Department of Mathematics
MATHS 253: Study Guide for Semester 2, 2007.

Welcome to MATHS 253. This paper will be taught in the second semester at the City Campus. It concludes the core sequence in linear algebra and calculus begun in MATHS 150 and MATHS 250. Success in 253 opens the door to many level 3 mathematics courses and beyond. Here is the essential information you need to start with.

1. Title:
   Maths 253 is also known as *Mathematics 5*.

2. Lecturer:
   Alastair McNaughton

   City office: Room 330, floor 3, Maths-Physics building, phone extn 88762.
   Office hours at city(office 330 Maths-Px building): 2 - 2.30pm Tues, Wed, Thur.
   I will be available at other times by appointment.
   Tamaki office: Room 731.330, Phone ext 85244.
   E-mail a.mcnaughton@auckland.ac.nz
   Alastair will lecture all of 253.

3. Times and rooms:

   (a) Lectures:
   Tuesday, Wednesday, Thursday at 1 pm in room .....
   Tutorials:
   Friday at 1 pm in room .....
   Note that attendance at the Friday tutorial is compulsory.

4. Description:

   (a) Course description:
   Maths 253 is the standard sequel to maths 250, available every semester 1 and 2 on the city campus. It covers topics in linear algebra and multi-variable calculus. It is a foundation for a large number of stage 3 courses in pure and applied mathematics and statistics and also for many advanced courses in physics and various other applied sciences. All students intending to advance in mathematics should take this course.

   (b) Points:
   This is a 2-point course.

(c) Pre-requisites:
250, or 152 or Physics 112 or Physics 210. Students wanting to take 253 directly from 208 should discuss the situation with Alastair. In general, students from 208 should take 250 before attempting 253. *It is possible students may have enrolled in 253 instead of 250 due to a technical error on ndeva. Please see me urgently if you are in this position.*

(d) Restrictions:
You cannot include Maths 253 along with Maths 230 or Physics 211 in your degree.

(e) Aims:
The main aim is to complete the students preparation prior to commencing the various advanced and more theoretically rigorous level 300 papers. Students will be required to reach a good technical skill level in linear algebra and in calculus. There will be emphasis on combining multi-variable calculus with linear algebra in a way that is suitable for further advanced study.

(f) Differences from maths 253 in 2005
The course has been shortened by 1/9.
Certain topics have been removed such as some material on series convergence tests and the study of adjoint linear transformations. The method of assessment has altered.
However, much of the content will be retained. No major new topics have been introduced.

5. Expectations of students:

(a) Pre-requisite knowledge:
In addition to the pre-requisite papers noted above, it is also essential that students have an ability and a desire to following reasoning. Mere computational excellence is inadequate.

(b) Recommended preparation:
Maths 250 (or Maths 130 if you took it prior to its termination).
As noted above, in exceptional circumstances this course can also follow on from 208 but if you are from 208 you will need to do some extra work to catch up especially over the first 3 weeks.

(c) Studying mathematics:
All students are expected to do 10 hours per week on this course. This comprises:
3 hours of lectures, 1 hour of tutorial and 6 hours of preparation, revision, assignments and test preparation.

(d) Study expectations:
Students are expected to attend all lectures and tutorials. In addition they are expected to spend about 6 hours per week doing mathematics. This may take the form of preparation for lectures, looking up topics in the

textbook, doing assignments, visiting the lecturer during office hours and so on. We expect our students to be interested in their work and keen to understand the concepts and the reasoning which are required.

(e) Attendance:
You are strongly advised to attend all lectures and tutorials. Maths 253 is a challenging course. You are unlikely to pass if you skip lectures. No tutorial credits can be given if you miss a tutorial, even if you have a medical certificate. However, any marks lost through inadvertent absence from tutorials can be recovered by subsequent "bonus" marks.

6. Resources:

(a) Texts:
Contemporary Linear Algebra, (Anton and Busby) and
Calculus, 8th edition (Anton, Bivens and Davis). They are available new at both the University Bookshop in the Student Commons area and VOL 1 Bookshop, 33 Symonds St. They are sold as a shrinkwrapped pair at a special price negotiated with the publisher. There may be a few second hand copies of the Linear Algebra book available as it was first used for another course in 2005. These texts are also the texts for MATHS 150/108/250/253.

