UNSW SYDNEY

Course Outline

MATH1251 Mathematics for Actuarial Studies and Finance 1B

School of Mathematics and Statistics

Faculty of Science

Term 2, 2022

Contents

1. Staff

Position	Name	Email	Room
Course Convenor	Associate Prof Jonathan Kress	j.kress@unsw.edu.au	RC-3073
Algebra Lecturer	Dr Dmitriy Zanin	d.zanin@unsw.edu.au	RC-4075
Calculus Lecturer	Professor Thanh Tran	thanh.tran@unsw.edu.au	RC-4061
Möbius contact	Associate Prof Jonathan Kress	j.kress@unsw.edu.au	RC-3073
Tutor-in-charge	Dr William Ellis	wjellis@unsw.edu.au	No office

Staff consultation times will be posted on Moodle and on the School of Mathematics and Statistics website page by the beginning of week 2.

2. Administrative matters

Contacting the Student Services Office

Please visit the School of Mathematics and Statistics website (located under "Student life & resources") for a wide range of information on

- School Policies, Forms and Help for Students, go to "Student Services" tab
- Courses, please go to "Undergraduate" > "**Undergraduate courses**" for information on all **course offerings.**
- Latest student news, go to "Student noticeboard". Notices are posted regularly for your information here.

Please familiarise yourself with the information found in these locations. The School web page is: https://www.unsw.edu.au/science/our-schools/maths.

If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly. The First Year Advisor in the Student Services Office is Ms Hilda Cahya. All administrative enquiries concerning first year Mathematics courses should be sent to either:

- By email to ug.mathsstats@unsw.edu.au
- By phone: 9385 7011
- Or in person to the Red Centre building, level 3, room 3072

Change of tutorials, due to timetable clashes or work commitments, permission to take class tests outside your scheduled tutorial, advice on course selection and other administrative matters are handled in the Student Services Office. Constructive comments on course improvement may also be emailed to the Director of First Year Mathematics, Dr Jonathan Kress. Should we need to contact you, we will use your official UNSW email address of Zstudentno@unsw.edu.au in the first instance. **It is your responsibility to regularly check your university email account. Please state your student number in all emails to the Student Services Office.**

3. Course information

Units of credit: 6

Pre-requisite(s): MATH1151

Exclusions for MATH1251: MATH1021, MATH1031, MATH1231, MATH1241, ECON1202, ECON2291.

Teaching times and locations: see the link on the Handbook web pages:

Handbook entry for MATH1251:

https://www.handbook.unsw.edu.au/undergraduate/courses/2020/MATH1251/?q=math1251&ct=all

Offered in Term 2 only.

Course summary

MATH1251 will provide you with an in-depth knowledge of topics in Calculus and Linear Algebra and show applications in interdisciplinary contexts through lectures and exercises. It will enhance your skills in analytical critical thinking and problem solving through illustrative examples in lectures and problem-based tutorials. The course will also engage you in independent and reflective learning through your independent mastery of tutorial problems and MATLAB.

The mathematical problem-solving skills that you will develop are generic problem-solving skills, based on logical arguments, which can be applied in multidisciplinary work. You will develop your communication skills through active participation in tutorials, and by writing clear, logical arguments when solving problems.

Course aims

MATH1251, along with MATH1151, aims to provide the mathematical tools needed for Actuarial Studies and related disciplines. Students who have completed this course will be able to recognise linear structures and apply techniques in linear algebra to analyse and solve problems of a linear nature. Students will be able to analyse systems governed by commonly occurring ordinary differential equations and apply techniques to solve these analytically and numerically. In addition, students will be able to solve multivariable optimisation problems and use Taylor series techniques to find approximations and derive theoretical results. MATH1251 will provide the Matlab skills need to apply these mathematical techniques to computational problems.

Course learning outcomes (CLO)

At the successful completion of this course you (the student) should be able to:

1. State definitions and theorems in the syllabus and apply them to specific examples.
2. Apply the concepts and techniques of the syllabus to solve appropriate problems.
3. Use technology as an aid to solve appropriate problems.
4. Communicate mathematical ideas effectively using correct terminology.
5. Recognise and create valid mathematical arguments.

4. Learning and teaching activities

Lecture and Tutorial Schedule

Lectures will be face-to-face with a limited capacity and also streamed live online and recorded via Echo360. Tutorials will mostly be face-to-face with some also online via Blackboard Collaborate. A link will be found on Moodle for both Blackboard Collaborate and Echo360. Lectures and selected tutorials will be recorded and the recording may include student comments or voices.

	Monday	Tuesday	Wednesday	Thursday	Friday
Lecture A	12 – 2pm (w1-2,4-5,7-10, CLB 7)			9am (w1-5,7-10, Science Th)	2 – 4pm (w1-5,7-10, CLB 7)
Tutorials	http://timetable.unsw.edu.au/2022/MATH1251.html#S2S				

Note: The lecture and tutorial on Monday 13 June (Week 3) will be cancelled due to a public holiday. A recorded lecture may be provided for this. Details will be announced on Moodle close to the time.	

Tutorials

Students in MATH1251 are enrolled in a tutorial for weeks 1 to 5 and 7 to 10. There will also be some Q&A session arranged via Moodle in the first half of the week. The Q&A sessions will be online using Blackboard Collaborate. The tutorial timeslot in your timetable on myUNSW will be for the Classroom Tutorial. The Classroom Tutorial will be a mix of Algebra and Calculus each week. Note that the weekly Möbius lesson contains a poll to vote for which questions will be discussed in the Classroom Tutorial later that week.

