UNSW AUSTRALIA

COURSE OUTLINE

Never Stand Still | Science | School of Mathematics and Statistics

MATH1151

Mathematics for Actuarial Studies and Finance 1A

INFORMATION BOOKLET

Semester 1, 2016

CONTENTS OF THE MATH1151 COURSE PACK 2016

Your course pack should contain the followingfive items:

1. *Information Booklet*

   Information on administrative matters, lectures, tutorials, assessment, syllabuses, class tests, computing, special consideration and additional assessment

2. *Algebra Notes (for MATH1151)*
3. *Calculus Notes (from MATH1131/1141 as additional resource)*
4. *Calculus Problems (for MATH1151)*

   Problems, answers, past class tests, table of integrals

5. *Past Exam Papers Booklet*

Information booklet contents

GENERAL INFORMATION FOR MATH1151

Background

MATH1151, Mathematics for Actuarial Studies and Finance 1A, is a first year course taught by the School of Mathematics and Statistics in semester 1, specifically designed for Actuarial Studies and Finance. It is worth **six units of credit**. Students, who pass MATH1151 in semester 1, continue to study MATH1251, Mathematics for Actuarial Studies and Finance 1B, in semester 2.
MATH1151 is a demanding course and the assumed knowledge for the course is the equivalent of a combined mark of about 140 on the NSW HSC Mathematics Extension 1 course.
The excluded courses for MATH1151 are MATH1011, MATH1031, MATH1131, MATH1141, ECON1202 and ECON2291.

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.

Contacting the Student Services Office

The School of Mathematics and Statistics web-site can be found at

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

In particular, the URL

`http://www.maths.unsw.edu.au/currentstudents/student-services`

provides a range of menus to choose from.
The student administration officer for First Year in the Student Services Office of the School of Mathematics and Statistics is Ms Markie Lugton. All administrative enquiries concerning first year Mathematics courses should be sent to Ms Lugton, either:

- by email to fy.MathsStats@unsw.edu.au
- by phone to 9385 7011
- or in person in room RC-3088.

Lectures

There are two algebra lectures and two calculus lectures per week.
Lectures commence in week 1 and run until week 12 as indicated in your timetable on myUNSW.
The lecturers for MATH1151 are:

Algebra A/Prof Joseph Dick, Room 2074, Red Centre, phone 9385 7040.

Calculus A/Prof. Ian Doust, Room 6113, Red Centre, phone 9385 7097.

The course authority for MATH1151 is the Director of First Year Studies, Peter Brown, who can be contacted via the Student Services Office, as detailed above.
The lecturer in charge of computing is Dr. Dr Quoc Thong Le Gia, Room 2084, Red Centre, phone 9385 7049.
Important announcements and handouts may be given out in lectures, so missing lectures (or even arriving late) may cause significant difficulties for you.

Tutorials

Students inMATH1151 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 Services Office, RC-3088. To change a tutorial you will need to provide proof of a timetable clash or work commitments.

Note that

- **ALL tutorials commence in week 2 and run until week 13**;
- attendance at tutorials is compulsory and the roll will be called in tutorials;

Computing and self-paced online modules

In addition to the Calculus and Algebra components, there is a Computing component in MATH1151. This is partly interwoven with the Calculus and Algebra components and partly independent of them. To assist in the self-directed learning of this component of the course, online self-paced learning modules are available in Moodle. These modules guide students through the computing component of this course and are integrated with, and enhance the lecture and tutorial content presented in Calculus and Algebra.

There will be introductory instructional modules available in Moodle. Students are then expected to work through and complete the specified online modules as detailed on page 5. Associated with each module is a graded quiz and the completed quizzes contribute 4% to the final grade.

Learning content will be accessible at all times for learning and revision, but the online assessments will only be available for credit until the published deadlines, given on page 5.

More information about the Computing component is given later in this booklet (see pages 5) and in the booklets *Computing Laboratories Information for Students 2016* and *Introduction to* MATLAB *2016.* These computing notes are freely available from the MATH1151 module on Moodle, and also on the computers in the mathematics computing laboratories.

