DEPARTMENT OF MATHEMATICS

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND

Mathematics Two Study Guide

Semester Two 2007

MATHS 102 S2 C
(15 Points)

COURSE DESCRIPTION

This course focuses on the development of mathematical skills and concepts leading up to calculus through active participation in problems involving real life contexts. The content is organised around the key idea of a function, and examines different kinds of functions and their characteristics. The course aims to build confidence and foster enjoyment in mathematics, as well as preparing you for further study. There is an emphasis on modelling and a variety of techniques are employed including the use of technologies.

Pre-requisites: The course is intended for those students who have studied mathematics to at least Year 12/Form 6 level but whose achievement is insufficient for entry into the standard Stage 1 courses (108/150).

Restrictions: MATHS 102 may not be taken concurrently with any other pure mathematics course, nor can it be taken after having previously passed any other pure mathematics course except MATHS 101.

A good pass (Grade B+ up) is recommended for progress to MATHS 150 or MATHS 108.

LEARNING OUTCOMES

A student who successfully completes this course will:

- Recognise and use various forms of function notation, being able to write down and graph the inverses of functions, and identify the domain and range of functions;
- Be able to identify, model and interpret the algebraic or graphical forms of poynomial, exponential, logarithmic and cyclic relationships with appropriate mathematical functions in both mathematical and real world contexts and appropriate applications;
- Be able to mathematise and then solve linear programming problems;
- Be able to relate rational functions with their graphs, identifying asymptotes and intercepts;
- Be able to to use basic algebra correctly to solve equations, including those involving surds and trigonometric formulae;
- Be able to perform arithmetic on complex numbers, including the transformation of complex numbers between a+b*i* and cis forms and using an Argand diagram;
- Be able to find the derivative and integral of polynomial, power, exponential, logarithmic, and trigonometric functions, including the use of product, quotient and chain rules for compound functions;
- Understand the relationship between the processes of integration and differentiation;
- Be able to identify when a derivative is an appropriate mathematical model, and use it to solve optimisation problems;
- Be able to identify when an integral is an appropriate mathematical model, and to use it to solve appropriate real world problems;
- Know when and how to use technology appropriately in the solution of mathematical problems in this course;
- Know several strategies for approaching problems with no obvious solution method;
- Have the ability to express mathematics in written form to communicate mathematical ideas and problem solutions;

LECTURERS

Course Coordinator and lecturer
Maxine Pfannkuch m.pfannkuch@auckland.ac.nz room 310 Science Centre ext 88794
Office hours: Mon to Thurs 11am–12pm, other times by arrangement
Lecturer
Garry Nathan g.nathan@auckland.ac.nz room 315 Science Centre ext 84931

ASSESSMENT

Your final grade will be based on a combination of coursework and a 2-hour final examination as detailed below. This means you must participate in coursework if you wish to pass the course.

Total coursework mark	**40%**	
Semester test (1½ hours)	10%	
Three written assignments	15%	4 % each assignment, 3% tutorial attendance
Five Skills Quizzes	5%	
Five collaborative assignments	10%	2% each assignment
End of semester exam (2 hours)	**60%**	

Written Test
There will be a written test from 6.30 – 8.00 pm on Wednesday 19 September (room to be advised).

Written Assignments (also see later description)
Place your assignment in the MATHS 102 hand-in box outside the Student Resource Centre (SRC) in the basement of the Science Centre Building 303 (maths/physics).

Due Dates (by 4pm)

Assignment 1	Monday 6th August	Assignment 2	Monday 10 September
Assignment 3	Monday 1st October		

Skills Quizzes (also see later description)
These will be completed on Cecil at the end of each week as shown in the MATHS 102 calendar at the end of this study guide. They will be available to do from 8am on the Monday of each week, until 4pm on the Friday of the same week, except for Quiz 1, which has slightly longer to complete.

Collaborative Assignments (CA: also see later description)
These are to be completed within the tutorial on the stated dates, so attendance at these is essential. There are 3% of the coursework marks awarded for attendance.

CA 1	Thursday 9 August	CA2	Thursday 16 August
CA3	Thursday 20 September	CA4	Thursday 4 October
CA5	Thursday 11 October		

Examination
The examination is 2 hours long. The date and time of the exam will be confirmed later in the course. An information sheet describing the format of the exam will be available on Cecil once the semester starts. In the event of problems at the time of the exam, you should contact Student Health and Counselling. More information is available on the examinations website: http://www.auckland.ac.nz/exams

EXPECTATIONS

Pre-requisite Knowledge
Students taking this course are expected to have a working knowledge of the basic elements of Year 11 and Year 12 Mathematics. Assumed knowledge for each module will be stated in lectures and in the supplementary course notes available on Cecil or optional purchase from the SRC. The Cecil skills quizzes will test students on pre-requisite knowledge. Students who experience difficulties with this knowledge are expected to spend some time learning it outside of lectures, using the sources of help suggested at the start of each module in the supplementary course notes.