In Term 1 2022, students can enrol in either face-to-face tutorials, or online tutorials. The face-to-face tutorials are subject to change depending on conditions within NSW. The online tutorials will use Blackboard Collaborate, a virtual classroom system. This is the same system that is used for lectures. See Moodle for details. A laptop with internet access is recommended for attending live classes online.

Attendance is compulsory for all tutorials and a roll will be taken by the tutor for face-to-face classes or automatically by Blackboard Collaborate for online classes. Selected tutorials may be recorded for students to review at a later time but this is not intended as a substitute for live attendance.

The time and location of your tutorial can be found on myUNSW. Students can change their tutorial time via myUNSW until the end of week 1. After that, they can only change tutorials by contacting the Mathematics and Statistics student services (see page 4) with evidence of a timetable clash or work commitments.

The main reason for having tutorials is to give you a chance to tackle and discuss problems which you find difficult or do not fully understand, so it is important to try at least a selection of tutorial problems before attending your class so that you know the questions you would like to ask of your tutor. A schedule of suggested homework problems, to be attempted before your classroom tutorial, will be posted on Moodle. In addition, the Q&A session will allow students to ask questions directly and get instant answers from tutors for topics that students do not fully understand.

If your tutorial falls on a public holiday, it will be cancelled for that week. You can optionally attend another tutorial class from the online options for that week only. You can find the times of tutorials on the central timetable, links above in the Lecture & Tutorial Structure table, or in the Blackboard Collaborate session list.

5. Assessments

Overview

In Term 2 2022 the Mastery Tests, Weekly Möbius Lessons and Assignment will be conducted online but the End of Term Exam will be in-person on campus. See the End of Term Examination section for more details.

The assessment structure of MATH1251 may be quite different to high school and other courses that you are used to. It is designed so that students should expect to be close to passing the course before taking the final exam with pre-exam assessment focusing on basic skills and the exam focusing on more advanced skills.

- The Möbius lessons allow answers to be checked while working on them, they are available for an extended period and students can work together, seek help and use any resources they wish. Most students gain a perfect score in these.
- The Mastery Tests allow unlimited practice of questions from the actual question bank before the test. Because of this, students should be aiming for a mark of 80% or greater in the Mastery Tests. Marks less than 80% should be seen as a warning sign of possible failure in the course.
- The Assignment is available over an extended period and students can work on this with the benefit of all the course resources. Students who pass MATH1251 typically obtain a mark of at least 6 or 7 out of 10 for the Assignment.
- The average mark for pre-exam work is typically well over 40/50.

- The exam focuses on questions that require understanding rather than routine calculation. A student's pre-exam mark is not a good predictor of the exam mark. The harder questions from past exams since 2020 are the best indication of what to expect in the exam, but there will be some more changes that will be announced closer to end of the term.
- If your performance in or ability to complete any assessment is affected by illness or other reasons beyond your control, you may be eligible for special consideration. See the section of special consideration for details.
- To pass MATH1251 you need 50% or greater overall. There is no requirement to gain any particular mark in any individual assessment items.

Weightings

Your final mark will be made up as follows:

Assessment task	Weight	Course Learning Outcomes
Online	40%	
Weekly Möbius Lessons	10%	1, 2, 3, 5
Mastery Tests	30% (15% + 15%)	1, 2, 3, 5
Assignment	10%	1, 2, 3, 4, 5
End of Term Examination	50%	1, 2, 3, 4, 5

Note:

- The marks for assessment items during the term available to you through Moodle.

  It is **your responsibility** to check that these marks are correct. If there is an error, contact the Course Convenor as soon as possible but no later than the time of the final exam.

  The webpage: https://student.unsw.edu.au/exams has many useful links related to the running of UNSW examinations.

- **Medical or other reasons are generally not accepted for missing the deadlines for the online tests as these tests are available for an extended period and can be completed from anywhere.**
- It is very important that you understand the University's rules for the conduct of Examinations and the penalties for **Academic Misconduct Guide**. This information can be accessed through myUNSW at: https://student.unsw.edu.au/exams NB: In recent years there have been cases where severe penalties have been imposed for misconduct in relation to tests and exams in Maths courses.
- Assessment criteria: UNSW assesses students under a standards based assessment policy. For how this policy is applied within the School of Mathematics and Statistics, please visit the website: http://www.maths.unsw.edu.au/currentstudents/assessment-policies
- If you are unwell / miss your **final examination**, please refer to the Special Consideration Policy by visiting the website: https://student.unsw.edu.au/special-consideration

Weekly Möbius lessons

Students are expected to complete all 9 Weeks of the weekly Möbius lessons, however, only the best 6 of the 9 weekly Möbius lessons will contribute 10% of your final mark. Special consideration will only be considered for students who have appropriate documentation to explain missing more than 3 weeks of the Möbius lessons. Note that Möbius lesson 0 does not count for marks but must be completed before Möbius lesson 1.

The weekly Möbius lessons cover topics from algebra, calculus and Matlab. You have unlimited attempts for these lessons. Students can check their answers as they are working and the highest mark for these will count, so students can attempt repeatedly until they are satisfied with their mark.