Assessment

The final raw mark will be made up as follows:

Algebra and Calculus class tests	20%
On-line Algebra and Calculus tests	4%
On-line Computing tests (MATLAB)	4%
Laboratory Computing test (MATLAB)	8%
End of semester exam	64%

Note that:

- You will **not** be allowed to take a calculator into class tests.
- Tutors are expected to enter class test marks into the School's database within a fortnight of the test being sat. These marks are then available to you through the School's Student Web Portal, accessible via the 'Maths & Stats marks' link in the MATH1151 course page.

  It is **your responsibility** to check that these marks are correct and you should **keep marked tests until the end of semester** 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 Friday Week 13.

  The web page

  `https://student.unsw.edu.au/exams`

  has many useful links related to the running of UNSW examinations.
- The rules governing the granting of the grade of PC are on the web page

  `https://student.unsw.edu.au/grades`
- **Medical certificates will generally not be accepted for missing the deadlines for the online tests**. See the section on "Computing Information" for more details.

Online Algebra and Calculus tests

Before the algebra and calculus tutorial class tests you must complete a simple online test that is designed to help you prepare for the tutorial tests. These tests are accessed via the web page

`https://mapletap.telt.unsw.edu.au:8443/mapleta`

where you login using your z id and z pass.
The schedule for these online tests is given below.

Test	**Available**	**Due**
TP1 - FinMath 1A Calculus online test 1	2pm Wednesday Week 3	4pm Wednesday Week 4
TP2 - FinMath 1A Algebra online test 1	2pm Monday Week 5	4pm Monday Week 6
TP3 - FinMath 1A Calculus online test 2	2pm Wednesday Week 7	4pm Wednesday Week 8
TP4 - FinMath 1A Algebra online test 2	2pm Monday Week 10	4pm Monday Week 11

The material covered by these tests is the same as for the tutorial algebra and calculus tests, as given on pages 17 and 19.

Detailed information on how to use the online testing system is available from Moodle.

In this section there is also a link, labelled "Link to Maple TA", to the web page where the tests are available. Despite the name "Maple" appearing in the link, these online tests are algebra and calculus tests and should **not** be confused with any other online test. To give you some familiarity with the online testing system a practice test will be available from week 1.

You will be allowed 5 attempts at each online algebra and calculus test but only your best mark for each test will count. Then, the best 3 of these 4 marks, one from each online test, will contribute up to 4% of your final grade.

Note:

- the first test becomes available on Wednesday of week 3;
- 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 numbers of users can have simultaneous access to Maple TA, so **do NOT** leave your attempts at these tests to the last day;
- **no additional attempts will be granted**. You have 5 attempts at these tests to allow for technical or other problems that may result in one or more attempts being lost;
- **no deadline extensions will be granted**. You should attempt these tests with sufficient remaining time to allow for unplanned service interuptions.

Class tests

Details of the dates and content of tests are given on pages 17 and 19 of this booklet. Sample copies of the tests are included in the Algebra Notes and in the Calculus problem booklet. Note that

- You **MUST** be enrolled in an Algebra tutorial and a Calculus tutorial and **YOU MUST TAKE EACH TEST IN THE TUTORIAL TO WHICH YOU HAVE BEEN OFFICIALLY ALLOCATED.**
- To each test you must bring
  - your **Student ID** card
  - some blank A4 writing paper
  - a **stapler** (so that you can staple a cover sheet to your answers).
- You will **not** be allowed to use a calculator in class tests.
- Your **best three scores** in the four tests will be counted towards your final assessment mark.

Computing tests

There will be two different forms of computing tests. An initial set of six small online tests will be run using Maple TA, followed by a laboratory based test in week 10. The online tests may be completed on any suitable web browser in your own time, but as the MATLAB package will be needed to answer the questions, the School computing labs are probably the best place to attempt the tests. These online MATLAB computing tests are linked to the self-paced MATLAB instruction modules 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, as

they must be completed in sequence, but to gain marks for the computing component of the course the tests must be completed before the deadlines indicated below. 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 in the following table. 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. Inability to complete these online tests due to congestion in the school computing labs or in Maple TA on the last day will **NOT** be accepted as an excuse for missing the deadlines.

