UNSW SYDNEY

Course Outline

MATH1151

Mathematics for Actuarial Studies and Finance 1A

School of Mathematics and Statistics

Faculty of Science

Term 1, 2021

Contents

1. Staff

Position	Name	Email	Room
Course Authority	Assoc Prof Jonathan Kress	j.kress@unsw.edu.au	RC-3073
Algebra Lecturer Calculus Lecturer	Professor Josef Dick Professor Gary Froyland	josef.dick@unsw.edu.au g.froyland@unsw.edu.au	RC-2074 RC-3060
Lecturer-in-charge of computing	Dr Thong Quoc Le Gia	qlegia@unsw.edu.au	RC-2084

Staff consultation times are provided on Moodle and in the School of Mathematics and Statistics website for *current students* > *undergraduate* > *student services* > *help for students* page, at the beginning of each term.

2. Administrative matters

Contacting the Student Services Office

Please visit the School of Mathematics and Statistics website for a wide range of information on School Policies, Forms and Help for Students by visiting the "**Student Services"** page.

For information on Courses, please go to "Current Student", "Undergraduate and/or Postgraduate", "**Courses Homepage**" for information on all **course offerings.**

The "Student Notice Board" can be located by going to the "Current Students" page. Notices are posted regularly for your information here. Please familiarise yourself with the information found in these locations. The School web page is found: http://www.maths.unsw.edu.au

If you cannot find the answer to your queries on the web pages 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 H Cahya, 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, 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, A/Prof 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

Assumed knowledge: The assumed knowledge for MATH1151 is a combined mark of at least 140 in HSC Mathematics and Mathematics Extension 1 or for students with Mathematics Extension 2 a combined mark of at least 175.

Excluded courses: MATH1011, MATH1031, MATH1131, MATH1141 and ECON1202.

MATH1151, Mathematics for Actuarial Studies and Finance 1A, is a first year course taught by the School of Mathematics and Statistics in Term 1, specifically designed for Actuarial Studies and Finance. It is worth **six units of credit**. Students, who pass MATH1151 in Term 1, continue to study MATH1251, Mathematics for Actuarial Studies and Finance 1B, in Term 2. MATH1151 is a demanding course. If you do not meet the assumed knowledge below, you should seek advice from the Director of First Year Mathematics.

Teaching times and locations: see the link on the Handbook web pages:
http://timetable.unsw.edu.au/2021/MATH1151.html

Course summary

This course will provide you with a good working knowledge of Calculus and Linear Algebra, and show, through the lectures, how this mathematics can be applied in interdisciplinary contexts. Your skills in analytical critical thinking and problem solving will improve because of the illustrative examples used in lectures and because of the problem based tutorial classes. These mathematical problem solving skills, which are based on logical arguments and specific techniques, are generic problem solving skills that can be applied in multidisciplinary work. You will be encouraged to develop your communication skills through active participation in tutorials, and by writing clear, logical arguments when solving problems.

Course aims

The aim of MATH1151 is that by the time you finish the course you should understand the concepts and techniques covered by the syllabus and have developed skills in applying those concepts and techniques to the solution of appropriate problems. Successful completion of this course, together with the second term course MATH1251, should mean that you will be well equipped both technically and psychologically to cope with the mathematics that you will meet in the later years of your program.

The syllabus includes a computing component, based on Matlab. The computer-based problems and tests define the level of proficiency you are expected to achieve in using Matlab.

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. Create valid mathematical arguments.

4. Learning and teaching activities

Lectures and Tutorial Schedule

Please note that Lectures and Tutorials run from week 1 to 5 and 7 to 10 according to your myUNSW timetable. Each student must be enrolled in the Lectures and a pair of Tutorials.

There are no lectures for the Matlab component of the course which is self-taught with help available in the Moodle forum and the Red-Centre lab RC-G012B on a drop-in basis.

For times and locations refer to central timetable: http://timetable.unsw.edu.au/2021/MATH1151.html

Tutorials

Students in MATH1151 are enrolled in two tutorials, one for algebra and one for calculus. The algebra tutorial is timetabled for the second half of the week, whilst the calculus tutorial is scheduled for the first half of the week. Students are able to change their tutorials, via myUNSW, until the end of week 1. After that time, they can only change their tutorials with the agreement of the Student Service, see page 4. To change a tutorial you will need to provide proof of a timetable clash or work commitments.

Note that attendance at tutorials is compulsory and the roll will be called in tutorials.

