University of Auckland, Department of Mathematics

MATHS 150 SC, Advancing Mathematics 1

Semester 2, 2008

COURSE INFORMATION

Welcome to MATHS 150

MATHS 150 is intended for students with a good mathematics background who are considering a major or a minor in mathematics and/or physics. In addition students planning a major in, for example, finance, economics, statistics, computer science or chemistry will find that their choices in those disciplines are greatly enhanced by a strong component of mathematics.

Expected background Lectures assume that students have 18 credits in Calculus at NCEA Level 3, including **at least 6 at merit level or better**, or the equivalent, or a good pass (B+ or better) in MATHS 102, or at least a B in CIE A2 Mathematics. Students with high grades in Level 3 Statistics should also be able to handle the material, with the proviso that there will be some topics in which they will need to study independently in order to catch up and keep up with the lectures. If you are not sure if you should be enrolled in MATHS 150, ask the lecturer for advice during the first two weeks of semester.

Texts The prescribed texts for this course are *Calculus* (Early Transcendentals), 8th Edition, by Howard Anton, Irl Bivens and Stephen Davis, and *Contemporary Linear Algebra*, by Howard Anton and Robert C. Busby, both published by Wiley. These books are also the required texts for Maths 250 / Physics 210 and Maths 253 and Physics 211. The texts are an essential part of the course; you should read them and do plenty of examples from them in addition to completing your assignments and tutorials. Students with excellent Statistics but without some units of Level 3 Calculus will find *Superstart*, a book available from the Student Resource Centre, a useful source of background material.

Lecturers, office hours, lectures, and tutorials The lecturers for this semester are

Wendy Stratton, room 413 (first half semester), email stratton@math.auckland.ac.nz,
telephone 373-7599 ext 85757, office hours to be arranged;
Bruce Calvert (weeks 7 - 9), email calvert@math.auckland.ac.nz,
office hours to be arranged; and
David Smith (weeks 10 - 12), email smith@math.auckland.ac.nz,
office hours to be arranged.

Lectures are scheduled to be held at 2 pm on Mondays, Tuesdays and Fridays. There will be a Matlab session at 2pm on Wednesday of the first week of semester, to which all students should go in order to learn how to use the computer laboratories and to begin learning how to use Matlab. From the second week of semester there will be collaborative tutorials at 2pm each Wednesday.

Assignments There will be 8 assignments, with one due in on most Fridays. The assignment questions will be available on the course website on the Friday before the assignment is due. Your answers should be submitted in neat writing (not in pencil or in red ink) on A4 paper using a Mathematics Department cover sheet, which is available from the Student Resource Centre. They should be handed in **no later than 4pm** on the due date. The due dates are

1st August; 8th August; 22nd August; 29th August;
26th September; 3rd October; 10th October; 17th October.

Assignments should be put in the appropriate Maths 150 post boxes in the basement of the Maths/Physics building and they will be returned to the **nearby collection shelves** after marking. **Late assignments or assignments posted in the wrong box will not be marked.** Fully worked solutions will be available on the website after the due date: these should be studied and understood, particularly where they apparently disagree with your own solutions.

Tutorials There will be tutorials, with short questions to be answered, every week **except the first** (on the first Wednesday there will be an unassessed Matlab training session). Tutorial locations will be given in class. During tutorials you are expected to try to solve the problems given with a group of not more than 3 other students. All members of each group must discuss the problems vigorously, both to become accustomed to using the new language you will be learning and to help **everyone** in the group to a full understanding of the mathematics involved. A silent group is not a successful group, no matter how perfectly each individual works, and the tutor may rearrange groups in this case. The tutor should

be called to help where no one in the group knows how to proceed. Fully worked solutions will be on the website after the tutorial day: these should be studied and understood.
Test and Examination There will be a test at 6pm on **Wednesday September 17th** (after the mid semester break). The date of the final examination will announced in lectures and on Cecil when it is known. If you are unable to sit the exam because of illness or bereavement, you should immediately inform either of the lecturers, get a doctor's certificate covering the date, and make an application for an aegrotat or compassionate consideration within 7 days. In this case you may be eligible for an aegrotat pass, but **only if** you have passed the test comfortably and have a good assignment record. Therefore you **must sit the test** and plan to pass it well.

Coursework and Examination

Coursework for **MATHS 150** consists of tutorials, assignments and a class test. Final grades will be calculated by the examiner from the best of the following:
1: Assignments 10%, Tutorials 10%, Test 20%, Exam 60%;
2: Assignments 10%, Tutorials 10%, Exam 80%;
3: Exam 100% if plussage applies (10/20 or better from Assignments and Tutorials).