Tests	**Due to be completed by**
1 and 2	4pm Friday of week 3
3 and 4	4pm Friday of week 5
5 and 6	4pm Thursday of week 7

The online MATLAB instruction modules are numbered from 0 to 10. Module 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 modules 1 to 6. You may read the remaining modules 7 to 10 if you wish, but we will not examine their material until MATH1251.

The second form of computing test will be run under exam conditions in the School's computing laboratories. You must book for this test. A booking form will be provided on Moodle by the beginning of week 8. You must bring your UNSW Student ID card to the test. Details of the laboratory test are given on page 24 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 semester exam may contain one or two sub-questions requiring a knowledge of MATLAB.

SCHEDULE OF ALL CLASS ASSESSMENTS

Lectures run in weeks 1–12 and tutorials run weeks 2–13. The table below gives the schedule of class tests, online tutorial preparation tests and computing assessments.

Week	Algebra	Calculus	Computing
1			
2			
3			Online tests 1 and 2 due
4		TP1	
Mid-semester break			
5		Test 1	Online tests 3 and 4 due
6	Test 1,TP2		
7			Online tests 5 and 6 due
8		TP3	
9		Test 2	
10			Test in Laboratory
11	TP4		
12	Test 2		
13			
End of semester examination — check UNSW exam timetables for details			

Examples of class tests are contained in the Algebra Notes booklet and the Calculus problems booklet.

TP1, TP2, etc denote the weeks when the online tutorial preparation tests are due for completion. If this falls on a Monday then the preceding week is listed. The precise availability of these tests is given on page 4 and also in Maple TA. Similarly, the precise deadlines for the online computing tests are given on page 6 and again in Maple TA.

UNSW 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:

`http://moodle.telt.unsw.edu.au`

Once logged in, you should see a link to MATH1151 that will take you to the MATH1151 homepage in Moodle.

Course Materials

The course materials for MATH1151 are:

MATH1151 *Course Pack 2016;*

Computing Laboratories Information for Students 2016;

Introduction to MATLAB *2016;*

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:

- *Information Booklet that you are now reading;*
- *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 theMATH1151 Course Page.

Getting help outside tutorials

From week 3 there is a roster which shows for each hour of the week a list of names of members of staff who are available at that time to help students in first year mathematics courses. This roster is displayed on the same noticeboard as timetables, near the School Office (Room 3070, Red Centre) and also outside the Student Services Office (Room 3088, Red Centre). It is also available from the web page

`http://www.maths.unsw.edu.au/currentstudents/consultation-mathematics-staff`

ASOC

The student society ASOC has provided peer support for students in MATH1151 and the School of Mathematics and Statistics will continue to support this ASOC program.

Calculator Information

For end of semester UNSW exams students must supply their own calculator. Only calculators on the UNSW list of approved calculators may be used in the end of semester exams. This list is similar to the list of calculators approved for HSC examinations.

BEFORE the exam period calculators must be given a "UNSW approved" sticker, obtainable from the School of Mathematics and Statistics Office, and other student or Faculty centres. The UNSW list of calculators approved for use in end of semester exams is available at

https://student.unsw.edu.au/exams

Academic misconduct

It is very important that you understand the University's Rules for the conduct of Examinations and the penalties for Academic Misconduct. This information can be accessed through myUNSW at:

https://student.unsw.edu.au/exams

Illness and other problems

If your performance in this course is affected by illness or other serious difficulties which are beyond your control, you can apply for Special Consideration and you may be offered the opportunity for Additional Assessment.

In order to be offered Additional Assessment it is essential that you **follow exactly the procedures set out in the document entitled "Application for Special Consideration in First Year Mathematics Courses Semester 1 2016."**

A copy of this document is included in this booklet on page 12.