5. Assessments

Overview

Your final raw mark will be made up as follows:

Assessment task	**Weight**
Algebra and Calculus Tests	28%
(Class: best of 3 of 4 halves: 8% each; Online: 2% each for the 2 tests)	
Matlab Tests	12%
(Online Matlab 1-6: 4%; Matlab lab: 8%)	
End of term exam	60%

Note:

- Tutors are expected to enter class marks into the School's database within a fortnight of the test being sat. These marks are then available to you through Moodle.

  It is **your responsibility** to check that these marks are correct and you should **keep marked tests until the end of term** in case an error has been made in recording the marks. If there is an error, either speak to your tutor or bring your test paper to the Student Services Office 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 web site: 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

Algebra, Calculus and Matlab Tests

Details of the content of the Class Tests and sample tests will be posted on Moodle at least one week before the test.

Week	Single Attempt Tests	Unlimited Attempt Tests
1		
2		Matlab Online Test 1
3		Matlab Online Test 2
4		Algebra and Calculus Online Test 1
5	Class test 1 on Maple TA	Matlab Online Test 3*
6	Flexibility week	
7		Matlab Online Test 4
8		Algebra and Calculus Online Test 2
9	Class test 2 on Maple TA	Matlab Online Test 5
10	Matlab Test on Maple TA	Matlab Online Test 6
End of Term examination – Check UNSW exam timetable for details		

All Unlimited Attempt Tests use Maple TA and have a deadline of 5pm on Friday of the indicated week. The highest mark for these will count so students can attempt repeatedly until they are satisfied with their mark. The Single Attempt Tests will also be available on Maple TA. The time windows in which these tests, along with practice materials, will be announced on Moodle at least one week in advance.

The Week 5 Matlab Online Test 3 will remain available until 5pm on Friday of Week 6 to provide extra flexibility.

Note:

- Each class test has an algebra and a calculus half with the marks for each half recorded separately. Your **best three scores** in the four halves will be counted towards your final assessment mark.

- If you miss a class test because of illness or other misadventure beyond your control, you must apply for special considerations within 3 working days and provide appropriate documentation such as a medical certificate dated within 24 hours of the assessment. You can apply on myUNSW. A replacement class test will be arranged later in the term.

Matlab Tests

Note that the Week 10 Lab Test referred to below will be conducted online in Term 1 2021.

For the computing (Matlab) component of the course is assessed with a sequence of online tests, that you can complete at home, and an online laboratory based test in week 10. Other than the week 10 lab test, the online tests may be completed on any suitable web browse in your own time, but you will need access to Matlab to answer the questions. Matlab is available in the School computing labs and via the myAccess service and you can also install your own copy of Matlab. These online MATLAB computing tests are linked to the self-paced MATLAB lessons in Moodle. Details on using Maple TA for online tests can be found on Moodle. These online MATLAB computing tests will be available (almost) continuously but to gain marks the tests must be completed before the deadlines. The online tests (in Maple TA) are designed to get you used to using MATLAB for simple problems and will test your knowledge of MATLAB syntax. You will have an unlimited number of attempts at these online computing tests, both before and after the deadlines. Note that it is only your best mark on each test before the deadline that counts towards your final grade. Again, **do NOT** leave your attempts at these online tests until the last day.

The online MATLAB lessons are numbered from 0 to 10. Lesson 0 has an associated quiz, which must be completed first, but does not count towards your mark. In MATH1151 you must complete the quizzes for lessons 1 to 6. You may read the remaining lessons 7 to 10 if you wish, but this material will not be examined until MATH1251. Matlab Online Tests 1 to 6 count 4% towards your final grade.

The Matlab Online Lab Test counts 8% towards your final grade. Details of the laboratory test are given on page 19 and practice problems for the test will be available on Moodle.

All computing tests are linked to the Algebra and Calculus material, so you should make sure you understand the course work before trying them.

Finally, the end of term exam may contain sub-questions requiring a knowledge of MATLAB.

Notes for online tests

- Each attempt at these tests must be your own work, but you are encouraged to discuss the methods required with other students;
- Each version of a test will be slightly different, so don't just copy answers from one attempt to the next;
- Only a limited number of users can have simultaneous access to Maple TA, so **do NOT** leave your attempts at these tests to the last day;
- **No deadline extensions will be granted.** You should attempt these tests with sufficient remaining time to allow for unplanned service interruptions.

Calculator Information

For end of term UNSW exams, students must supply their own calculator. Only calculators on the UNSW list of approved calculators may be used in the end of term exams. Before the exam period, calculators must be given a "UNSW approved" sticker, obtained from Nucleus: Student Hub in the

main library. The UNSW list of calculators approved for use in end of term exams is available at: https://student.unsw.edu.au/exam-approved-calculators-and-computers

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 MATH1151 that you will take you to the MATH1151 homepage in Moodle.