Mastery Tests

As well as completing the weekly Möbius lessons, you will take two Mastery Tests based on the same set of questions and some additional questions based on classroom tutorial questions. These tests will be conducted in week 5 for the first test and week 10 for the second test. The actual times of these tests will be announced on Moodle at least one week before the test. Each of the Mastery Tests will contribute 15%. **Students will have a single attempt for each Mastery Test**.

The Mastery Tests will be conducted online in Term 1 2022 on Möbius. Each Mastery Test has a selection of questions from both the algebra and calculus course, and the second may require the use of Matlab. Each test attempt will have a different random selection of questions from a test question bank. You will be allowed unlimited practice, with immediate feedback, on the questions in this test bank, so you are expected to have worked out exactly how to answer the questions before you attend the test.

If you miss a Mastery Test because of illness or other misadventure beyond your control, you must apply for special consideration. See the section of special consideration for details.

Assignment

The purpose of the assignment is to improve your mathematical writing by providing feedback on your writing and helping you to recognise good mathematical writing. It will also give you practice at presenting solutions to exam style questions.

The questions will be presented to you on Möbius, and you will write solutions to these questions. You will be able to check the correctness some parts of your answer using Möbius so your main task will be to present your answers well with good explanations of your working.

The assignment will require some use of Matlab.

Your work will need to be typed (not handwritten and scanned) and you will submit your work online through links on Moodle. The assignment deadline will be 11:59pm on Tuesday of week 9. The assignment will have a maximum mark of 10. A penalty of 5% of the maximum mark will be deducted from the awarded mark per day late up to a maximum of 5 days late. **Submissions over 5 days late will receive a mark of zero**.

Complete details of the process for the assignment will be provided when the assignment is released. Note the marking criteria are focused on how you explain and present your answers.

End of Term Examination

In Term 2 2022 the End of Term Examination will be conducted using Möbius. **The exam will be conducted under supervised conditions in the Red-Centre computer labs during the official exam period.** Very limited exceptions will be allowed for students who are unable to travel to Sydney. The date and time of the final examination will be available on myUNSW and further details of the exam arrangements, including for students unable to come to Sydney, will be available on Moodle when the final exam timetable is released.

This year is the first year in which the MATH1251 exam is worth 50%. In previous years, the exam had a higher weighting, and the pre-exam assessments had a different structure. From 2022, the assessment tasks during the term allow repeated attempts over an extended period and focus more on basic skills. As a result, students should be aiming for a high mark in the pre-exam assessment, and this indicates significant progress towards achieving the learning outcomes of this course. The exam is time limited and has more complex questions. Therefore, a high mark in the pre-exam assessment is not always an accurate indication of the final course mark.

Schedule of all assessments

Lectures and tutorials run during weeks 1 to 5 and 7 to 10. The table below gives the schedule all assessments.

Week	Mastery Tests and Assignment	Weekly Möbius Lessons
1		Möbius Lesson 0 due 4pm Wednesday* Start work on Möbius Lesson 1
2		Möbius Lesson 1 due 4pm Wednesday Start work on Möbius Lesson 2
3		Möbius Lesson 2 due 4pm Wednesday Start work on Möbius Lesson 3
4		Möbius Lesson 3 due 4pm Wednesday Start work on Möbius Lesson 4
5	Mastery Test 1 on Möbius	Möbius Lesson 4 due 4pm Wednesday Start work on Möbius Lesson 5
6	Flexibility week	
7	Assignment released	Möbius Lesson 5 due 4pm Wednesday Start work on Möbius Lesson 6
8		Möbius Lesson 6 due 4pm Wednesday Start work on Möbius Lesson 7
9	Assignment due Tuesday 11:59pm	Möbius Lesson 7 due 4pm Wednesday Start work on Möbius Lesson 8
10	Mastery Test 2 on Möbius	Möbius Lesson 8 due 4pm Wednesday Möbius Lesson 9 due 11:59pm Sunday**
11	Monday to Thursday: Study break Friday: Start of exams – Check myUNSW for exam timetable	
End of Term examination – Check UNSW exam timetable for details		

* The deadline for Matlab lesson 0 will be extended to 4pm Wednesday of Week 2.

** The deadline for Möbius Lesson 9 is at the end of Week 10, but it will remain open (and the mark will count) until 4pm Wednesday of Week 11.

Calculator Information

For 2022, students will be able to use any handheld calculator or Matlab during assessments.

6. Course Materials

Moodle

The School of Mathematics and Statistics uses the Learning Management System called Moodle. To log in to Moodle, use your zID and zPass at the following URL: https://moodle.telt.unsw.edu.au/

Once logged in, you should see a link to MATH1251 that you will take you to the MATH1251 homepage in Moodle.

Course Pack and Textbook

The course materials for MATH1251 are:

- MATH1251 Course Pack (see below);

S.L. Salas, E. Hille and G.J. Etgen, Calculus - *One and Several Variables*, any recent edition, Wiley.

The latest edition of the textbook, Salas, Hille and Etgen, *Calculus - One and Several Variables*, 10th Edition comes packaged with access to the electronic resources known as WileyPlus. This electronic version provides internet access to the textbook, problems, worked solutions, tests (for self-assessment) and other electronic resources related to the text material. The purchase of the text from the UNSW Bookshop gives web access to the WileyPlus server for one year; it is possible to renew the web access on a yearly basis at a fee determined by the publisher. It is also possible to purchase just the web access to the electronic version of the textbook for one year. This can also be done at the UNSW Bookshop. Note that these WileyPlus electronic resources are provided by the publisher John Wiley, and not by the School of Mathematics and Statistics. Any difficulties that you might have with access to WileyPlus must be resolved directly with the publisher.