Take particular note that

- The School will **NOT** contact you to tell you that you have been granted Additional Assessment. It is **YOUR RESPONSIBILITY** to find this out by following the instructions in the document mentioned above.
- **If you have a poor record of attendance or performance during the semester you may be failed regardless of illness or compassionate grounds affecting the final exam.**

Note also that

- If illness affects your attendance at or performance in a **class test**, do **not** make an application for Special Consideration. Simply show the original medical certificate to your tutor and also give a copy of the medical certificate to your tutor. This information will be taken into account when calculating your final assessment mark.
- Transport delays and oversleeping will **not** be accepted as reasons for missing class tests. (But note that only your best three test results are counted for assessment.)
- Because it is possible to sit the computing tests on many days, **except in very unusual circumstances, medical certificates will not be accepted as excuses for not sitting the computing test**. Therefore, it is recommended that you book to sit at an early time. If you are ill for the entire week when the computing test is held, you may be required to sit the computing test at a later date.
- Because online Maple TA tests are available for an extended period, **medical certificates will not be accepted as excuses for not completing these tests**. Therefore, it is recommended that you complete these tests as early as possible.
- If you arrive too late to be admitted to the end of semester exam, go **immediately** to the Mathematics and Statistics Student Services Office, Room 3088, Red Centre.

School of Mathematics and Statistics Policies

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 MathsStats 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. Lack of knowledge about a policy will not be an excuse for failing to follow the procedures in it.

Course improvement

You will be invited to complete a CATEI Subject Evaluation form on-line at the end of the semester.

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 semester 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 the software package MATLAB. The computer-based problems and tests define the level of proficiency you are expected to achieve in using MATLAB.

Learning Outcomes

A student should be able to:

- state definitions as specified in the syllabus,
- state and prove appropriate theorems,
- explain how a theorem relates to specific examples,
- apply the concepts and techniques of the syllabus to solve appropriate problems,
- prove specific and general results given specified assumptions,
- use mathematical and other terminology appropriately to communicate information and understanding,
- use the computing package MATLAB as an aid to solve appropriate problems.

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 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.

Peter Brown
Director of First Year Studies
School of Mathematics and Statistics
fy.MathsStats@unsw.edu.au

APPLICATIONS FOR SPECIAL CONSIDERATION IN FIRST YEAR MATHEMATICS COURSES SEMESTER 1 2016

If you feel that your performance in, or attendance at, a final examination has been affected by illness or circumstances beyond your control, or if you missed the examination because of illness or other compelling reasons, you may apply for special consideration. Such an application **may** lead to the granting of additional assessment.

It is essential that you take note of the following rules, which apply to applications for special consideration in all first year Mathematics courses.

1. **Within 3 days** of the affected examination, or at least as soon as possible, you must **submit a request for special consideration to UNSW Student Central** ON-LINE.

   Please refer to link below for How to Apply for Special Consideration,

   https://my.unsw.edu.au/student/atoz/SpecialConsideration.html
   ApplyingforSpecialConsideration

2. **Please do not expect an immediate response from the School.** All applications will be considered together. See the information below.

3. **You will NOT be granted additional assessment in a course if your performance in the course** (judged by attendance, class tests, assignments and examinations) **does not meet a minimal standard**. A total mark of at least 40% on all assessment not affected by a request for special consideration will normally be regarded as the minimal standard for award of additional assessment as will at least 80% attendance at tutorial classes.

4. It is **YOUR RESPONSIBILITY** to find out **FROM THE SCHOOL OF MATHEMATICS AND STATISTICS** whether you have been granted additional assessment and when and where the additional assessment examinations will be held. **Do NOT wait to receive official results from the university**, as these results are not normally available until after the Mathematics additional assessment exams have started.

   a) A **provisional** list of results in all Mathematics courses and of grants of additional assessment will be available via the "Maths&Stats marks" link in the UNSW Moodle module of your course. The date for this will be announced later.

   b) Please read all announcements on Moodle. Failure to read announcements will not be accepted as a reason for missing supplementary exams and for not following the correct procedures.