Course Pack and Textbook

The course materials for MATH1151 are:

- MATH1151 Course Pack 2020;
- Computing Laboratories Information for Students 2020;
- Introduction to Matlab 2020;

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 MATH1151);
- Calculus Notes (from MATH1131/1141 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 MATH1151 Course Page.

7. Expectations of students

School 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 web site.

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 web site starting at:

http://www.maths.unsw.edu.au/currentstudents/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.

Course improvement

You will be invited to complete a course evaluation form online at the end of the term.

Graduate Attributes

MATH1151 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 and 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, which you are based on logical arguments, that 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.

8. Academic integrity, referencing and plagiarism

Academic integrity is fundamental to success at university. Academic integrity can be defined as a commitment to six fundamental values in academic pursuits**:** honesty, trust, fairness, respect, responsibility and courage.[1] At UNSW, this means that your work must be your own, and others' ideas should be appropriately acknowledged. If you don't follow these rules, plagiarism may be detected in your work.

Further information about academic integrity and **plagiarism** can be located at:

- The *Current Students* site https://student.unsw.edu.au/plagiarism**,** and
- The *ELISE* training site http://subjectguides.library.unsw.edu.au/elise/presenting

[1] International Center for Academic Integrity, 'The Fundamental Values of Academic Integrity', T. Fishman (ed), Clemson University, 2013.

The *Conduct and Integrity Unit* provides further resources to assist you to understand your conduct obligations as a student: https://student.unsw.edu.au/conduct.

University Statement on Plagiarism

This statement has been adapted from statements by the St James Ethics Centre, the University of Newcastle, and the University of Melbourne.

Plagiarism is the presentation of the thoughts or work of another as one's own. Examples 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 a work contributed to a group assessment item that is greater than that actually contributed.
- 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 of 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.

The Learning Centre website is the central University online resource for staff and student information on plagiarism and academic honesty. It can be located at: www.lc.unsw.edu.au/plagiarism

The Learning Centre also provides substantial educational written materials, workshops, and tutorials to aid students, for example, in:

- Correct referencing practices;
- Paraphrasing, summarising, essay writing, and time management;
- Appropriate use of, and attribution for, a range of materials including text, images, formulae and concepts.
- Individual assistance is available on request from The Learning Centre.

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.

9. 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 is displayed on the same Notice Board as timetables, near the School Office (room 3070, Red Centre), it is also available from the web page:

http://www.maths.unsw.edu.au/currentstudents/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 1 2021 the Drop-in Centre is operating online, and opening times during term is typically 10am to 3pm from Mondays to Fridays.

The Maths drop-in centre schedule will be available on the Schools website and Moodle 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.

https://www.maths.unsw.edu.au/currentstudents/Mathematics-Drop-in-Centre

Lab Consultants

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

https://www.maths.unsw.edu.au/currentstudents/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 known as Disability Services Unit)
- UNSW IT Service Centre: https://www.it.unsw.edu.au/students/index.html

10. Special Consideration

Please adhere to the Special Consideration Policy and Procedures provided on the web page below when applying for special consideration.

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 School will contact you (via student email account) after special consideration has been granted to reschedule your missed assessment, for a *lab test or paper-based test* only.

For applications for special consideration for *assignment extensions*, please note that the new submission date and/or outcome will be communicated through the special consideration web site only, no communication will be received from the School.

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

11. Algebra Syllabus and Lecture Timetable

The algebra course for MATH1151 is based on the MATH1151 Algebra Notes, which are essentially reading and must be brought to all algebra tutorials. There is very little overlap between this syllabus and the algebra specified in the NSW HSC curriculum. The computer package MATLAB will be used in the MATH1151 algebra course. An approximate lecture timetable is given below. The lecturer will try to keep to this timetable, but variations might be unavoidable, especially due to public holidays.

Chapter 1. Introduction to Vectors

Lectures 1 – 4
Vector quantities. Rules for addition and scalar multiplication of geometric vectors.
Brief mention of matrices for Matlab applications. Addition of vectors and multiplication by scalars. (Section 1.1)
Vector quantities and Rn. (Section 1.2)
Analytic geometry and other applications. (Section 1.3)
Points, line segments and lines. Displacements. Lines in R2, R3, and Rn. (Section 1.4) Parametric vector equations for planes in Rn. The linear equation form of a plane. (Section 1.5)