Salas, Hille & Etgen is sold at the UNSW Bookshop.

Course Packs are also sold through the UNSW Bookshop, while the computing laboratory notes and introduction to Matlab are free to download.

The Course Pack contains the following items:

- Algebra Notes (for MATH1251);
- Calculus Notes (from MATH1231/1241 as an additional resource);
- Calculus Problems Booklet;
- Past Exam Papers Booklet.

Booklets contained in the Course Pack will not be available separately from the School of Mathematics and Statistics. However, the information in this booklet and the algebra and calculus problems can be accessed through the web from the MATH1251 Course Page.

7. Expectations of students

School and UNSW Policies

The School of Mathematics and Statistics has adopted a number of policies relating to enrolment, attendance, assessment, plagiarism, cheating, special consideration etc. These are in addition to the Policies of The University of New South Wales. Individual courses may also adopt other policies in addition to or replacing some of the School ones. These will be clearly notified in the Course Initial Handout and on the Course Home Pages on the Maths & Stats website.

Students in courses run by the School of Mathematics and Statistics should be aware of the School and Course policies by reading the appropriate pages on the Maths & Stats website starting at:

https://www.unsw.edu.au/science/our-schools/maths/student-life-resources/student-services/assessment-policies

The School of Mathematics and Statistics will assume that all its students have read and understood the School policies on the above pages and any individual course policies on the Course Initial Handout and Course Home Page. Lack of knowledge about a policy will not be an excuse for failing to follow the procedure in it.

Academic Integrity and Plagiarism

UNSW has an ongoing commitment to fostering a culture of learning informed by academic integrity. All UNSW staff and students have a responsibility to adhere to this principle of academic integrity. Plagiarism undermines academic integrity and is not tolerated at UNSW. *Plagiarism at UNSW is defined as using the words or ideas of others and passing them off as your own.*

The **UNSW Student Code** provides a framework for the standard of conduct expected of UNSW students with respect to their academic integrity and behaviour. It outlines the primary obligations of students and directs staff and students to the Code and related procedures.

In addition, it is important that students understand that it is not permissible to buy essay/writing services from third parties as the use of such services constitutes plagiarism because it involves using the words or ideas of others and passing them off as your own. Nor is it permissible to sell copies of lecture or tutorial notes as students do not own the rights to this intellectual property.

If a student breaches the Student Code with respect to academic integrity, the University may take disciplinary action under the **Student Misconduct Procedure**.

The UNSW Student Code and the Student Misconduct Procedure can be found at:
https://student.unsw.edu.au/plagiarism

An online Module "Working with Academic Integrity" (https://student.unsw.edu.au/aim) is a six-lesson interactive self-paced Moodle module exploring and explaining all of these terms and placing them into your learning context. It will be the best one-hour investment you've ever made.

Plagiarism

Plagiarism is presenting another person's work or ideas as your own. Plagiarism is a serious breach of ethics at UNSW and is not taken lightly. So how do you avoid it? A one-minute video for an overview of how you can avoid plagiarism can be found https://student.unsw.edu.au/plagiarism.

Examples of Plagiarism include:

- Direct duplication of the thoughts or work of another, including by copying work, or knowingly permitting it to be copied. This includes copying material, ideas or concepts from a book, article, report or other written document (whether published or unpublished), composition, artwork, design, drawing, circuitry, computer program or software, web site, Internet, other electronic resource, or another person's assignment without appropriate acknowledgement;
- Paraphrasing another person's work with very minor changes keeping the meaning, form and/or progression of ideas of the original;
- Piecing together sections of the work of others into a new whole;
- Presenting an assessment item as independent work when it has been produced in whole or part in collusion with other people, for example, another student or a tutor; and,
- Claiming credit for a proportion of work contributed to a group assessment item that is greater than what you actually contributed to.
- Submitting an assessment item that has already been submitted for academic credit elsewhere may also be considered plagiarism.

The inclusion of the thoughts or work of another with attribution appropriate to the academic discipline does not amount to plagiarism.

Students are reminded of their Rights and Responsibilities in respect to plagiarism, as set out in the University Undergraduate and Postgraduate Handbooks and are encouraged to seek advice from academic staff whenever necessary to ensure they avoid plagiarism in all its forms.

Useful resources are available at https://www.student.unsw.edu.au/plagiarism.

Students are also reminded that careful time management is an important part of study and one of the identified causes of plagiarism is poor time management. Students should allow sufficient time for research, drafting, and the proper referencing of sources in preparing all assessment items.

Additional Support

ELISE (Enabling Library and Information Skills for Everyone)

ELISE is designed to introduce new students to studying at UNSW.

Completing the ELISE tutorial and quiz will enable you to:

- analyse topics, plan responses and organise research for academic writing and other assessment tasks
- effectively and efficiently find appropriate information sources and evaluate relevance to your needs
- use and manage information effectively to accomplish a specific purpose
- better manage your time
- understand your rights and responsibilities as a student at UNSW
- be aware of plagiarism, copyright, UNSW Student Code of Conduct and Acceptable Use of UNSW ICT Resources Policy
- be aware of the standards of behaviour expected of everyone in the UNSW community
- locate services and information about UNSW and UNSW Library

Some of these areas will be familiar to you, others will be new. Gaining a solid understanding of all the related aspects of ELISE will help you make the most of your studies at UNSW.