(b) Text Publisher's Web site.
Students using the Anton texts have the publisher's permission to visit and use the following companion Web site: http://www.wiley.com/college/anton The Department of Mathematics encourages you to visit this site and use any material available there.

(c) Lecture Outline Notes:
There will be no books of lecture notes supplied for this course. For most topics excellent notes and explanations and worked examples will be available directly from the textbook. Where necessary, I may supply brief supplementary notes on some topics for which the textbook coverage is too brief. In these cases the supplementary notes will be placed on cecil, but usually not until we reach these topics in the lectures. In places these notes may include spaces for worked examples which will be filled in during the lectures. **Please do not ask for these missing examples from the lecturer if you do not attend a lecture.**

(d) Course website:
This semester we expect to have all relevant material available on Cecil. There will be no additional web site.

7. **Lecture topics.**

week	lecture	topic
1	1	General review of basic concepts.
	2	Partial differentiation and the chain rule. Implicit differentiation.
	3	Differentials, the tangent plane and the gradient vector.
2	1	Orthogonal and orthonormal bases and the Gram-Schmidt process.
	2	Linear transformations and their matrix representation.
	3	Change of basis.
3	1	Introduction to double integration.
	2	Evaluation of iterated integrals by reversing the order.
	3	Polar coords. Applications to finding areas.
4	1	Similar matrices.
	2	Similarity.
	3	Diagonalization.
5	1	Triple integrals.
	2	Evaluation of triple integrals by changing the order. Cylindrical coords
	3	Changing the variables and the Jacobian matrix.
6	1	Orthogonal matrices, orthogonal similarity.
	2	orthogonal diagonalisability.
	3	Applications of orthogonal diagonalisability.
7	1	Quadratic forms.
	2	Quadratic forms in geometry.
	3	Positive definite quadratic forms.
8	1	The second order term in the Taylor formulae: quadric surfaces.
	2	The Hessian matrix and quadratic forms. Unconstrained optimisation.
	3	Constrained optimisation using Lagrange methods.
9	1	Parametric equations of curves as vector functions.
	2	Arc length and arc length parametrization.
	3	Tangent and principal normal vector, curvature
10	1	Vector calculus and the line integral of a scalar function.
	2	Vector fields and the line integral of a vector function.
	3	Conservative vector fields and the potential function.
11	1	Non-conservative vector fields and Green's theorem.
	2	Green's theorem cont
	3	Examples using Green's theorem
12	1	Abstract vector spaces. Inner product spaces.
	2	Orthogonal bases and projections on finite-dimensional subspaces.
	3	Fourier series.

8. Assessment:
   To qualify for plussage a student must obtain at least 50 percent for the sum of the tutorial and the assignment marks.
   If the student qualifies for plussage the assessment formula will be either
   10% assignments, 6% tutorials, 30% test, 54% exam,
   or
   40% test, 60% exam
   whichever gives the better result.
   If the student does not qualify for plussage the assessment formula will be
   10% assignments, 6% tutorials, 30% test, 54% exam.

   Note there is no option of just sitting the finals exam only.

   (a) Assignments:
   There will be 4 assignments due at 4pm on the following Thursdays:
   2, 16 August, 20 September, 4 October. No extensions will be allowed.
   Each assignment counts for 2.5 percent of your assessment.

   (b) Test:
   The proposed date for the test is **Friday, 24 August, 6-7.30pm**, room to be announced. This test will count for 30 percent of your assessment (or perhaps 40 percent if you obtain plussage). Students who do not sit the test and who have a approved aegrotate form may be required to sit another test at a later date.

   (c) The exam:
   The exam will be for 2 hours only. Along with the syllabus changes this means that you should not expect the final exam to be much the same as for pre 2006. Examination of the topics in the first part of the course will now occur as part of the test.

   (d) Aegrotates:
   Students who cannot sit either the test or the final examination due to some approved medical or other emergency, should complete an aegrotate application form in the normal manner. However, an aegrotate pass cannot be granted to any student purely on the completion of assignments and tutorials only. You must sit at least one of either the test or the examination to be considered for an aegrotate pass.