5. The **timetables** for the additional assessment examinations will be available on the Mathematics website at the same time as the provisional list of results.

   The dates for the mid-year additional assessment examinations will be announced later in the Semester.

6. If you have two additional assessment examinations scheduled for the same time, please consult the School of Mathematics and Statistics Office as soon as possible so that special arrangements can be made.

7. You will need to produce your UNSW Student Card to gain entry to additional assessment examinations.

IMPORTANT NOTES

- The additional assessment examination may be of a different form from the original examination and must be expected to be at least as difficult.
- If you believe that your application for special consideration has not been processed, you should immediately consult the Director of First Year Studies of the School of Mathematics and Statistics (Room 3073 Red Centre).
- If you believe that the above arrangements put you at a substantial disadvantage, you should, at the earliest possible time, send full documentation of the circumstances to the Director of First Year Studies, School of Mathematics and Statistics, University of New South Wales, Sydney, 2052.

In particular, 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 Student Equity and Disabilities Unit (SEADU) who provide confidential support and advice. Their web site is

http://www.studentequity.unsw.edu.au

SEADU may determine that your condition requires special arrangements for assessment tasks. Once the First Year Office has been notified of these we will make every effort to meet the arrangements specified by SEADU.

Additionally, if you have suffered a serious misadventure during semester then you should provide full documentation to the Director of First Year Studies as soon as possible. In these circumstances it may be possible to arrange discontinuation without failure or to make special examination arrangements.

Professor B. Henry
Head, School of Mathematics and Statistics

UNIVERSITY STATEMENT ON PLAGIARISM

Plagiarism is the presentation of the thoughts or work of another as one's own.[1] 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[2].

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.

[1] Based on that proposed to the University of Newcastle by the St James Ethics Centre. Used with kind permission from the University of Newcastle.

[2] Adapted with kind permission from the University of Melbourne

ALGEBRA SYLLABUS AND LECTURE TIMETABLE

The algebra course for MATH1151 is based on the MATH1151 Algebra Notes, which are essential 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 $\mathbb{R}^n$. (Section 1.2)
Analytic geometry and other applications. (Section 1.3)
Points, line segments and lines. Displacements. Lines in $\mathbb{R}^2$, $\mathbb{R}^3$, and $\mathbb{R}^n$. (Section 1.4)
Parametric vector equations for planes in $\mathbb{R}^n$. 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 $A\mathbf{x} = \mathbf{b}$. (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 12–15
Length, distance between points. (Section 4.1)
Angles and dot product in $\mathbb{R}^2$, $\mathbb{R}^3$, $\mathbb{R}^n$. (Section 4.2)
Orthogonality and orthonormal basis, projection of one vector on another. Relationship between coordinates of a vector and projections of the vector on orthonormal basis vectors. (Section 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 $\mathbb{R}^3$: 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 16–24
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 functions. 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. Applications of the normal distribution. Estimation of probabilities. (Section 5.6)
The sampling distribution for the mean and the central limit theorem. Sums of random variables. (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 following table is a guide as to the problems which you should try to do before each tutorial. Tutors may need to vary a little from this suggested problem schedule.

For tutorial in week	**Try to do up to**	
	chapter	**problem**
1	No tutorial, but start learning how to use MATLAB and Maple TA	
2	1	30
3	1	50
4	2	20
5	2	45
6	3	30(Test 1)
7	3	55
8	4	26
9	4	43
10	5	22
11	5	45
12	5	55 (Test 2)
13	5	78

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 following table shows the week in which each test will be held and the topics covered.

		Topics covered	
Test	Week	**chapter**	**sections**
1	6	1	All
		2	2.1 to 2.7
2	12	2	2.8
		3	All
		4	All
		5	5.1 to 5.4

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'Hôpital's rule.

4. Parametric Curves and Polar Coordinates (1 hour)

Parametric curves, polar coordinates, gradients.

5. The Riemann Integral (5 hours)

Riemann sums and the Riemann integral, the Mean Value Theorem for integrals, the Fundamental 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 following table shows the calculus problems which are relevant to each week's calculus tutorial. You should work on them 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.