The *ELISE* training webpages:

https://subjectguides.library.unsw.edu.au/elise/aboutelise

Equitable Learning Services (ELS)

If you suffer from a chronic or ongoing illness that has, or is likely to, put you at a serious disadvantage, then you should contact the Equitable Learning Services (previously known as SEADU) who provide confidential support and advice.

They assist students:

- living with disabilities
- with long- or short-term health concerns and/or mental health issues
- who are primary carers
- from low SES backgrounds
- of diverse genders, sexes and sexualities
- from refugee and refugee-like backgrounds
- from rural and remote backgrounds
- who are the first in their family to undertake a bachelor-level degree.

Their web site is: https://student.unsw.edu.au/els/services

Equitable Learning Services (ELS) may determine that your condition requires special arrangements for assessment tasks. Once the School has been notified of these, we will make every effort to meet the arrangements specified by ELS

Additionally, if you have suffered significant misadventure that affects your ability to complete the course, please contact your Lecturer-in-charge in the first instance.

Academic Skills Support and the Learning Centre

The Learning Centre offers academic support programs to all students at UNSW Australia. We assist students to develop approaches to learning that will enable them to succeed in their academic study. For further information on these programs please go to:

http://www.lc.unsw.edu.au/services-programs

8. Getting help outside tutorials

Staff Consultations

From week 2 there will be a roster which shows for each hour of the week a list of names of members of staff who are available to help students in the first year mathematics courses, no appointment is necessary. This roster will be announced in the Moodle course page and linked to the folder in Moodle called “Help is available!” It is also provided in the link below.

https://www.unsw.edu.au/science/our-schools/maths/student-life-resources/student-services/consultation-mathematics-staff

Mathematics Drop-in Centre

The Maths drop-in centre provides free help to students with certain first and second year mathematics courses. All first year MATH courses are supported. In Term 2 2022 the Drop-in Centre will be available online. Some limited in-person sessions may also be arranged. See Moodle for details.

The Maths drop-in centre schedule will be available on the Schools website below by the end of week 1. Please note that no appointment is necessary, this is a drop-in arrangement to obtain one-on-one help from tutors. The Maths drop-in centre is accessible through the web link below.

https://www.unsw.edu.au/science/our-schools/maths/student-life-resources/student-services/mathematics-drop-in-centre

Lab Consultants

For help with the Maple computing component of the first year courses, consultants will be available via the Drop-in Centre. For more details, visit website:

https://www.unsw.edu.au/science/our-schools/maths/student-life-resources/student-services/computing-information/maple-lab-consultants

Additional support for students

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills and Support: https://student.unsw.edu.au/academic-skills
- Student Wellbeing, Health and Safety: https://student.unsw.edu.au/wellbeing

- Equitable Learning Services: https://student.unsw.edu.au/els (formerly Disability Services Unit)
- UNSW IT Service Centre: https://www.it.unsw.edu.au/students/index.html

9. Applications for Special Consideration

If you are unable to complete an assessment on time or during the proscribed period due to illness or other reason beyond your control, you can apply for special consideration.

For all information on Special Consideration, including the circumstances that are covered or excluded and how to apply, see the Special Consideration web site:

https://student.unsw.edu.au/special-consideration

Please note that the application is not considered by the Course Authority, it is considered by a centralised team of staff at the Nucleus Student Hub.

The central team will advise you, by email to your UNSW student email, of the outcome of your application and the date of any supplementary assessment or extension as appropriate.

For final exams with special consideration granted, the Exams Unit will email the rescheduled "supplementary exam" date, time and location to your student zID email account directly. Please ensure you regularly check your student email account (zID account) for this information.

The supplementary exam period/dates can be found at this web site:

https://student.unsw.edu.au/exam-dates

Please ensure you are aware of these dates and that you are available during this time.

Important Notes

If you believe your application for Special Consideration has not been processed, you should email **specialconsideration@unsw.edu.au** immediately for advice.

- If you suffer from a chronic or ongoing illness that has, or is likely to, put you at a serious disadvantage, then you should contact the Equitable Learning Services (formerly known as the Disability Support Services) who provide confidential support and advice. Their web site is: https://student.unsw.edu.au/els
- Equitable Learning Services (ELS) may determine that your condition requires special arrangements for assessment tasks. Once the School has been notified of these, we will make every effort to meet the arrangements specified by ELS.
- Additionally, if you have suffered significant misadventure that affects your ability to complete the course, please contact the Director of First Year, Associate Professor Jonathan Kress by email or in person for advice. The contact details are the Red Centre, level 3 room RC-3073 or by email to j.kress@unsw.edu.au

Professor A Coster

Head, School of Mathematics and Statistics

10. Algebra Lecture timetable and syllabus

The algebra course for Math1251 is based on chapters 6 to 9 of the MATH1251 Algebra Notes, which are essential reading and must be brought to all algebra tutorials. The lecturer will not cover all the material in these notes in their lectures as some sections of the notes are intended for reference and for background reading. An **approximate** lecture timetable is given below. The lecturer will try to keep to this timetable, but variations might be unavoidable. As in MATH1151, the computer package MATLAB will be used in the MATH1251 algebra course.