Chapter 2. Linear Equations and Matrices

Lectures 5 – 8
Introduction to systems of linear equations. Solution of 2 × 2 and 2 × 3 systems and geometrical interpretations. (Section 2.1)
Matrix notation. (Section 2.2)
Elementary row operations, elementary matrices. (Section 2.3) Solving systems of equations via Gaussian elimination. (Section 2.4) Deducing solubility from row-echelon form. (Section 2.5)
Solving systems with indeterminate right hand side. (Section 2.6) General properties of solutions to Ax = b. (Section 2.7)
Applications in Actuarial Studies, Finance and Commerce. (Section 2.8)

Chapter 3. Matrices

Lectures 9 – 11
Operations on matrices. (Section 3.1) Transposes. (Section 3.2)
Inverses. (Section 3.3)
Determinants. (Section 3.4)
Applications of matrix multiplication. (Section 3.5)

Chapter 4. Vector Geometry

Lectures 12 – 14
Length, distance between points. (Section 4.1) Angles and dot product in R2, R3, Rn. (Section 4.2)
Orthogonality and orthonormal basis, projection of one vector on another. Relationship be- tween coordinates of a vector and projections of the vector on orthonormal basis vectors. (Sec- tion 4.3)
The cross product: definition and arithemetic properties, geometric interpretation of cross product as perpendicular vector and area (Section 4.4)
Scalar triple products, determinants and volumes (Sections 4.5)
Equations of planes in R3: the parametric vector form, linear equation (Cartesian) form and point-normal form of equations, the geometric interpretations of the forms and conversions from one form to

another. (Section 4.6)
Projections and least-squares approximations (Section 4.7)

Chapter 5. Probability

Lectures 15 – 22
Introduction to probability and statistics. (Section 5.1) Preliminary set theory. (Section 5.2)
Axiomatic probability, sample spaces, conditional probability, Bayes rule, independent events. (Section 5.3)
Discrete random variables (uniform, binomial, Poisson, geometric). Mean and variance of a discrete random variable. (Section 5.4)
Continuous random variables (uniform, negative exponential). Cumulative distribution func- tions. Mean and variance of a continuous random variable. (Section 5.5)
The normal distibution. The standard normal distribution. Evaluating normal probability integrals. Conversion from general normal distributions to standard normal distributions. Ap- plications of the normal distribution. Estimation of probabilities. (Section 5.6)
The sampling distribution for the mean and the central limit theorem. Sums of random vari- ables. (Section 5.7)
Approximations to the binomial distribution by the normal distribution and by the Poisson distribution. (Section 5.8)

ALGEBRA PROBLEM SETS

The Algebra problems are located at the end of each chapter of the Algebra Notes booklet. They are also available from the course module on the UNSW Moodle server. 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] or an [H]. 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 intended for students in MATH1141 – they relate to topics which are only covered in MATH1141 and are included only for interest. 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 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 schedule of problems for each tutorial will be posted on Moodle.

CLASS TESTS AND EXAMS

Questions for the class tests in MATH1151 will be similar to the questions marked [R] and [H] in the problem sets. Since each class test is only twenty or twenty-five 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).

The topics covered in the class tests will be announced on Moodle.

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.

CALCULUS SYLLABUS FOR MATH1151

The calculus syllabus assumes that students are very familiar with the mathematics contained in the NSW HSC Extension 1 course. In particular, it assumes that all students are familiar with the calculus of the exponential and log functions. Whereas the algebra strand of the course contains many results of an algorithmic nature, the calculus strand emphasises an approach to mathematics of a more abstract and conceptual kind. This emphasis is designed to help you cope with more advanced mathematics that you will likely meet in later years. The times given for the various topics are approximate only.

1. The Exponential Function (4 hours)

Real numbers, the Least Upper Bound Axiom, the exponential and log functions, the hyperbolic and inverse hyperbolic functions.

2. Limits (4 hours)

Formal definitions of limits as $x \to \infty$, informal definitions of limits at finite points, the Pinching Principle, continuity and types of discontinuity, Bolzano's Theorem, the intermediate value theorem, the min-max theorem, "little-oh" notation.

3. Differentiation (3 hours)

Definition of the derivative, approximation by the tangent line, the chain rule, implicit differentiation, critical points, Rolle's Theorem, the Mean Value Theorem, applications, l'Hoˆpital's rule.

4. Parametric Curves and Polar Coordinates (1 hour)

Parametric curves, polar coordinates, gradients

5. The Riemann Integral (4 hours)

Riemann sums and the Riemann integral, the Mean Value Theorem for integrals, the Funda- mental Theorems, integration by substitution and parts, improper integrals of the 1st kind, comparison theorems.

6. Quadrature (2 hours)

The Midpoint, Trapezoid and Simpson's Rules with error estimations.