Week	**Calculus problems**		**Week**	**Calculus problems**	
1	No		7	98–115	
	Tutorials		8	116–124	
2	1–31		9	125–141	(Test 2)
3	32–42		10	142–155	
4	43–61		11	156–162	
5	62–77	(Test 1)	12	163–171	
6	78–97		13	172–180	

CLASS TESTS AND EXAMS

The table shows which problems are relevant to each test.

Test	Standard problems in ranges
1	1–61
2	62–77 78–115

It is important to note that:

- The class tests do not cover the whole syllabus.
- Questions in the exams may be very different from those in the class tests.

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 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. 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 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. The laboratories will normally be open as follows:

	M020	**G012**
During semester: Monday to Friday	9 am to 9 pm	9 am to 9 pm
Week 10 and Monday of Week 11:	9 am to 9 pm	**Closed**
Saturdays, Sundays	Closed	Closed
During holidays: Monday to Friday	9 am to 9 pm	Closed
Public holidays and Weekends	Closed	Closed.

Any changes to these times will be posted on the door of Room M020, and displayed on the monitors outside G012.

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.

How to start

You should read the *Introduction to* MATLAB notes which can be found at

`http://www.maths.unsw.edu.au/currentstudents/first-year-computing-notes`

In Week 1 you should go to the Red Centre lab G012 and complete the MATLAB introductory module and in Maple TA you should complete the assignment "Using Maple TA". Consultants will be on duty from 12noon to 4pm each day to help you get started with these tasks.

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

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 in, the computers will allow a five minute login with ID "newuser" and password "newuser" so you can access `https://idm.unsw.edu.au` and reset or unlock your zPass. Be aware that two consecutive failed login attempts will lock you out of the computing system for 30 minutes, or until you reset or unlock your zPass.

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.

Using other computers

A personal copy of MATLAB may be of great use to you throughout your studies at university. However it is not necessary for you to buy MATLAB at any stage to complete any of your mathematics courses at UNSW.

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 2016* 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 others to do your test.

Assessment

There will be two different forms of computing tests. The details of the online MATLAB tests have been described previously in the section on Computing tests on page 5.

The second form of computing test will be run under exam conditions in the School's computing laboratories during week 10. You must book for the test through the course page for MATH1151 on Moodle, and bring your UNSW Student ID card to the test.
All 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 semester exam may contain one or two sub-questions requiring a knowledge of MATLAB.

Special consideration for the laboratory test

Because the computing tests can be sat at many different times, medical, or other, reasons for missing the test will generally not be accepted. For this reason you are advised to choose an early time to sit the test. If you consider that you have an exceptional reason for missing the test then you must speak to the Lecturer in Charge MATH1151 Computing as soon as possible after the tests have been completed. Tutors do not have permission to accept medical certificates for the computing test.

If possible, special arrangements for the computing laboratory test will be made for students with supporting documentation from SEADU. If you wish to exercise this option, you must contact Dr Kress before the laboratory tests have commenced so that any needed special facilities can be arranged.

Details of the computer laboratory Matlab test follow in the next pages.

MATH1151 LABORATORY TEST

Tests will be held in the Red Centre computer lab G012 at various times during Week 10. Before you can sit for the test at one of these times, you must use an online booking facility: log on to Moodle, go the the MATH1151 home page and follow the appropriate link under the heading "MATLAB lab test". This booking facility should be available during week 8 of the semester. If you believe that all the proposed times will be impossible for you, inform the Student Services Office immediately.

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. Don't just sit at home and work out commands which you think will work. It is essential that you try out your answers on the computer to check that they do work and to get practice at recognising and recovering from common mistakes.

Model solutions to all the practice questions will be available from the MATH1151 module on Moodle.