Chapter 6. Complex Numbers

Lectures 1-6
This section covers complex numbers in Cartesian and polar forms, complex arithmetic and geometry, factorization of polynomials and stability of dynamical systems.
Development of number systems and closure. Definition of complex numbers and of complex number addition, subtraction, multiplication and division.
Equality, real and imaginary parts, complex conjugates.
Argand diagram, polar forms, modulus, argument.
De Moivre's Theorem and Euler's Formula. Arithmetic of polar forms.
Powers and roots of complex numbers. Binomial theorem and Pascal's triangle.
Trigonometry and geometry.
Complex polynomials. Fundamental theorem of algebra, factorization theorem, factorization of complex polynomials of form $z^n - z_0$, real linear and quadratic factors of real polynomials.
Stability of discrete and continuous time systems.

Chapter 7. Vector Spaces

Lectures 7-14
The aim of this section of the course is to introduce the general theory of vector spaces and to give some basic examples. The majority of examples will be for the real vector space $\mathbb{R}^n$, but some examples will be given for the complex vector space $\mathbb{C}^n$, the vector space M_{mn} of $m \times n$ matrices, the vector space of polynomials and the vector space of real-valued functions.

Introduction to vector spaces. Examples of vector spaces. Properties of vector arithmetic.
Subspaces.
Linear combinations and spans.
Linear independence.
Basis and dimension, coordinate vectors.
Polynomials and real-valued functions as vector spaces.
Data fitting and polynomial (Lagrange) interpolation.

Chapter 8. Linear Transformations

Lectures 15-18
The basic aims of this section are to introduce the general theory of linear transformations, to give some geometric applications of linear transformations and to establish the close relationship between linear functions and matrices.

Introduction to linear maps. Linear maps and the matrix equation.
Geometrical examples.
Subspaces associated with linear maps.
Rank, nullity and solutions of $A\mathbf{x} = \mathbf{b}$. Further applications.
Linear maps between polynomial and real-valued function vector spaces.
Matrix representations for non-standard bases in domain and codomain.
Matrix arithmetic and linear maps.

Injective, surjective and bijective linear maps.

Chapter 9. Eigenvalues and Eigenvectors

Lectures 19-24
The aims of this section are to introduce the ideas of eigenvalue and eigenvector and to show some applications of these ideas to diagonalization of matrices, evaluation of powers of matrices and solution of simple systems of linear differential equations. Examples for hand calculation will be restricted to 2 x 2 matrices and very simple 3 x 3 matrices, with larger problems done using MATLAB.

Definition, examples and geometric interpretation of eigenvalues and eigenvectors.
Eigenvectors, bases and diagonalization of matrices.
Applications to powers of matrices and solution of systems of linear differential equations.
Markov Chain Processes.

Problem Sets

At the end of each chapter there is a set of problems. Some of the problems are very easy, some are less easy but still routine and some are quite hard. To help you decide which problems to try first, each problem is marked with an [R], an [H] or an [X]. The problems marked [R] form a basic set of problems which you should try first. Problems marked [H] are harder and can be left until you have done the problems marked [R]. You *do* need to make an attempt at the [H] problems because problems of this type will occur on tests and in the exam. If you have difficulty with the [H] problems, ask for help in your tutorial.

The problems marked [X] are extension material and are intended for students aiming for the grade of HD in MATH1251. They require more mathematical maturity and ingenuity than other suggested problems. Small parts of final exam questions may require similar mathematical understanding.

There are a number of questions marked [M], indicating that MATLAB is required in the solution of the problem.

Problem Schedule

The main purpose of tutorials is to give you an opportunity to get help with problems which you have found difficult and with parts of the lectures or the Algebra Notes which you don't understand. In order to get real benefit from the tutorials, it is essential that you try to do relevant problems *before* the tutorial, so that you can find out the areas where you need help.

The problems for each week's classroom tutorial will be presented in the Weekly Möbius Lessons that ends on Tues

You should work on the problems at home or in the library between classes. Some of them will be worked through and discussed in the tutorials. Tutors may need to vary a little from this suggested problem schedule.

Class Tests and Exams

Questions for the class tests in MATH1251 will be similar to the questions marked [R] and [H] in the problem sets. Since each class test is only twenty minutes in length only shorter straight forward tests of theory and practice will be set. As a guide, see the recent past class test papers (at the end of the algebra notes).

Examination questions are, by their nature, different from short test questions. They may test a greater depth of understanding. The questions will be longer, and sections of the course not covered in the class tests will be examined. As a guide, see the recent past exam papers in the separate past exam papers booklet.

Algebra class test 1 will be in week 5 and will be based on the suggested problems from weeks 1 to 4.

Algebra class test 2 will be in week 9 and will be based on the suggested problems for weeks 5 to 8.

Theory in the Algebra course

The theory is regarded as an essential part of this course and it will be examined both in class tests and in the end of year examination.

You should make sure that you can give **DEFINITIONS** of the following ideas**:**

Chapter 7. Subspace of a vector space, linear combination of a set of vectors, span of a set of vectors, linear independence of a set of vectors, spanning set for a vectors space, basis for a vector space, dimension of a vector space, coordinate vector of a vector with respect to an ordered basis.

Chapter 8. Linear function, kernel and nullity of a linear function, image and rank of a linear function.

Chapter 9. Eigenvalue and eigenvector, diagonalizable matrix.

You should be able to give **STATEMENTS** of the following theorems and propositions.

Chapter 7. Theorem 1 of §7.3, Propositions 1 and 3 and Theorem 2 of §7.4, Proposition 1 and Theorems 2,3,4,5 and 6 of §7.5, Theorems 1,2,3,4,5,6 and 7 of §7.6.

