THE UNIVERSITY OF SYDNEY
Semester 1, 2017

Information Sheet for **MATH1002 Linear Algebra**

Websites: It is important that you check both the Junior Mathematics website and the MATH1002 website regularly.

Junior Mathematics webpage: `http://www.maths.usyd.edu.au/u/UG/JM/`
MATH1002 webpage: `http://www.maths.usyd.edu.au/u/UG/JM/MATH1002`

Both sites may be accessed through the Learning Management System (Blackboard):

`https://elearning.sydney.edu.au`.

Important announcements relating to Junior Mathematics are posted on the Junior Mathematics page. On the MATH1002 page you will find online resources and other useful links. Announcements regarding assessment tasks will be made on this page at various times throughout the semester.

Lectures: There are 5 different lecture streams. You should attend one stream (that is, two lectures per week), as shown on your personal timetable.

Times	**Location**	**Lecturer**
8 am Mon & Tue	Wallace	Alex Casella
8 am Mon 8 am Tue	Footbridge LT Seymour Centre LT S301 (York)	Vinoth Nandakumar/Joshua Ching
11 am Mon & Tue	E Ave Aud	Anne Thomas
11 am Mon & Tue	Wallace	Dzmitry Badziahin/Ting-Ying Chang
11 am Mon 11 am Tue	PNR Lecture Theatre 1 (Farrell) Chemistry Lecture Theatre 2	Becky Armstrong/Robert Haraway

Lectures run for 13 weeks. The first lecture will be on Monday 6 March. The last lecture will be on Tuesday 6 June.

Consultation times: Consultation times are posted on the MATH1002 webpage.

Tutorials: Tutorials (one per week) start in Week 1. There are no tutorials in Week 13. You should attend the tutorial given on your personal timetable. Attendance at tutorials will be recorded. Your attendance will not be recorded unless you attend the tutorial in which you are enrolled.

Tutorial and exercise sheets: The question sheets for a given week will be available on the MATH1002 webpage. Solutions to tutorial exercises for week n will usually be posted on the web by the afternoon of the Friday of week n.

Textbook: *A First Course in Linear Algebra*, by David Easdown. Available from the Co-op Bookshop.

Assessment: Your final raw mark for this unit of study will be calculated as follows:

65%: Exam at end of Semester 1.
15%: Quiz 1 mark (using the better mark principle).
15%: Quiz 2 mark (using the better mark principle).
2.5%: Assignment 1 mark.
2.5%: Assignment 2 mark.

The *better mark principle* means that for each quiz, the quiz counts if and only if it is better than or equal to your exam mark. If your quiz mark is less than your exam mark, the exam mark will be used for that portion of your assessment instead. For example, if your quiz 1 mark is better than your exam mark while your quiz 2 mark is worse than your exam mark, then the exam will count for 80%, quiz 1 will count for 15%, and the assignments will count for 5% of your overall mark. The assignment marks count for 5% regardless of whether they are better than your exam mark or not.

Final grades are returned within one of the following bands:

High Distinction (HD), 85–100: representing complete or close to complete mastery of the material; **Distinction (D), 75–84:** representing excellence, but substantially less than complete mastery; **Credit (CR), 65–74:** representing a creditable performance that goes beyond routine knowledge and understanding, but less than excellence; **Pass (P), 50–64:** representing at least routine knowledge and understanding over a spectrum of topics and important ideas and concepts in the course.

A student with a passing or higher grade should be well prepared to undertake further studies in mathematics which are dependent on this unit of study. A student achieving a distinction or higher grade should consider enrolling in advanced units in second semester.

Examination: There is one examination of 1.5 hours' duration during the examination period at the end of Semester 1. Further information about the exam will be made available at a later date on the website.

Quizzes: Quizzes will be held during tutorials. You must sit for the quiz during the tutorial in which you are enrolled, unless you have a Permission Slip from the Student Services Office, issued only for verifiable reasons. Otherwise, your quiz mark may not be recorded.

Assignments: There are two assignments, which must be submitted electronically, **as PDF files only**, in Turnitin (an internet-based plagiarism-prevention service), via the Learning Management System (Blackboard) website by the deadline. Note that your assignment will not be marked if it is illegible or if it is submitted sideways or upside down. It is your responsibility to check that your assignment has been submitted correctly.

Assessment and feedback schedule:

Task	Available	Deadline/date	Latest extension*	Feedback
Assignment 1	Fri 17 Mar	11:59 pm Mon 27 Mar	11:59 pm Mon 3 Apr	Wed 5 Apr
Quiz 1		26–28 Apr (Week 7)		3–5 May
Assignment 2	Fri 28 Apr	11:59 pm Mon 8 May	11:59 pm Mon 15 May	Wed 17 May
Quiz 2		24–26 May (Week 11)		31 May, 1–2 Jun

* Extensions for assignments are only possible for students registered with Disability Services or applying for Special Consideration or Special Arrangements.