   (e) Tutorials:
   The tutorials are the most important part of this course. The class time each Friday will be used as a tutorial. You will be given a set of interesting problems to do and at the end of each tutorial you will need to hand in your work. It will not be marked in detail, but a mark [1 mark] will be awarded if I consider you have made a fair effort. Essentially this is a mark for participation. It is likely that some of the tutorial time will be spent discussing these problems and related matters. Answers to the tutorial problems will be put on Cecil after the tutorial is completed. Students who

hand in exceptionally good answers to tutorials will be awarded bonus marks which may be exchanged for credits toward other tutorials or assignments. The tutorials are not assignments, but rather an opportunity for you to spend an hour a week doing some mathematics and discussing the significance of it. Each tutorial will be worth 0.5 percent of your assessment.

9. Technology:
   The Department of Mathematics is using the software package Matlab for all undergraduate courses from 2006. Matlab knowledge will be useful not only for MATHS 208 but also for all subsequent mathematics courses.
   Matlab is available for use in the Mathematics/Statistics/Computer Science Basement Computer lab, B91 (9-8, Mon-Thur, and 9-5 Fri). Tutor assistance is available. Matlab is also available in the Student Commons.

   A student-version of Matlab is available for purchase ($65) from the SRC for use on your own computer (Windows/Mac/Linux).
   Matlab help is available at http://www.auckland.ac.nz/matlab/
   Familiarity with Matlab is not mandatory this semester.

10. Calculators:
    Calculators will be permitted in mid-term test and the final examination.

11. Formula sheets:
    These will *not* be provided in tests and examinations.

12. CECIL:
    CECIL is the prime means of information about the running of the course. All announcements made in lectures will also be made on CECIL. Students are requested to log on to CECIL on a regular basis, and use it to get information about the course, about assignments, about any matters concerning rooms, resources, or assessments. Access Cecil at http://www.cecil.auckland.ac.nz

13. Class Notices:
    Announcements sent via Cecil are simultaneously sent to your **University Webmail** address. Log onto NetAccount from any university computer using your netlogin and netpassword, to access your University Webmail at
    https://webmail2.ec.auckland.ac.nz/webmail.html.
    Alternatively you can redirect your University webmail by logging onto NetAccount and going to the link
    https://admin.ec.auckland.ac.nz/emailRedirection/.

    You are advised that many essential notices are sent via Cecil through the semester - it is your responsibility to read these notices either via Cecil or your University Webmail.

14. Collaborating & Cheating:
    You are encouraged to discuss problems with one another and to work together on assignments, but you must not copy another person's assignment. Assignment

marks contribute to the final mark you receive in this course. We view cheating on assignment work as seriously as cheating in an examination.

Generally acceptable forms of collaboration:

- Getting help in understanding from staff and tutors – you are encouraged to ask for help.
- Discussing assignments and methods of solution with other students.

Generally unacceptable forms of collaboration ("cheating"): Copying all or part of another student's assignment, or allowing someone else to do all or part of your assignment for you. Allowing another student to copy all or part of your assignment, or doing all or part of an assignment for somebody else. This is treated as seriously as copying another student's assignment.

If you are in any doubt about the permissible degree of collaboration, then please discuss it with a staff member.

15. Getting Help:
    It is important that you keep up with the pace on a day by day basis. If you find that you are having difficulty keeping up with the lecture material you must seek help immediately. Let your lecturer know you are getting behind. Visit your lecturer in his office hours as soon as you can. Also visit the assistance room. For assistance with the material covered in the course:

    - Ask about the material in the Friday tutorial.
    - Visit the lecturers in their offices during office-hours. Refer page 1.
    - Get help and advice from the tutors in the Assistance Room in room B25 in the basement of the Mathematics Building. It will be open on weekdays from 9am to 5pm, starting in week 2.

16. Harassment & Complaints:
    Complaints about assignment or tutorial marks are best taken to your lecturer who is in a position to do something immediately. More general complaints can be taken up by your class representative who should be elected or appointed in the first couple of lectures. You may also approach the Head of Department or the Departmental Manager for Mathematics (extension 88063). Harassment on any grounds, such as racial, sexual, religious and academic is totally unacceptable. Complaints about harassment are best taken to the University Mediator (extension 87478) or to any member of the Resolve Network whose names are displayed on posters around the campus.

I wish you all a profitable time and due success in this course.

Alastair McNaughton