Chapter 8. Theorems 2,3 and 4 of §§8.1, Theorems 1 and 2 of §8.2, Theorems 1 and 5, Proposition 7 and Theorems 8,9 and 10 of §8.4.

Chapter 9. Theorems 1,2 and 3 of §9.1. Theorem 1 and 2 of §9.2.

You should be able to give **PROOFS** of the following theorems and propositions.

Chapter 7. Theorem 2 of §7.4, Theorems 2,3 and 4 of §7.5, Theorem 2 of §7.6.

Chapter 8. Theorem 2 of §8.1, Theorem 1 of §8.2, Theorems 1, 5 and 8 of §8.4.

Chapter 9. Theorem 1 of §9.1

11. Calculus

Lecture timetable and syllabus

The calculus syllabus below contains a number of topics which are part of the MATH1241 syllabus and in addition some topics that are generally taught to second year students – such as Lagrange multipliers and double integrals. The time given for each topic is approximate.

Integration techniques (2 hours)

The trigonometric integrals and reduction formulae, trigonometric and hyperbolic substitutions, rational functions and partial fractions, standard substitutions. (Salas and Hille, edition 10, Chapter 8, 8.1-8.6)

Ordinary differential equations (7 hours)

Terminology including particular, general, implicit and explicit solutions. First order equations including separable, linear and exact equations. Slope fields, integral curves, existence and uniqueness. Modelling. Linear differential operators as linear transformations, the solution space for homogeneous differential equations and the solution set for inhomogeneous differential equations. Constant coefficient differential equations including the method of undetermined coefficients. Applications. Dimension of the solution space. Euler's method for the numerical solutions of differential equations. (Salas and Hille, edition 10, Chapter 9, 9.1-9.3, Chapter 19, 19.1-19.4.)

Taylor series (7 hours)

Approximation of functions by Taylor polynomials and Taylor's Theorem with remainder. Applications to stationary points.

Sequences: Convergence and divergence, sums, products, quotients and composites of series. Upper and lower bounds, sup and inf, bounded monotonic sequences and the completeness of the real numbers. Recursively defined sequences. (Salas and Hille, edition 10, Chapter 11, 11.1-11.3.)

Series: Partial sums, convergence and divergence, the *k*th term test for divergence. Comparison, integral, ratio and root tests for convergence of series with positive terms. Absolute and conditional convergence, including the alternating series (Leibniz') test and rearrangement considerations. (Salas and Hille, edition 10, Chapter 12, 12.1-12.5.)

Power series: Taylor and Maclaurin series. The radius and interval of convergence. Manipulation of power series by addition, multiplication, differentiation, integration and simple substitutions. Commonly occurring power series. (Salas and Hille, edition 10, Chapter 12, 11.6-12.9.)

Further functions of several variables (3 hours)

Tangent planes and Taylor series for functions of two variables. Classification of critical points of functions of two variable. The method of Lagrange multipliers for constrained extrema. (Salas and Hille, Edition 10, Chapter 16, 16.4-16.7.)

Double integrals (4 hours)

The double integral as a repeated integral, interchange of order of integration, change of variable. (Salas and Hille, Edition 10, Chapter 17, 17.1-17.4)

Problem Sets

The Calculus problems are provided in a separate booklet in the course pack. Additional problems are located at the end of each chapter of the MATH1231 and MATH1241 Calculus Notes booklet. They are also available from the course page on Moodle. Some of the problems are very easy, some are less easy but still routine and some are quite hard. All students should make sure that they attempt and can do the unstarred questions. The starred problems are slightly harder than the starred problems and the double starred problems are just plain difficult!

Remember that working through a wide range of problems is the key to success in mathematics.

Problem Schedule

The main reason for having tutorials is to give you a chance to get help with problems which you find difficult and with parts of the lectures or textbook which you don't understand. To get real benefit from tutorials you need to try the relevant problems *before* the tutorial so that you can find out the areas in which you need help

Please note that the **tutorial problem list will be posted on Moodle.**

You should work on the problems at home or in the library between classes. Some of them will be worked through and discussed in the tutorials. Tutors may need to vary a little from this suggested problem schedule.

Note there is some overlap between the MATH1231 questions and those in the MATH1251 calculus problems.

Class Tests and Exams

Questions for the class tests in MATH1251 will be similar to the unstarred and single starred questions in the MATH1251 calculus problem book, or the questions marked (R) and (H) in the MATH1231 problems. Since each class test is only 45 minutes in length, only shorter straight forward tests of theory and practice will be set. As a guide, see the recent past class test papers (at the end of the Calculus problem booklet). It is important to note that the class tests do not cover the whole syllabus.
The tests will cover sections of the syllabus as shown in the table below. The table also shows which problems are relevant to each test.
Examination questions are, by their nature, different from short test questions. They may test a greater depth of understanding. The questions will be longer, and sections of the course not covered in the class tests will be examined. As a guide, see the recent past exam papers in the separate past exam papers booklet.

Test	When	Syllabus sections	Unstarred and starred problems in ranges
1	Week 5	1. Integration techniques 2. Ordinary differential equations	1-13 14-42

2	Week 9	2. Ordinary differential equations 3. Taylor series 4. Further functions of several variables	43-62 63-95 95-109

12. Computing Information

How much?