Special consideration and special arrangements: While studying at the University of Sydney, you may need to apply for special consideration or special arrangements as follows:

> Special consideration may be granted to students where well-attested illness, injury, or misadventure occurs to them (or someone they have carer's responsibility for) during the semester or the exam period. Special arrangements may be granted for essential community commitments. Further information on eligibility, document requirements, and how to apply is available at `http://sydney.edu.au/science/cstudent/ug/forms.shtml#special_consideration`. Applications must be made using the University's formal application process.
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> Final examinations will be held in the formal examination period. Students affected by illness, injury or misadventure may lodge a request for Special Consideration to sit a replacement examination in the formal Replacement Examination period (week 18).
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> If you are registered with Disability Services and would like to have adjustments applied to the replacement examination, you are required to amend your Academic Plan with Disability Services specifically for this replacement examination. This needs to be done as soon as you are notified of award of the replacement opportunity. If you have not done so, you will be allowed to sit the replacement, but under unadjusted conditions.

You should *not* submit an application of either type

- if you are absent from a tutorial and there is no assessment associated with the missed tutorial, or
- if you miss a quiz, since the better mark principle applies.

The assessment category for the assignments is "Submitted Work".

Any questions? Before you contact us with any enquiry, please check the FAQ page:

`http://www.maths.usyd.edu.au/u/UG/JM/FAQ.html`.

Where to go for help: For administrative matters, go to the *Student Services Office, Carslaw 520*. For help with mathematics, see your lecturer, your tutor, a duty tutor, or use the Ed discussion forum (`https://edstem.com.au`). Lecturers guarantee to be available during their indicated office hours, but may be available at other times as well. If you are having difficulties with mathematics due to insufficient background, you may seek help from the *Mathematics Learning Centre, Carslaw 177*. You may also email questions about the subject to `MATH1002@maths.usyd.edu.au`. Ensure that any emails that you send to this address contain your name and SID, because anonymous emails will be ignored.

Objectives: The objectives of this unit are to:

- introduce the concept of a vector, both as an abstract and geometric construct;
- introduce the basic concepts of linear algebra – systems of linear equations, matrices, determinants, eigenvalues and eigenvectors;
- illustrate the power and beauty of mathematics as a tool for expressing, thinking about, and solving problems;
- improve your ability to think logically, analytically, and abstractly;
- enhance your problem-solving skills.

In addition, this unit provides students with a solid foundation for further studies in mathematics and/or other scientific disciplines.

Outcomes: Students who successfully complete this unit will be able to demonstrate competency in:

- applying mathematical logic and rigour to solving problems;
- representing vectors both algebraically and geometrically in $\mathbb{R}^2$ and $\mathbb{R}^3$, and being able to perform arithmetic with them;
- using vectors to solve classical geometric problems;
- performing and manipulating dot and cross products;
- setting up systems of linear equations;
- solving systems of linear equations using Gaussian elimination;
- performing matrix arithmetic and calculating matrix inverses and determinants;
- finding eigenvalues and eigenvectors;
- diagonalising a matrix;
- expressing mathematical ideas and arguments coherently in written form.

Proposed week-by-week outline:

Week	Topics
1	Geometric vectors in the plane and space. Scalar multiples. Parallelogram, commutative and associative laws of vector addition. Zero vector. Negative vectors and subtraction. Properties and applications to geometry.
2	Position vectors. Unit vectors. Hat of a vector. Cartesian form and component-wise operations. Parallel vectors and linear independence of two vectors.
3	Dot product: geometric and algebraic formulae. Commutativity of dot product. Distributivity. Vector projection. Scalar components. Vector components. Orthogonal components.
4	Cross product: geometric and algebraic formulae. Anti-commutativity of cross product. Distributivity. Area of a parallelogram inscribed by two vectors.
5	Lines and planes in space. Parametric vector equation, parametric scalar equations and cartesian equations of a line. Vector and cartesian equations of a plane. Normal vector to a plane.
6	Linear equations. Systems of linear equations. Solutions of a system. Homogeneous systems. Inconsistent systems.
7	Augmented matrices. Elementary row operations. Row echelon form and Gaussian elimination. Leading variables and back substitution. Reduced row echelon form and Gauss–Jordan elimination.
8	Matrices. Row and column vectors. Matrix addition, subtraction and multiplication. Scalar multiplication. Zero matrix. Identity matrix. Negative of a matrix. Properties of matrix operations.
9	Inverse of a matrix. Determinant of a two-by-two matrix. Powers of a matrix. Formula for inverse of a two-by-two matrix. Using augmented matrices to invert a matrix. Using the inverse matrix to solve a system of equations.
10	Determinants. Expansion along any row or down any column. Determinant method for cross products. Multiplicative property of determinants. Invertibility criterion using determinants. Effect on determinants of using row and column operations.
11	Eigenvalues and eigenvectors of a matrix. Eigenspace corresponding to an eigenvalue. Characteristic polynomial of a matrix. Solving homogeneous systems to find eigenvectors.
12	Diagonal matrices. Diagonalisation and applications.
13	Revision.