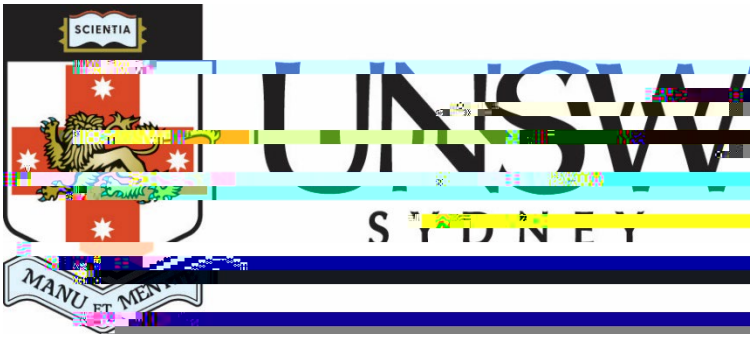


# Course Outline

## MATH1151

## Mathematics for Actuarial Studies and Finance 1A

School of Mathematics and Statistics

Faculty of Science

Term 1, 2023

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# 1. Staff

| Position | Name | Email | Room |
|---|---|---|---|
| Director of First Year | A/Prof. Jonathan Kress | j.kress@unsw.edu.au | RC-3073 |
| Course Authority | A/Prof. Jonathan Kress | j.kress@unsw.edu.au | RC-3073 |
| Algebra Lecturer | Prof. Josef Dick | | |
| Calculus Lecturer | A/Prof. Jan Zika | | |

# 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

2. Apply concepts and techniques from Algebra and Calculus to solve problems.
3. Use technology as an aid to solve appropriate problems in Algebra and Calculus.
4. Communicate mathematical ideas in written form using correct terminology and using technology.
5. Apply concepts in Algebra and Calculus to unexpected contexts.
6. Identify and construct valid mathematical arguments.

# 4. Learning and teaching activities

Mastery Tests. Marks less than 80% should be seen as a warning sign of possible failure in the course.

- The Assignment is available over an extended period and students can work on this with the benefit of all the course resources. Students who pass MATH1151 typically obtain a mark of at least 6 or 7 out of 10 for the Assignment.
- The average mark for pre-exam work is typically well over 40/50.
- The exam focuses on questions that require understanding rather than routine calculation. A student's pre-exam mark is not a good predictor of the exam mark. The harder questions from past exams since 2020 are the best indication of what to expect in the exam, but there will be some more changes that will be announced closer to end of the term.
- If your performance in or ability to complete any assessment is affected by illness or other reasons beyond your control, you may be eligible for special consideration. See the section of special consideration for details.
- To pass MATH1151 you need 50% or greater overall. There is no requirement to gain any particular mark in any individual assessment items.

## Weightings

Your final mark will be made up as follows:

| **Assessment task** | **Weight** | **Course Learning Outcomes** |
|---|---|---|
| Weekly Möbius Lessons | 10% | 1, 2, 3, 5 |
| Mastery Tests | 30% (15% + 15%) | 2, 3 |
| Assignment | 10% | 1, 2, 4, 5, 6 |
| End of Term Examination | 50% | 1, 2, 3, 4, 5, 6 |

Note:

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

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

  The webpage: https://student.unsw.edu.au/exams has many useful links related to the running of UNSW examinations.
- **Medical or other reasons are generally not accepted for missing the deadlines for the Weekly Mobius Lessons as these tests are available for an extended period and can be completed from anywhere and only the best 6 of 9 weeks count towards your final mark.**
- It is very important that you understand the University's rules for the conduct of Examinations and the penalties for **Academic Misconduct Guide**. This information can be accessed through myUNSW at: https://student.unsw.edu.au/exams NB: In recent years there have been cases where severe penalties have been imposed for misconduct in relation to tests and exams in Maths courses.

- Assessment criteria: UNSW assesses students under a standards based assessment policy. For how this policy is applied within the School of Mathematics and Statistics, please visit the website: http://www.maths.unsw.edu.au/currentstudents/assessment-policies
- If you are unwell / miss your **final examination**, please refer to the Special Consideration Policy by visiting the website: https://student.unsw.edu.au/special-consideration

## Weekly Möbius lessons

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

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

## Mastery Tests

As well as completing the weekly Möbius lessons, you will take two Mastery Tests based on the same set of questions and some additional questions based on classroom tutorial questions. These tests

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

## End of Term Examination

In Term 1 2023 the End of Term Examination will be conducted using Möbius. **The exam will be conducted under supervised conditions in the Red-Centre computer labs during the official exam period.**

| | | |
|---|---|---|
| 10 | Mastery Test 2<br>(EXM class) | Möbius Lesson 8 due 4pm Wednesday<br>Möbius Lesson 9 due 11:59pm Sunday** |
| 11 | Monday to Thursday: Study break<br>Friday: Start of exams – Check myUNSW for exam timetable | |
| End of Term examination – Check UNSW exam timetable for details | | |

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

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

# 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 (see below);
- Introduction to Matlab;

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-

Booklets contained in t

An online Module “Working with Academic Integrity” (https://student.unsw.edu.au/aim) is a six-lesson interactive self-

## Academic Skills Support and the Learning Centre

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

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

## Other Supports

UNSW Australia offers support to students in a number of ways. On the Current Students gateway you can find links to relevant services across campus. Visit https://student.unsw.edu.au/stpsst37(nt)-1.1 (s)]TJ0(uns)-8 ((ent)-1.w)-2.9 (.)-1.1 (e)-12.3 (ev)-8 (1 (au/)-13.1 (

- The Current Students Gateway: https://student.unsw.edu.au/
- Academic Skills

## 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 $9^{á}$. (Section 1.2)
Analytic geometry and other applications. (Section 1.3)
Points, line segments and lines. Displacements. Lines in $9^{6}$, $9^{7}$, and $9^{á}$. (Section 1.4) Parametric vector equations for planes in 9

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 distribution

## 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)

)RUPDO GHILQLWLRQV RI OLPLWV DV [ : ’ LQIRUPDO GHILQLWLRQV RI
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 (4 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

Selected Calculus problems for the Classroom Tutorial are selected from the problems in the MATH1151 Calculus Problems booklet. They 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.

# 11. Computing Information

## Background

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 Möbius you should complete the assignment "Introduction to Möbius Lessons".

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.

## 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.

**12.**