Mathematical Foundations

MATH1050

Dr. Jon Links
MATH1050: Mathematical Foundations
Semester 1, 2006

Brief description of course content

This course aims to consolidate students’ knowledge and skills in calculus and linear algebra, and to extend this knowledge towards a firm basis for future studies in mathematics. It covers the core content of the secondary school Maths C course and is designed for students who have completed secondary school Maths B or MATH1040. It includes matrices, vectors, sequences, complex numbers and calculus.

Lecturer

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The course profile and course material can be found on the web at the following address:

http://www.maths.uq.edu.au/courses/MATH1050

This also contains up-to-date news about the course material and announcements for students. Please check this regularly during the semester.

Class contact hours: 3L, 1T, 3C (Check times and venues with mySInet for any late changes.)

There are NO tutorials or contact sessions in the first week!
Assumed background:

This course assumes that students have a good understanding of the material in either secondary school Maths B or MATH1040. The course will not be easy, and students should expect to work hard to get good results.

Course goals:

The aim of this course is to allow any student to reach a suitable standard of mathematics (roughly equivalent to secondary Mathematics C) in order to enable them to tackle a first level Mathematics course such as MATH1051, as well as MATH1061 and/or STAT1201. It will also enable students to cope with a reasonable level of mathematics in their other (non-maths) courses.

Graduate Attributes:

On completion of the course, the graduate will have developed the following attributes:

1. In-depth Knowledge of the Field of Study
   • An in-depth understanding and well-founded knowledge of the mathematics presented in this course, by encountering mathematical techniques and theorems, and using this material to solve problems.
   • An understanding of the breadth of mathematics, by encountering techniques to which the graduate has not previously been exposed.
   • An understanding of the applications of mathematics to relevant fields, by considering applications of mathematics to fields such as modeling, economics and engineering.

2. Effective Communication
   • An enhanced ability to present a logical sequence of reasoning using appropriate mathematical notation and language.
• An enhanced ability to interact effectively with others in order to work towards a common goal, by discussing mathematical problems and trying to derive appropriate solutions.

• An enhanced ability to select and use the appropriate level, style and means of written communication, using the symbolic, graphical, and diagrammatic forms relevant to the context, and displaying the ability to unambiguously and rigorously communicate mathematical facts and reasoning.

3. Independence and Creativity

• An enhanced ability to work and learn independently, by needing to independently solve complex mathematical problems as part of assignment and examination work.

• An enhanced ability to generate and synthesize ideas, by approaching difficult problems from a variety of different ways.

• An enhanced ability to formulate problems mathematically, starting with a textual description, extracting the key mathematical components, and then applying appropriate mathematical skills and procedures to solve the problems.

• An enhanced ability to generate approaches for the mathematical solution of problems including the identification and adaptation of existing methods.

4. Ethical and Social Understanding

• A knowledge and respect of general ethical scientific standards, particularly in relation to working in the area of mathematics.

• An appreciation of the history of mathematics as an ongoing and important human activity.

• An appreciation of the power and importance of mathematics in affecting our culture and technology.

Teaching and Learning Methods

MATH1050 is worth 2 units. There are six contact hours scheduled for each week. Check mySI-net for class times and rooms.

• There are three hours of lectures per week. You should attend ALL of the lectures each week. We will work through lots of material in lectures, and you should obtain a copy of the slides (see the section on "Textbooks and References" below).

• Each week there are thirteen tutorial slots. You need to attend one tutorial per week. We are using electronic sign-on for these tutorial times. Make sure you select a tutorial. You will work through the weekly problems in the tutorials, and have a chance to ask questions or receive personalised help.

• There are three additional "Contact Sessions" each week, which will be used to work through extra examples and to identify and resolve common problems. These may not be held every week, and you will be advised if they are not on. You should ensure that you are available to attend one of the timeslots.

You are welcome to attend extra contact sessions if you like.
ASSESSMENT

Required assessment tasks:

Assessment will consist of weekly tutorial attendance, regular assignments, a take-home mid-semester exam and a final exam at the end of semester.

- Each week, at the beginning of your tutorial, you will be given a set of tutorial questions. You are expected to work on these questions during the tutorial. You are encouraged to discuss the questions with your peers and ask for assistance from your tutor. Before the end of the tutorial you must show your work to your tutor, who will sign it. Provided that you have put a genuine effort into solving the tutorial problems, the tutor will record your name as having done the tutorial problems for that week. Your work will be checked for effort rather than for correctness. Solutions to the tutorial problems will be handed out the following week. Each week’s tutorial participation is worth 1%, to a maximum of 10%. You will be required to attend one tutorial class each week.

- Marks will be awarded for assignment work. There will be five assignments, and each will contribute 4% towards your final grade. The due date for each assignment will be announced in lectures.

- A take home midsemester exam will be made available on the lecture of Friday April 7 and will be due in by 5pm on Monday April 10. It will count 10% towards the final assessment.

- The exam at the end of semester will be of two hours duration, and will contribute 60% towards final assessment. It will cover material from the entire semester.

You are strongly urged to complete all items of assessment. It will not be possible to award a final grade solely by the result of the final exam.

Assessment criteria

Solutions will be marked for accuracy, appropriateness of mathematical techniques and clarity of presentation as will be demonstrated by examples presented in lectures.