Course-load
Semester courses at The University of Auckland are assumed to require 10 hours per week of student time. In MATHS 102, the normal pattern of student study is expected to be (each week):

- 3 hours lectures
- 1 hour tutorial
- 3 hours lecture preparation/revision
- 3 hours assignments/quizzes/test preparation.

Students are expected to attend and come prepared to all lectures and tutorials. This means that you will have reviewed the previous lectures notes, and studied any preliminary material for the next lecture. It is important to note that not all course material will be covered in lectures. Students should study the supplementary course-notes, especially the topics noted as part of the course. It is the responsibility of the student to ensure that they are familiar with this material.

LECTURES and TUTORIALS

Lectures in this course are working times, they require you to think, not just sit passively and listen! Students should come prepared to ask questions, have discussions in groups, do mathematical problems or explore mathematical questions. This means students will need paper, calculators (see later), an open mind, and a sense of humour.

There are four teaching sessions a week. The Monday, Tuesday and Wednesday sessions will be whole class lectures. The Thursday times have been divided into smaller teaching groups or tutorials, which you will have selected at enrolment. These sessions will alternate between tutorials where assistance will be given with the four written assignments, test and examination; and collaborative tutorials that emphasise the importance of interaction and collaborative work in problem solving. During the six collaborative tutorial sessions (Practice + 5 assessed), you will be given questions to be solved in groups. These questions will make up 10% of the total assessment for the course. You will also receive 1% for attendance at each of the three written assignment tutorials.

Lectures 4-5pm. Monday, Wednesday: Room Eng 1439, Tuesday: Room Large Chemistry

Tutorials Thursday Rooms to be notified.

CECIL

Cecil is the main means of information about this course. All course materials, notices, assignments, solutions etc will be made available through Cecil. Make sure you visit the MATHS 102 Cecil site early in the course to see what is available there, and log on regularly to keep up to date with announcements, assignment solutions etc. You can access Cecil via the university website, http://cecil.auckland.ac.nz

TEXT

There is no REQUIRED text for this course. A comprehensive MATHS 102 course-book called *Functioning in Mathematics* is available to purchase from the University Bookshop (UBS) for $24.99. The book contains notes to accompany each topic covered in lectures, exercises and solutions, the previous semester test and exam and solutions, and work-sheets to accompany each lecture that will be completed during the lecture. We do advise you to buy this book, but if you prefer, everything in the book is available on Cecil.

Revision (Additional Support)

There are several books available to help students requiring assistance with basic skills. These are all available either on desk copy at the short loan library in the Kate Edgar Information Commons, or for purchase from the SRC and/or Volume One Bookshop.

- Skills in Mathematics Volumes 1 & 2 by Forbes, Morton & Rae: Covers much of the skill content of MATHS 102. These are very useful for students with weaknesses in some skill areas. Worked examples, and full worked solutions to exercises.
- *Maths: A Student's Survival Guide*, by Jenny Olive (not for sale at SRC).
- *Superstart*, a more advanced text written here at The University of Auckland for a 2-week skills-based course that runs prior to the start of semester one each year.

Students having problems with earlier knowledge are referred to the Student Learning Centre (Kate Edgar Commons), or to school mathematics texts. A suitable basic reference and source of exercises would be David Barton's *Gamma Mathematics Level 11* which is available for $44.95 from Abacus Educational Book Supply.

WORKING TOGETHER & CHEATING

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. You are encouraged to discuss problems with one another and to work together on assignments, but you must not copy another person's assignment. Any cases of suspected cheating will be referred to the course coordinator. Marks for the assignment may be deducted, or in serious or repeat cases, the student may be deleted from the course, or referred to the university for other possible disciplinary action.

Generally the following are acceptable forms of collaboration:

- Getting help in understanding from staff and tutors.
- Discussing assignments and methods of solution with other students.

Unacceptable forms of collaboration ("cheating") include:

- 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. For complete information about the university's policy on cheating, see *Guidelines: Conduct of Coursework* on the university website.

TECHNOLOGY

Calculators

We strongly recommend that students obtain a graphics calculator for this course, but should you not wish to purchase a graphics calculator, you MUST have at least a scientific calculator with trigonometric, exponential, and logarithmic functions.