In MATH1251 there are online computing tests worth 4% of your final mark and **there will be a laboratory test, in week 10 worth 8% of your final mark.** Further, there will be exam questions worth at least another 3% of your final mark so in total 15% of your final mark is derived from the computing component of the course. The Computing component depends on the other components and will require a knowledge of the appropriate Algebra and Calculus.

Aim

The aim of the Computing component is twofold.

- The primary aim of the computing component of MATH1251 is to develop your skills in using MATLAB. The name of this software package derives from MATrix LABoratory, reflecting its origins in the early 1980s as an interactive interface to a library of Fortran routines for matrix computations. A company called *The MathWorks Inc.* produces MATLAB, and has progressively expanded the package to cover many areas of mathematics besides linear algebra, Also, MATLAB now has a highly developed programming language, a sophisticated graphics system, and software tools including a debugger, a profiler and support for developing graphical user interfaces. Another feature of MATLAB is its ability to work with Fortran or C/C++ codes, as well as with Microsoft Excel. These advanced features of MATLAB are essential for many commercial applications, but in MATH1251 you will only be expected to use a restricted number of the basic mathematical and graphical functions in MATLAB, and do some simple programming.
- Secondly, you will gain some experience in teaching yourself how to use a complicated computing package. This is a skill that will be needed in other courses at UNSW and in the workforce.

Computing lab

Note that at the time of writing, the Red-Centre labs are closed due to the COVID-19 situation. The lab information below is provided in case it is possible reopen the labs later in Term 2. An announcement will be made on Moodle if this occurs.

The main computing laboratory is in room G012 in the Red Centre. You can get to this lab by entering the building through the main entrance to the School of Mathematics (on the Mezzanine Level) and then going down the stairs to the Ground Level. A second smaller lab is room M020, on the mezzanine level in the Red Centre.

For the computers in the school laboratories, your login ID is “z” followed immediately by your seven-digit student number and your password is your zPass, issued to you at enrolment. If you have difficulties logging reset or unlock your zPass using the UNSW Identity Manager: https://idm.unsw.edu.au .

The laboratories will normally be open between 8am and 9pm each weekday during the term. Any changes to these times will be posted on the door of Room M020.

Remember that there will always be unscheduled periods when the computers are not working because of equipment problems and that this is not a valid excuse for not completing tests on time.

Remote access

All of the software that you need for this course is installed on the computers in the Red Centre labs. This software can also be accessed from your own computer. For information on accessing Mathematical and

Statistical software from outside the Red Centre labs, please see the information provided on this course's page in UNSW Moodle. You can also use a remote access version of Matlab via the myAccess service http://myaccess.unsw.edu.au .

Accounts and passwords

If you had an account for computers in the Mathematics Labs in term 1, you will continue to use the same account with the same password in term 2.

Remember that for the computers in the school laboratories, login ID is "z" followed immediately by your seven digit student number and your password is your zPass. If you have difficulties logging in, use the UNSW Identity Manager at https://iam.unsw.edu.au to reset or unlock your zPass.

If you have problems with your account, you should go to Room M022 on the Mezzanine Level of the Red Centre between 1pm and 2pm on any week day from Thursday of Week 1. You will need to show your student card.

Learning Matlab

As a rough guide, you should spend around one hour per week on computing in MATH1251. This is an average figure, and we recommend that you make a special effort in the first few weeks to master the basics. In lectures, you will see numerous examples of how MATLAB is used to solve a variety of mathematical problems, but there is not sufficient class time for a systematics treatment of MATLAB.

When you come to write M-files (scripts or functions) you will need to use an editor. We recommend the built-in MATLAB editor (type **help edit**) because it has several features specifically tailored to writing MATLAB programs. Nevertheless, you can use any of the other available editors, such as kwrite, kate etc.

Help will be available from the consultants who will be available in Room G012 from 11am to 4pm each day.

If you have any constructive criticism or comment about the Computing component then please let us know.

Maple

Other first-year mathematics courses use a different software package called Maple. However, the Actuarial Studies Unit advised us that MATLAB was more suitable for their purposes and would be introduced into their second and third year courses. Many later year applied mathematics courses, including those taken by students in Finance/Mathematics programs, already use MATLAB. Some later year pure mathematics courses use Maple.

The main distinction between the two software packages is MATLAB works primarily with an array of numeric data, Maple works primarily with symbolic expressions. We do not expect you to learn Maple in MATH1251, but it is available on the PCs in the Mathematics computing labs and you are free to use it.

Matlab Toolboxes

As well as its kernel routines, MATLAB has a collection of specialised software libraries called toolboxes. We will not use any of them in MATH1151 or MATH1251, but in later year courses many of you will see the financial, statistics and the optimization toolboxes. Use the MATLAB **help** command to see a complete list of the toolboxes available on the computing laboratory PCs.

One toolbox not available is the Symbolic Math Toolbox, which essentially allows you to use certain Maple commands within MATLAB.

13. Some Greek Characters

Listed below are the Greek characters most commonly used in mathematics.

Name	Lower case	Upper case	Name	Lower case	Upper case
Alpha	α		Nu	ν	
Beta	β		Xi	ξ	
Gamma	γ	Γ	Pi	π	Π
Delta	δ	Δ	Rho	ρ	
Epsilon	ϵ		Sigma	σ	Σ
Zeta	ζ		Tau	τ	
Eta	η		Phi	ϕ or φ	Φ
Theta	θ	Θ	Chi	χ	
Kappa	κ		Psi	ψ	Ψ
Lambda	λ	Λ	Omega	ω	Ω
Mu	μ				