Tutorials and assignments are **essential** components of this course. If you do not attend tutorials and submit assignments, then, judging by results over the last few years, you will fail this course.

Lecture Outlines The lecture outlines are an essential aid to students. They give the main definitions and theorems for each topic and refer the student to the relevant pages in the texts for further study and to appropriate exercises. You should have a copy of these with you during lectures. A bound copy can be bought at the Student Resource Centre, or you can print it out yourself from the course website.

The **course CD** can be purchased either with the lecture outlines or separately and contains many extra resources. These include background material, and for each subtopic, many fully worked examples and power point slides with step by step discussions of some problems. In addition, there is extension material for those students who have the time and the wish to investigate this subject in greater depth than expected in the syllabus. The CD also contains old exams and tests and their solutions.

Class website and Cecil MATHS 150 has a class website with address **http://www.math.auckland.ac.nz/class150** . Information about the course, lecturers, office hours and tutorials, and all handouts, assignments and tutorials will be available here. All coursework marks will be available on Cecil at **http://cecil.auckland.ac.nz/login.aspx** . There is a link to the class website from the Knowledge Map in Cecil. Please note that your final grade will be found on nDeva, not on Cecil.

Matlab and calculators All mathematics courses have access to the programming package Matlab and we expect Maths 150 students to use Matlab in some assignments. Calculators, including programmeable calculators like the Texas Instruments TI89, are allowed in tests and exams, with the proviso that their memories will be cleared before these. However **full working must be shown** in order to gain full marks in **all written work**.

How to Study Begin by keeping and reading this Course Information sheet which will be handed out at the first lecture. Attend lectures and take notes. Read the corresponding parts of the textbooks preferably before the lecture. Try the suggested exercises after each lecture.
If you don't understand something, keep trying until it makes sense. Ask questions of each other and of your lecturers. Go to their offices and ask. You can contact your lecturers by email or telephone too. Start on your assignments as soon as you get them. Attend tutorials and try to get into a group that has someone in it who knows what they are doing.

Getting Help For assistance with the material covered in the course:
(1) Ask questions in class.
(2) Ask about the material in the weekly tutorial.
(3) You can also get help and advice from the tutors in the **Assistance Room** in room B25 in the basement of the Mathematics Building (open on weekdays from 10am to 4pm).
(4) Visit the lecturer in his or her office hour. Office hours are given on the course website and will be posted on their office doors.

Warning about copying The University of Auckland will not tolerate cheating, or assisting others to cheat, and views cheating in coursework as a serious academic offence. The work that a student submits for grading must be the student's own work, reflecting his or her learning. Where work from

other sources is used, it must be properly acknowledged and referenced. This requirement also applies to sources on the world-wide web. A student's assessed work may be reviewed against electronic source material using computerised detection mechanisms.
In this course, students are strongly encouraged to discuss assignment, tutorial and other problems with each other. However assignment answers should be entirely the student's own work, resulting from the understanding gained from lectures, texts and discussion. Anyone judged to have copied or to have allowed their work to be copied will be given no marks for that work and could face disciplinary action such as being banned from attending further courses. Please take this very seriously.

COURSE OUTLINE

Sets, intervals and inequalities, the absolute value. Domain, range, and inverses of functions, including trigonometric, exponential and logarithmic functions.
Limits and limit theorems, Squeeze Theorem, continuity, The Intermediate Value Theorem. Limits at infinity and asymptotes of functions.
Tangents and rates of change, Derivatives and differentiability, differentiation rules, Chain Rule.
Implicit differentiation, maxima and minima, the Extreme Value, Fermat's, Rolle's and the Mean Value Theorems. Concavity, graph sketching and optimization.
The Riemann Integral and the Fundamental Theorem of Calculus. Integration by substitution and by parts. First order differential equations, slope fields and Euler's method. Modelling with these.

Vectors in IR^n , norms, angles, the dot product and orthogonality. The Cauchy Schwartz inequality.
Linear combinations of vectors, and vector and parametric vector equations of lines and planes in IR^3.
Normal vectors, and Cartesian equations of planes.
Linear systems, augmented matrices and elementary row operations. Echelon forms, Gaussian elimination and back substitution, Homogeneous linear systems and some applications of linear systems.
Operations on matrices, algebraic properties of matrices, matrix inverses and elementary matrices.
Determinants and the cross product.

Maths 150 contains some beautiful mathematics, and we hope you will enjoy it as much as we do.

Wendy Stratton, Bruce Calvert and David Smith,
July 2008