Graphics calculators will be used by some lecturers in their teaching, and are supported by supplementary material located on Cecil. You can use a graphics calculator in all assignments, the test, and the examination. Graphics calculators will really help your mathematics learning in MATHS 102, and although some other courses may not permit them in exams, they can still be used in assignments etc. Any model graphics calculator may be used (e.g. Casio, TI, Sharp). If you are buying a new graphics calculator, we recommend the model TI 89 which has many algebraic and statistical functions. It will be available from the Student Resource Centre while stocks last.

Computers

The mathematics department is progressively introducing the use of Matlab in all its courses. However, MATHS 102 will continue to use the graphing package *AUTOGRAPH*. It is available on the computers in the Mathematics Undergraduate Computer Laboratory. There will be a tutorial on computer graphing (CA 2, on Thursday 16 August).

WRITTEN ASSIGNMENT INFORMATION

You will have 3 assessed written assignments, to be handed by 4pm on the dates shown earlier. Assignment four is not marked, it is provided to help you prepare for exams, by covering the topics after assignment 3. Model answers will be provided for all four assignments.

Each written assignment will be marked out of 50, reduced to a mark out of 10. All marks are rounded up, e.g. a mark of 45/50 will be worth 9/10, with marks of 46 to 50 all worth 10/10. Bonus marks are sometimes awarded for exceptional work (up to a maximum of 10/10).

Starting work on the night before your assignment is due is not a good idea! The presentation of your assignment solutions is important. Markers cannot be expected to 'hunt' for your solutions. Solutions should be numbered and all necessary working clearly shown. In other words do not penalise yourself through handing in hastily done work that cannot be easily read. You are expected to attempt the questions before attending tutorials. The tutorials are designed to give you help with problems you have in understanding the mathematics. If you go along not having even looked at the questions and expecting to be given all the answers, you will be disappointed!

Use the special blue cover sheet for mathematics available from the SRC. Put your name, course number, assignment number, and tutorial group on the front page, and Student ID on the back.

COLLABORATIVE ASSIGNMENTS INFORMATION:

Discussion is important in the process of mathematics learning. Being able to communicate your understanding is an important aspect of mathematical knowledge. In this course you will be given an opportunity to develop these skills. A collaborative assignment task is an activity in which a group of students (usually three) attempt to solve a mathematics problem together. The solution is submitted as a joint effort and all three students will gain the same mark. You do not have to work with the same students every time. The first week's tutorial will be a practice tutorial to give you an opportunity to get used to the system, and to meet your tutors. The assessment is in two equal parts:

Oral in which tutors will assess the extent of the collaboration of the group members in the problem solving process and the understanding that the whole group has of the problem and its solution.

Written in which the group's written solution will be handed in and marked in the usual way.

SKILLS QUIZZES:
These will consist of 5 quizzes each comprising 10 questions and worth 1% towards your course-work mark. They may be attempted on Cecil anytime during the scheduled week, as long as they are completed by 4pm on the Friday at the end of that week. You may have up to three attempts for each test, with your best mark being counted. The questions will be chosen to test student's knowledge of the preliminary skills required before each module (see the Module notes in the Supplementary Course Notes for more details). Quiz One will cover Module O and Module 1.

DELNA
DELNA is The University of Auckland's English Language testing programme. Information on the programme can be found at: http://www.delna.auckland.ac.nz/ DELNA:

- Diagnoses your academic English language ability.
- Does not cost you anything.
- Directs you to the best language support for you.
- Does not exclude you from the courses you are enrolled in.
- Does not appear on your academic record.

The Department of Mathematics requires ALL first year students to undertake DELNA screening. This is a half-hour web-based test. Individual results are given only to you, although the department gets a summary of the class results. Arrangements for sitting the test will be made through the Course Coordinator, who will advertise times and places where the screening can take place.

ENGLISH LANGUAGE ASSISTANCE
If students require assistance with English there are several services provided by the university and by the Department of Mathematics. The main assistance is ELSAC – the English Language Assistance Centre at Web site http://www.elsac.auckland.ac.nz/ This computer-laboratory based service is free and open 7 days a week. Tutors are available to help. Alternatively, there are credit-bearing English language courses (ESOL 100/101/102—see p340 of the 2007 Calendar). The Department of Mathematics offers special tutorial support for Maori and Pasifika students (contact Garry Nathan, Extn 84931, and occasionally runs Mandarin or Cantonese-speaking tutorials (contact Jamie Sneddon, Extn 82121).

