



UNSW SCIENCE
School of Maths and Statistics

Course outline

MATH2501
Linear Algebra

Term 2, 2022

Staff

Position	Name	Email	Room
Lecturer-in-charge	Dr Denis Potapov	d.potapov@unsw.edu.au	RC-6111

Please refer to your Timetable on MyUNSW for your Lecture Tut, Lab enrolment days and times.
Timetable weblink: <http://timetable.unsw.edu.au/2022/MATH2501.html>

Administrative Contacts

Please visit the School of Mathematics and Statistics website for a range of information on School Policies, Forms and Help for Students.

For information on Courses, please go to “Current Students” and either Undergraduate and/or Postgraduate”, Course 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: <https://www.maths.unsw.edu.au>

If you cannot find the answer to your queries on the web you are welcome to contact the Student Services Office directly.

By email Undergraduate ug.mathsstats@unsw.edu.au

By phone: 9385 7011

Should we need to contact you, we will use your official UNSW email address of in the first instance. **It is your responsibility to regularly check your university email account. Please state your student number in all emails.**

Course Information

Assumed knowledge / Pre-Requisite: MATH1231 or MATH1241 or MATH1251 or DPST1014

Exclusions: MATH2601, MATH2099

We are aware some course exclusions on the Handbook may be different to the School website. We are in the process of updating this information. Meanwhile, students should be following the Handbook course information with the School website information as a supplement.

Course Aims

This course aims to examine key ideas in linear algebra. Students will improve and develop their analytical thinking skills and their ability to communicate technical arguments clearly. Material on vector spaces and related topics which was introduced in MATH1231, MATH1241 or MATH1251 will be revised and understood in greater depth. We shall introduce more advanced work in this area including applications to geometry, data fitting and differential equations.

Course Description

Linear algebra is a key tool in all of mathematics and its applications. For example, the output of many electrical circuits depends linearly on the input (over moderate ranges of input), and successfully correcting the trajectory of a space probe involves repeatedly solving systems of linear equations in hundreds of variables. Linear methods are vital in ecological population models, and in mathematics itself. You have met systems of linear equations and matrices, vector spaces and linear transformations in first year Mathematics courses, without necessarily understanding all the subtleties involved.

In MATH2501, you will review the material from first year, so that vector spaces and linear transformations become familiar friends rather than uneasy acquaintances. You will learn about geometric transformations: projections (which can also be viewed as least squares approximations), rotations and reflections. You will see how to view many linear transformations as being made up of "stretches" in various directions, (the diagonalisation process), and the more general Jordan form. This will allow you to calculate functions of matrices (such as the exponential of a matrix) and hence to solve systems of linear differential equations.

MATH2501 or MATH2601?

The final marks in MATH2501 will be scaled with reference to final marks in MATH2601, taking into consideration the greater degree of difficulty of MATH2601. As a result few, if any, High Distinction grades will be awarded in MATH2501; normally, no student will be awarded a final mark of more than 90%. For this reason, in addition to the greater depth of knowledge to be obtained, students who have obtained marks of more than 70% in first year mathematics should seriously consider taking MATH2601 instead of MATH2501.

Assessment and Deadlines

Assessment	Week	Weighting %
Test 1 (online quiz + class test)	Week 4	6% + 10%
Test 2 (online quiz + class test)	Week 7	6% + 10%
Test 3 (online quiz + class test)	Week 10	6% + 10%
Final Exam	Exam Period	52%

Tests

The class tests are designed to give you a chance to assess your mastery of the course material, including both the theoretical and computational aspects of the course.

Test 1 covers the topics of lectures of weeks 1-3;

Test 2, covers the topics of lectures of weeks 4-6; and

Test 3, covers the topics of lectures of weeks 7-9.

Each test will have two components: Online Quiz and Class Test

- Online Quiz: Each online quiz will be available on Maple.TA throughout the week of the test (from Monday to Friday). You will have unlimited number of attempts with each quiz. The quiz result is the result of your best attempt.
- Class Test: Class Test question sheet will be published on Moodle in a dedicated section at the scheduled time (announced on Moodle). You are required to be online at that time at your home or any other location which you find suitable.

You will have 60 minutes to complete your test paper.

You will need to scan (or take photo) of every page of your workings and upload it to Moodle within 60 minutes timeframe.

There will be an active "Virtual Classroom" session (which coincides with lecture time) where an academic will be preset to respond to any questions you may have in relation to test paper.

Further details about class test arrangements are published on Moodle.

Examination

The final exam is the major assessment task. Its purpose is to determine the level of student mastery of both the theoretical and computational course material. The duration of the final exam will be two hours.

Further details about the examination will be available on Moodle closer to the time.

Late Submission of Assessment Tasks

No late submissions will be accepted. (Where "late" in this context means after any extensions granted for Special Consideration or Equitable Learning Provisions.)

Course Learning Outcomes (CLO)

CLO1 demonstrate an understanding of the basic concepts and problems of finite dimensional linear algebra

CLO2 apply the key ideas of linear algebra to geometry and differential equations.

CLO3 demonstrate competency in mathematical presentation, written and verbal skills as applied to the field of linear algebra.

Course Schedule

The course will include material taken from some of the following topics. This is should only serve as a guide as it is not an extensive list of the material to be covered and the timings are approximate. The course content is ultimately defined by the material covered in lectures.

Weeks	Topic
1	systems of linear equations; matrix operations; matrix inverse
2	vector spaces and subspaces; linear dependence, span, spanning sets and basis
3	coordinate vector; linear maps and matrix of a linear map
4	scalar products, orthonormal bases; coordinate vector and orthonormal basis; Gram-Schmidt and QR factorisation;
5	least square method and orthogonal projections; orthogonal complements; determinants; eigenvalues and eigenvectors
7	orthogonal maps; symmetric matrices, and quadratic curves
8	Inertia Theorem, Cayley-Hamilton Theorem, minimal polynomial
9	Similar Matrices, Jordan Forms, Identification of Jordan Forms
10	Applications of Jordan Forms

Textbooks

- First Year Algebra Book
- "Linear Algebra" Stephen H. Friedberg; Arnold J Insel ; Lawrence E Spence ; Englewood Cliffs, N.J : Prentice-Hall, c1979

Moodle

Log in to Moodle to find announcements, general information, notes, lecture slide, classroom tutorial and assessments etc.

<https://moodle.telt.unsw.edu.au>

School and UNSW Policies

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

<https://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.

Academic Integrity and Plagiarism

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

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

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

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

The UNSW Student Code and the Student Misconduct Procedure can be found at:

<https://student.unsw.edu.au/plagiarism>

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

Plagiarism

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

Additional Support

ELISE (Enabling Library and Information Skills for Everyone)

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

Completing the ELISE tutorial and quiz will enable you to:

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

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

The *ELISE* training webpages:

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

Equitable Learning Services (ELS)

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

They assist students:

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

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

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

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

Academic Skills Support and the Learning Centre

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

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

Applications for Special Consideration for Missed Assessment

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 Dates on Final Term Exams and Supplementary Exams please check the “Key Dates for Exams” ahead of time to avoid booking holidays or work obligations.

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

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

Course Evaluation and Development (MyExperience)

Student feedback is very important to continual course improvement. This is demonstrated within the School of Mathematics and Statistics by the implementation of the UNSW online student survey *myExperience*, which allows students to evaluate their learning experiences in an anonymous way. *myExperience* survey reports are produced for each survey. They are released to staff after all student assessment results are finalised and released to students. Course convenor will use the feedback to make ongoing improvements to the course.