Information Sheet for MATH1902 Linear Algebra (Advanced)

Websites
It is important that you check both the MATH1902 website and the Junior Mathematics website regularly. Both sites may be accessed through WebCT, or directly.


Important announcements relating to Junior Mathematics are posted on the Junior Mathematics page.
On the MATH1902 page you will find on-line resources and other useful links. Announcements regarding assessment tasks will be made on this page at various times throughout the semester. Make sure you check the page weekly.

Lectures

<table>
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<tr>
<th>Times</th>
<th>Location</th>
<th>Lecturer</th>
<th>Consultation</th>
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<tbody>
<tr>
<td>11 am Mon &amp; Tue</td>
<td>New Law School LT101</td>
<td>A/Prof D Easdown</td>
<td>Tuesdays, 1-2 pm</td>
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<tr>
<td></td>
<td>Carslaw room 619</td>
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Lectures run for 13 weeks, and the last lecture will be on Tuesday 31 May.

Tutorials
Tutorials (one per week) start in week 1. There is no tutorial in week 13. You should attend the tutorial given on your personal timetable. Attendance at tutorials will be recorded. Your attendance cannot be recorded unless you attend the tutorial in which you are enrolled. Your attendance record will be taken into account in the event that you apply for special consideration at any stage.

Tutorial sheets
The tutorial question sheets for a given week will be available on the MATH1902 webpage. **You must print out the current week’s tutorial sheet from the web, and take it to your tutorial with you.**
Solutions to tutorial exercises for week \( n \) will usually be posted on the web by the afternoon of the Friday of week \( n \).
Assessment
Your final raw mark for this unit will be calculated as follows:

- 70%: Exam at end of semester 1.
- 20%: Quiz mark.
- 10%: Assignment mark.

Your final raw mark is then scaled to produce your final mark. Marks are scaled so that the distribution of grades is consistent with the quality of the class, and the difficulty of the unit, as required by the University.

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.

Quizzes
Two quizzes will be held during tutorials, on Wednesday 30 March and Wednesday 4 May. Each quiz is worth 10% of your final raw mark. You must sit for the quiz during the tutorial in which you are enrolled. Your quiz mark will not be recorded if you sit for the quiz in a tutorial in which you are not enrolled.

Assignments
Two assignments will be set and marked. Each assignment is worth 5% of your final raw mark. Assignments will be due on Tuesday 5 April and Tuesday 31 May. Please see page 25 of the Junior Mathematics Handbook for details relating to the submission of assignments.

Text book

Where to go for help
For administrative matters, go to the Student Office, Carslaw room 520.
For help with mathematics, see your lecturer, or your tutor. Lecturers guarantee to be available during their indicated office hour, but may well be available at other times as well.
Aims and Learning Outcomes
Advanced units of study (MATH1901 and 1902) in mathematics in first semester build on the broad foundations of calculus and precalculus learnt at school, integrating them with new and novel concepts in linear algebra. Students should start to gain an appreciation of the power and beauty of mathematics that evolved over 2,000 years yet is indispensable to our modern way of life. Calculus and linear algebra are two cornerstones of mathematics, and over the course of one semester students taking both units start to see these subjects intertwine to form the backbone of almost all applications of mathematics to physical and biological sciences and engineering.
(The first continuation is in second semester of the junior year, studying integral calculus and modelling in MATH1903, and then, subsequently, a spectacular explosion of ideas coming together in the first semester of the intermediate year, studying vector calculus in MATH2961.)
By the end of the semester, students should be able to

- apply mathematical logic and rigour to solving problems;
- express mathematical ideas coherently in written and oral form;
- demonstrate fluency in manipulating complex numbers, functions of one or two variables, limits, differentiability and polynomial approximations;
- demonstrate fluency in vector and matrix arithmetic, and their applications to solving systems of equations.

In particular, students taking MATH1902 should be able to

- perform arithmetic of geometric vectors in the plane and in space, with applications to classical problems in geometry;
- perform and manipulate dot, cross and triple products and vector projections, with applications to lines and planes in space;
- develop fluency with systems of equations and the methods of Gaussian and Gauss-Jordan elimination;
- perform matrix arithmetic, calculate matrix inverses, determinants, eigenvalues and eigenvectors;
- develop fluency with methods of diagonalisation and applications;
- become conversant with important classical results, such as the Fundamental Theorem of Algebra and the Cayley-Hamilton Theorem, that underlie more advanced topics in linear algebra.
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<thead>
<tr>
<th>Week</th>
<th>Topics</th>
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<tbody>
<tr>
<td>1</td>
<td>Introduction to linear algebra. Geometric vectors. Properties and applications to geometry.</td>
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<tr>
<td>2</td>
<td>Unit and hat vectors. Cartesian form and component-wise operations. Parallel vectors, linear dependence and independence.</td>
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<td>3</td>
<td>Dot products, geometric and algebraic forms. Projections, scalar, vector and orthogonal components.</td>
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<td>4</td>
<td>Cross products, geometric and algebraic forms. The right-hand rule, properties and applications to geometry. Revision leading up to the first quiz.</td>
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<tr>
<td>7</td>
<td>Matrices, row and column vectors. Matrix operations and properties. Sigma notation and proofs.</td>
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<td>8</td>
<td>Elementary matrices. Inverse matrices, properties and applications. Revision leading up to the second quiz.</td>
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<tr>
<td>10</td>
<td>Determinants, rank of matrices, invertibility criteria, properties and applications.</td>
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<tr>
<td>11</td>
<td>Eigenvalues and eigenvectors. Characteristic equations and the Cayley-Hamilton Theorem.</td>
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<tr>
<td>12</td>
<td>Diagonalisation and applications. Introduction to Markov processes, and applications to internet search engines. Rotations, reflections and shears. Introduction to real and complex Jordan forms.</td>
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<tr>
<td>13</td>
<td>Revision. Second assignment due.</td>
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