GETTING FURTHER HELP
For assistance with the material covered in the course:

- Ask questions in class
- Ask about the material in the Thursday tutorial.
- 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), or
- Get some one to one tutoring assistance using the booking sheet at the mathematics office on the 3rd floor.
- Visit the lecturer during office hours.

The Student Learning Centre (SLC) in the Information Commons also offers some one-to-one assistance. You pay $10 to join the SLC and this entitles you to book SLC assistance for the entire calendar year.

HARASSMENT & COMPLAINTS
Complaints about assignment or tutorial marks are best made 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).

MATHS 102 COURSE OUTLINE

INTRODUCTORY MODULE: Mathematical modelling and the idea of a function. (2 lectures)

- Welcome to MATHS 102
- Mathematical Models and Functions

MODULE 1: (9 lectures) Polynomial functions

- Linear Functions
- Simultaneous Equations
- Linear Inequalities and Number Sets
- Linear programming in two dimensions
- Quadratic Functions
- Solutions to quadratic equations
- The Quadratic Formula
- Cubic & Higher Order Polynomial Functions

MODULE 2: (6 lectures) Rational, Exponential and Logarithmic Functions

- Rational Functions
- Exponential Functions
- Logarithmic Functions
- Logarithms & Exponents

MODULE 3: (9 lectures) Gradient Functions - Differential Calculus

- Rates
- The Gradient of a Function
- The Derivative Function
- Differentiation
- Optimisation
- Higher Derivatives
- Exponential & Logarithmic Functions
- Product & Quotient Functions
- Composite Functions

MODULE 4: (6 lectures) Trigonometric Functions

- Radians & Circular functions
- Trigonometric Relationships & Graphs
- Modelling Waves
- Trigonometric Formulae & their Applications (not examined)
- Differentiation of trigonometric functions
- Complex Numbers

MODULE 5: (4 lectures) Area Functions - Integral Calculus

- Area Under a Curve

- Indefinite Integration
- Definite Integration
- Applications of Integration

MATH 102
Semester Two 2007

TUTORIAL/ASSIGNMENT & LECTURE PLAN

Week beginning	Monday	Tuesday	Wednesday	Thursday
16 July	Mod 0/1 Maxine	Mod 0/2 Maxine	Mod 1/1 Maxine	**No Tutorial**
23 July	Mod 1/2 Maxine **Asst 1 out**	Mod 1/3 Maxine **Skills 1 Due**	Mod 1/4 Maxine	Tutorial Collab (practice)
30 July	Mod 1/5 Maxine	Mod 1/6 Maxine	Mod 1/7 Maxine	Tutorial: Help Assignment 1
6 August	Mod 1/8 Maxine **Asst 1 due** **Asst 2 out**	Mod 1/9 Maxine	Mod 2/1 Maxine	Tutorial Collab #1 **Skills 2 Due Friday**
13 August	Mod 2/2 Maxine	Mod 2/3 Maxine	Mod 2/4 Maxine	Tutorial (computer) Collab #2
20 August	Mod 2/5 Maxine	Mod 2/6 Maxine	Mod 3/1 Garry	Tutorial Assignment 2 **Skills 3 Due Friday**
27 August	MID SEMESTER	MID SEMESTER	MID SEMESTER	MID SEMESTER
3 September	MID SEMESTER	MID SEMESTER	MID SEMESTER	MID SEMESTER
10 September	Mod 3/2 Garry **Asst 2 due** **Asst 3 out**	Mod 3/3 Garry	Mod 3/4 Garry	Tutorial: Test Revision
17 September **Test week**	Mod 3/5 Garry	Mod 3/6 Garry	Mod 3/7 Garry TEST	Tutorial: Collab #3
24 September	Mod 3/8 Garry	Mod 3/9 Garry	Mod 4/1 Garry	Tutorial Assignment 3 **Skills 4 Due Friday**
1 October	Mod 4/2 Garry **Asst 3 due** **Asst 4 out**	Mod 4/3 Garry	Mod 4/4 Garry	Tutorial: Collab #4
8 October	Mod 4/5 Garry	Mod 4/6 Garry	Mod 5/1 Garry	Tutorial: Collab #5 **Skills 5 due Friday**
15 October	Mod 5/2 Garry	Mod 5/3 Garry	Mod 5/4 Garry	Tutorial: Exam Revision & Asst 4
22 October	Labour Day	exams / study	exams / study	exams / study
29 October	exams / study	exams / study	exams / study	exams / study

5 November	exams / study	exams / study	exams / study	exams / study