

Mathematics Two Study Guide

Semester Two 2011

MATHS 102 SS C (15 Credits)

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 polynomial, 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 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 $a+bi$ 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;

LECTURER

Garry Nathan nathan@math.auckland.ac.nz room 301 Building 810 ext 84931
Office hours: Monday 2 - 3, and Wednesday 11 - 12.
other times by arrangement. Lecturer for Modules 0, 1 and 4

Judy Paterson (co-ordinator) j.paterson@auckland.ac.nz room 305 Building 810 ext 88605
Office hours: Tues/Wed 2.00 – 3.00 pm
other times by arrangement. Lecturer for Modules 2, 3 and 5.

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%	5 % each
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 held during lecture hours on Wednesday 14th September (room subject to confirmation).

Written Assignments (also see later description) **NO EXTENSIONS WILL BE GIVEN**

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 Friday 12th August Note this is issued after all class changes have occurred
Assignment 2 Friday 26 August Assignment 3 Friday 7 October

Skills Quizzes (also see later description) **NO EXTENSIONS WILL BE GIVEN**

These will be completed on Cecil at the end of each week for the first five weeks of the course. They will be available to do from 8am on the Monday of each week, until 11pm on the Sunday. Skills 1 is due on Monday 10th Jan and will be open from Thursday 6th Jan. Skills 2 is open from midnight Monday 10th.

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.

CA 0 Thursday 28 July
CA 1 Thursday 4 August CA2 Thursday 18 August
CA3 Thursday 22 September CA4 Thursday 29 September
CA5 Thursday 13 October

Examination

The date and time of the exam will be confirmed later in the course. 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 Thursday sessions will be whole class lectures. The Friday 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 Monday, Tuesday, Wednesday, 1 pm to 2 pm,
Venue Mon and Wed BLT 100 Tues ENG 1439

Tutorials Thursday 10 -11, 11 -12, 3 – 4 are all in 301 – 248
 Thursday 2 -3 is in room 804 – 210

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). 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. We strongly 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 longer-term from the main library. Try Volume One Bookshop for second-hand copies.

- Skills in Mathematics Volumes 1 & 2 by Forbes, Morton & Rae: Covers much of the skill content of MATHS 102 (sadly out of print). 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.
- *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 (buy at the SRC).
- <http://hotmath.com/help/videos/index-college.html> An excellent commercial site that provides helpful videos at a quite reasonable cost!
- www.studyit.org.nz is a site that offers support for NCEA Level 1, 2 and 3 Achievement Standards and good links to other sites that offer support and practice.

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

Cheating is viewed as a serious offence by The University of Auckland. Penalties are administered by the Discipline Committee of the Senate, and may include suspension or expulsion from the University. Beginning in 2009, if a student deliberately cheats and receives a penalty, the case will be recorded in a University-wide Register. The record of the offence will normally remain until one year after the student graduates. The Register will help identify repeat offenders, with the risk that these students will receive more severe penalties for repeat offences.

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 or CAS-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 and CAS-calculators will be used by some lecturers in their teaching, and some support is given in supplementary material located on Cecil. You can use any model calculator in all assignments, the test, and the examination. Graphics and CAS-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.

Computers

The mathematics department is progressively introducing the use of Matlab in all its courses. However, MATHS 102 will still use the graphing package *AUTOGRAPH* instead. It is available on the computers in the Mathematics Undergraduate Computer Laboratory. There will be a tutorial on computer graphing (CA 2, on Friday 15th January).

WRITTEN ASSIGNMENT INFORMATION: NO EXTENSIONS

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: NO EXTENSIONS

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 11pm on the Sunday 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.

For more information please go to the website.

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 the 2010 Calendar). The Department of Mathematics offers special tutorial support for Maori and Pasifika students (contact Garry Nathan, Extn 84931).

GETTING FURTHER HELP

For assistance with the material covered in the course:

- Ask questions in class.
- Ask about the material in the Friday tutorial.
- Get help and advice from the tutors in the **Assistance Room** in SciSpace, Room G16, ground floor of the Mathematics Building 303 (10am-3pm daily from 10th January to Monday 15th February), or
- Get some one to one tutoring assistance from the Student Learning Centre (SLC) in the Information Commons. You pay \$10 to join the SLC and this entitles you to book SLC assistance for the entire calendar year.
- Visit the lecturer during office hours.

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: (5 lectures) Trigonometric Functions

NOTE This Module runs on Mondays from 22 August to 3 Oct

- 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
Summer School 2010

TUTORIAL/ASSIGNMENT & LECTURE PLAN

Week starting	Monday	Tuesday	Wednesday	Thursday	Friday
Mon 18 July	Mod 0/Lect 1	Mod 0/Lect 2	Mod 1/Lect 1	No Tutorial	
Mon 25 July	Mod 1/Lect 2	Mod 1/Lect 3	Mod 1/Lect 4	Collab Tutorial 0 - practice	
Mon 1 Aug	Mod 1/Lect 5 Assign 1 out	Mod 1/Lect 6	Mod 1/Lect 7	Collab Tutorial 1	Skills 1 due Sunday evening
Mon 8 Aug	Mod 1/Lect 8	Mod 2/Lect 1	Mod 2/Lect 2	Assignment Tutorial	Skills Two Due Sunday evening Assign 1 Due
Mon 15 Aug	Mod 1/Lect 9 Assign 2 Out	Mod 2/Lect 3	Mod 2/Lect 4	Collab Tutorial 2 Computer based	
Mon 22 Aug	Mod 4/Lect 1	Mod 2/Lect 5	Mod 2/Lect 6	Assignment Tutorial	Skills Three Due Sunday evening Assign 2 Due
	Mid semester break				
	Mid semester break				
Mon 12 Sept	Mod 4/Lect 2	Mod 3/Lect 1	Mod 3/Lect 2 Test	No Tutorial	
Mon 19 Sept	Mod 4/Lect 3 Assign 3 Out	Mod 3/Lect 3	Mod 3/Lect 4	Collab Tutorial 3	Skills Four Due Sunday evening
Mon 26 Sept	Mod 4/Lect 4	Mod 3/Lect 5	Mod 3/Lect 6	Collab Tutorial 4	
Mon 3 Oct	Mod 4/Lect 5 Assign 4 Out (not handed in or marked)	Mod 3/Lect 7	Mod 3/Lect 8	Assignment Tutorial	Skills Five due Sunday evening Assign 3 Due
Mon 10 Oct	Revision lecture Module 3 and 4 - Review Assign 4	Mod 3/Lect 9	Mod 5/Lect 1	Collab Tutorial 5	
Mon 17 Oct	Mod 5/Lect 2	Mod 5/Lect 3	Mod 5/Lect 4	Exam Revision Tut Optional	