MATH1151 SESSION 1 2016
Matlab COMPUTING TEST
SAMPLE VERSION

Student name	Student number

- Students may **not** bring any materials to the test except for some writing paper and a pen or pencil for rough working. Any rough working and notes must be handed in at the end of the test.
- You may attempt the questions in any order, but you must create five files called `q1.m`, `q2.m`, `q3.m`, `q4.m`, `q5.m` containing your answers to questions 1, 2, 3, 4, 5 respectively. Each file must be a script M-file. Any other files that are needed (for example function files) must also be saved under the names `f1.m`, `f2.m` ... etc. Files with any other names will **not be considered**. You must use small (lower case) letters as a file `Q1.m` will **not** be processed.
- Your test will be marked based on a hard copy of your M-file and of the output it produces **after the workspace has been cleared**. For example, to test your answer to the first question you should type `clear all` followed by `q1` in the MATLAB command window.
- The test may include one question that requires you to create a postscript file called `myplot.ps`. In this case, type `gv myplot.ps` at the Linux prompt to see what the marker will see when marking the question.
- Make sure you **SAVE YOUR WORK REGULARLY**
- Use semi-colons to suppress **unnecessary** output. Excessively long output may be penalised.
- You may use MATLAB's online help facilities.

The test questions are on the back of this sheet.

SAMPLE VERSION

Time allowed: **45 minutes**.

Use semi-colons where appropriate.

1. Enter the following three vectors **a**, **b** and **c**, and evaluate the vector algebra expressions $2\mathbf{a} - 3\mathbf{b}$ and $7\mathbf{a} - 4\mathbf{c}$, if they exist:

$$\mathbf{a} = [1, 2, 3, 4, \ldots, 11], \qquad \mathbf{b} = [20, 18, 16, 14 \ldots, 2], \qquad \mathbf{c} = [1, 4, 9, 16, 25, \ldots, 121].$$

2. Evaluate the sum

$$\sum_{n=20}^{50} \frac{2n+1}{1+n^2} = \frac{41}{1+20^2} + \frac{43}{1+21^2} + \cdots + \frac{99}{1+49^2} + \frac{101}{1+50^2}.$$

3. Define the coefficient matrix A and the right-hand-side vector $\mathbf{b}$ for the linear system

$$\begin{array}{rcrcrcrcrcl} 6x_1 & + & 4x_2 & - & x_3 & + & x_4 & & & = & 5 \\ -x_1 & - & 2x_2 & & & & & + & x_5 & = & 3 \\ 2x_1 & + & 2x_2 & + & 9x_3 & + & 2x_4 & & & = & 8 \\ & & 3x_2 & & & & & - & 4x_5 & = & -11 \\ -x_1 & & & - & 2x_3 & - & 2x_4 & + & 5x_5 & = & 3. \end{array}$$

   Set up the augmented matrix $[A \mid b]$, calculate the reduced row-echelon form R and display the appropriate message: `Linear systems has no solutions`, `Linear system has a unique solution`, `Linear system has infinitely many solutions`. (Decide which case is appropriate just by looking at R. You are **not** asked to find a solution.)

4. Create a plot of the polynomial $x^5 - 9x^3 + 2x - 4$ for $-3 \leq x \leq 3$ put gridlines on your plot and then save the plot in a PostScript file `myplot.ps` (using `print`).

5. * Find the unique point of $\mathbb{R}^2$ where the two curves

$$y = x^3 - 5x - 1 \quad \text{and} \quad y = 5 - e^x$$

   intersect. The coordinates should be correct to machine precision.

This test paper and any rough work
must be handed back
at the end of the test.

STUDENT-OWNED COMPUTERS FOR MATHEMATICS COURSES

The School of Mathematics and Statistics is committed to providing, through its own laboratories, all the computing facilities which students need for courses taught by the School. No student should feel the need to buy their own computer in order to undertake any Mathematics course. Nevertheless, the following information is provided for the benefit of those who may wish to use their own computer for work associated with Mathematics courses.

All of our courses have an online presence, and it is there you should look for course materials or links unless your lecturer tells you otherwise.

The School of Mathematics and Statistics provides assistance to students using teaching software in its laboratories. It does not have the resources to advise or assist students in the use of home computers or in communication between home computers and university facilities.

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				