08W (C)
Enquiries: Department of Mathematics and Statistics reception

MATH 491

Summer Research Project **15 points**
MATH 491-07SU2 (C)
Enquiries: Alex James and Ben Martin

STAT 405

Bioinformatics **15 points**
STAT 405-08S1 (C)
Enquiries: Mike Steel

STAT 440

Probability Theory **15 points**
STAT 440-08S1 (C)
Enquiries: Dominic Lee

STAT 445

Multivariate and Financial Time Series **15 points**
STAT 445-08S1 (C)
Enquiries: Marco Reale

STAT 446

Generalised Linear Models **15 points**
STAT 446-08S1 (C)
Enquiries: Jennifer Brown and Marco Reale

STAT 449

Project **30 points**
STAT 449-08W (C)
Enquiries: Department of Mathematics and Statistics reception

STAT 452

Applied Statistics **15 points**
STAT 452-08S1 (C)
STAT 452-08S2 (C)
Enquiries: Jennifer Brown

STAT 455

Sampling Methods **15 points**
STAT 455-08S1 (C)
Enquiries: Jennifer Brown

STAT 456

Time Series and Stochastic Processes **15 points**
STAT 456-08S1 (C)
Enquiries: Department of Mathematics and Statistics reception

STAT 458

Applied Stochastic Modelling **15 points**
STAT 458-08S2 (C)
Enquiries: Department of Mathematics and Statistics reception

STAT 459

Computational Statistics **15 points**
STAT 459-08S2 (C)
Enquiries: Dominic Lee

STAT 460

Extreme Value Statistics **15 points**
STAT 460-08S2 (C)
Enquiries: Carl Scarrott

STAT 461

Bayesian Statistics **15 points**
STAT 461-08S2 (C)
Enquiries: Dominic Lee

The Klein bottle: an example of a non-orientable surface. Picture a bottle with a hole in the bottom. Now extend the neck. Curve the neck back on itself, insert it through the side of the bottle without touching the surface, and extend the neck down inside the bottle until it joins the hole in the bottom. A true Klein bottle in four dimensions does not intersect itself where it crosses the side. Unlike a drinking glass, this object has no "rim" where the surface stops abruptly. Unlike in a balloon, a fly can go from the outside to the inside without passing through the surface (so there isn't really an "outside" and "inside").

STAT 462

Data Mining **15 points**
STAT 462-08S2 (C)
Enquiries: Marco Reale

STAT 463

Multivariate Statistical Methods **15 points**
STAT 463-08S2 (C)
Enquiries: Carl Scarrott

STAT 464

Statistical Inference **15 points**
STAT 464-08S1 (C)
STAT 464-08S2 (C)
Enquiries: Department of Mathematics and Statistics reception

STAT 491

Summer Research Project **15 points**
STAT 491-07SU2 (C)
Enquiries: Alex James and Ben Martin

Engineering mathematics and statistics courses

EMTH 171

Mathematical Modelling and Computation **18 points**

EMTH 171-08S2 (C)

An introduction to mathematical modelling and simulation via case studies using standard computer packages. Structured programming for mathematical problem solving.

Recommended Preparation: MATH 108
Restrictions: MATH 171

Enquiries: Alex James

EMTH 202

Calculus **15 points**

EMTH 202-08W (C)

Differentiation and integration of multivariate functions and vector valued functions; transform methods for solving differential equations.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: Mike Plank and Mark Hickman

EMTH 203

Linear Algebra **15 points**

EMTH 203-08W (C)

Linear systems; numerical solutions of linear equations; vector spaces and linear transformations; eigenvalues and eigenvectors; inner product spaces, orthogonality and quadratic forms; complex spaces.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: Mark Hickman and Arno Berger

EMTH 204

Calculus and Algebra **30 points**

EMTH 204-08W (C)

An accelerated course in linear algebra and calculus of several variables; linear systems and equations; vector spaces and linear transformations; eigenvalues and eigenvectors; inner product spaces, orthogonality and quadratic forms; vector fields and ordinary differential equations.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: John Hannah and Peter Renaud

EMTH 205

Engineering Statistics **6 points**

EMTH 205-08S2 (C)

Measurements and data. Probability and random variables. Common distributions. Estimation and hypothesis testing. Regression. Reliability.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: Dominic Lee

EMTH 210

Engineering Mathematics **15 points**

EMTH 210-08S1 (C)

Partial differentiation, differential equations, integration, Fourier series and linear algebra.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry

Enquiries: Chris Price

EMTH 271

Mathematical Modelling and Computation 2 **15 points**

EMTH 271-08S2 (C)

Use of the package MATLAB including matrix, algebra, user-defined functions, surface plotting. Numerical methods including solutions of systems of linear equations, solution of ordinary differential equations and systems of equations, approximation techniques. Modelling projects. Engineering applications using spreadsheets.

Prerequisites: Subject to approval of the Dean of Engineering and Forestry
Restrictions: MATH 271

Enquiries: John Hannah and Mike Plank

EMTH 391

Engineering Applied Mathematics and Statistics **12 points**

EMTH 391-08S2 (C)

Elementary probability and statistics, distributions, estimation and confidence intervals, goodness of fit tests. Partial differential equations, their use in modelling engineering applications, methods of solution and properties of these solutions.

Prerequisites: (EMTH 210 or EMTH 271) and subject to approval of the Dean of Engineering and Forestry.
Restrictions: MATH 361, ENCI303, EMTH 205, ENME330

Enquiries: Mike Plank and Carl Scarrott

EMTH 410-417

Special topics **15 points**

Enquiries: Department of Mathematics and Statistics reception

EMTH 600-610

These papers are available for students on the Masters of Engineering degree

Enquiries: Department of Mathematics and Statistics reception

Contact information

Please contact us if you have further questions regarding our courses or research.

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