7. Functions of Several Variables (4 hours)

Surfaces in 2-space, partial differentiation, the tangent plane and differentiability, Jacobians, differentials, Chain rules, Leibniz's Rule, gradients.

PROBLEM SETS

The problems in the MATH1151 Calculus Problems booklet come in three varieties: really challenging problems, marked with **; slightly harder than normal questions, marked with * and standard level questions with no additional markings at all. All students should make sure that they attempt and can do these standard questions and make serious attempts at the * and ** questions. 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. The schedule of problems for each tutorial will be posted on Moodle.

CLASS TESTS AND EXAMS

The topics covered in the class tests will be announced on Moodle.

12. Computing Information

Background

The University of NSW has a policy that all its students should be introduced to the basics of computer use during their course. For students in Business, Biological and Physical Sciences and Engineering, part of that requirement is met by the Computing component of First Year Mathematics. Most of you will also need to use computers in other courses within your program. What you learn with us will be of direct use in later years since many other Schools in the University (particularly the Engineering and Science Schools) are now starting to use the same packages as the School of Mathematics and Statistics. Also, experience with our computing packages will make it easier to learn computing elsewhere. All Mathematics and Statistics majors should consider doing further computing courses, such as MATH2301 Mathematical Computing, in their degree program.

Aim

The primary aim of the computing component of MATH1151 is to develop your skills in us- ing 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. 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 MATH1151 you will only be expected to use a restricted number of the basic mathematical and graphical functions in Matlab, and do some simple programming.

Computing Lab

The Red-Centre Labs are closed in Term 1 2021.

The main computing laboratory is Room G012 of the Red Centre. You can get to this lab by entering the building through the main entrance to the School of Mathematics and Statistics (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 of the Red Centre.

For more information, including opening hours, see the School's website:
https://www.maths.unsw.edu.au/currentstudents/computing-information

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 through the university's myAccess service. The UNSW Matlab licence also allows you to install a copy of Matlab on your own computer. For information on using the myAccess service and how to install Matlab, please see the information provided on this course's Moodle page.

How to Start

You should read the *Introduction to Matlab* notes which can be found at:
https://www.maths.unsw.edu.au/currentstudents/first-year-computing-notes

In Week 1 you should complete the Matlab introductory module and in Maple TA you should complete the assignment “Using Maple TA”.

Additionally, the MATH1151 module in Moodle has several short instructional videos illustrating how to access and use all the computing related components of MATH1151.

From week 1 onwards, you are expected to master the material in the Computing Notes by completing the self-contained Matlab learning modules and by obtaining help, if necessary, from the Consultants available in the Drop-in Centre.

Learning Matlab

As a rough guide, you should spend around one hour per week on computing in MATH1151. 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 examples of how Matlab is used to solve a variety of mathematical problems, but there is not sufficient class time for a systematic 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 editor.

Maple

The other first-year mathematics courses use a different software package called Maple. However, the School of Risk and Actuarial Studies has advised us that Matlab is 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 that whereas Matlab works primarily with arrays of numeric data, Maple works primarily with symbolic expressions. We do not expect you to learn Maple in MATH1151, but it is available on the laboratory PCs 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 lab PCs.

Warnings

Misuse of university IT systems is treated as Academic Misconduct and is a serious offence. Guidelines for acceptable conduct are in the *Computing Laboratories Information for Students 2020* booklet.

The Mathematics Computer Labs will be heavily used this year as there are about 4000 students with accounts. Queues will develop at peak times such as when assignments or tests are due. Plan what

you are going to do on the computer BEFORE you sit down at a computer — don't waste your time and other people's. Problems with your own (home) computer, internet service or the UNSW IT systems are not considered to be an excuse for missing tests or test deadlines. So you should PLAN AHEAD and not leave things until the last minute.

You should not use Matlab or Maple to do your Algebra and Calculus tutorial problems (unless it is explicitly indicated) until you have understood the material thoroughly, as working through the problems is important for learning the material. Once the material is understood you can then use Matlab or Maple to check your answers. You may also use Matlab and Maple for other courses.

It is academic misconduct to do other people's tests or to allow other to do your test.

Laboratory Test

This test will be held online during Week 10. A wide window of at least 24 hours will be available for this test. Details will be announced on Moodle by the start of Week 8.

The test will cover the features of Matlab discussed in the online learning modules 0 to 6, as well as any other material mentioned in the practice problems provided via Moodle.

You will NOT need to remember the exact syntax of each command because you will have access to an online copy of the Introduction to Matlab notes and the online help within Matlab itself. However, you WILL need to practise for the test by working through the practice problems.

13. Some Greek Characters

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

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