If you miss an assessment item: In case of illness (or bereavement) you may be exempted from an assignment if a medical certificate (or other documentation) is received by the course co-ordinator within one week of the due date of the assignment. If you are exempted, then your assignment marks are weighted on a pro-rata basis. Note that ad hoc excuses (car trouble and the like!) will not be accepted; only documentation in connection with illness or bereavement.

Criteria for the award of grades

Your grade for this course will be determined by which of the following levels of achievement that you consistently display in the items of assessment.
To earn a **Grade of 7**, a student must demonstrate an excellent understanding of the course material. This includes clear expression of nearly all their deductions and explanations, the use of appropriate and efficient mathematical techniques and accurate answers to nearly all questions and tasks with appropriate justification. They will be able to apply mathematical techniques to completely solve both theoretical and practical problems. Students who obtain a final mark of 85% or more will obtain a 7.

To earn a **Grade of 6**, a student must demonstrate a comprehensive understanding of the course material. This includes clear expression of most of their deductions and explanations, the general use of appropriate and efficient mathematical techniques and accurate answers to most questions and tasks with appropriate justification. They will be able to apply mathematical techniques to partially solve both theoretical and practical problems. Students who obtain a final mark of between 75% and 84% will obtain a 6.

To earn a **Grade of 5**, a student must demonstrate an adequate understanding of the course material. This includes clear expression of some of their deductions and explanations, the use of appropriate and efficient mathematical techniques in some situations and accurate answers to some questions and tasks with appropriate justification. They will be able to apply mathematical techniques to solve fundamental problems. Students who obtain a final mark of between 65% and 74% will obtain a 5.

To earn a **Grade of 4**, a student must demonstrate an understanding of the basic concepts in the course material. This includes occasionally expressing their deductions and explanations clearly, the occasional use of appropriate and efficient mathematical techniques and accurate answers to a few questions and tasks with appropriate justification. They will have demonstrated knowledge of techniques used to solve problems and applied this knowledge in some cases. Students who obtain a final mark of between 50% and 64% will obtain a 4.

To earn a **Grade of 3**, a student falls short of satisfying the basic requirements for a pass (i.e. the student fails), but demonstrates some knowledge of the basic concepts in the course material. This includes occasional expression of their deductions and explanations, the use of a few appropriate and efficient mathematical techniques and attempts to answer a few questions and tasks accurately and with appropriate justification. They will have demonstrated knowledge of techniques used to solve problems. Students who obtain a final mark of between 45% and 49% will obtain a 3.

To earn a **Grade of 2**, a student must demonstrate some knowledge of the basic concepts in the course material. This includes attempts at expressing their deductions and explanations and attempts to answer a few questions accurately. Students who obtain a final mark of between 20% and 44% will obtain a 2.

A student will earn a **Grade of 1** if they show a poor knowledge of the basic concepts in the course material. This includes attempts at answering some questions but showing an extremely poor understanding of the key concepts. Students who obtain a final mark of less than 20% will obtain a 1.

**Assessment policy**

Students should be familiar with the rules which relate to assessment in their degrees as well as general university policy such as found in the General Award Rules. These are all set out on the myAdvisor page on the UQ website

Calculators will be permitted in the final exam. Any calculator with data storage capability must have the memory erased before the start of the exam.

You may also use a calculator when completing the assignments.

**Plagiarism:**

The University has adopted the following definition of plagiarism:

“Plagiarism is the action or practice of taking and using as one’s own the thoughts or writings of another, without acknowledgment. The following practices constitute acts of plagiarism and are a major infringement of the University's academic values:

- Where paragraphs, sentences, a single sentence or significant parts of a sentence are copied directly, and are not enclosed in quotation marks and appropriately footnoted;
- Where direct quotations are not used, but are paraphrased or summarised, and the source of the material is not acknowledged either by footnoting or other simple reference within the text of the paper; and
- Where an idea which appears elsewhere in printed, electronic or audio-visual material is used or developed without reference being made to the author or the source of that material.”

When a student knowingly plagiarises someone’s work, there is intent to gain an advantage and this may constitute misconduct.

Students are encouraged to study together and to discuss ideas, but this should not result in students handing in the same or similar assessment work. Do not allow another student to copy your work. While students may discuss approaches to tackling a tutorial problem, care must be taken to submit individual and different answers to the problem. Submitting the same or largely similar answers to an assignment or tutorial problem may constitute misconduct, and various actions (such as grading that piece of assessment as worth 0 marks, or more formal and serious penalties) may be undertaken against you.


**Supplementary examinations**

A supplementary examination may be awarded in one course to students who obtain a grade of 2 or 3 in the final semester of their program and require this course to finish their degree. You should check the rules for your degree program for information on the possible award of supplementary examinations. Applications for supplementary examinations must be made to the Director of Studies in the Faculty.

EPSA Faculty policy on the award of supplementary exams may be found via the Faculty Guidelines on Examinations from the EPSA student page [http://www.epsa.uq.edu.au/index.html?page=7640&pid=7563](http://www.epsa.uq.edu.au/index.html?page=7640&pid=7563)
Special examinations

If a student is unable to sit a scheduled examination for medical or other adverse reasons, she/he can and should apply for a special examination. Applications made on medical grounds should be accompanied by a medical certificate; those on other grounds must be supported by a personal declaration stating the facts on which the application relies.

Applications for special examinations for central and end-of-semester exams must be made through the Student Centre. Applications for special examinations in school exams are made to the course coordinator.

More information on the University’s assessment policy may be found at http://www.uq.edu.au/hupp/index.html?page=25113&pid=25075

EPSA Faculty policy on the award of special exams may be found via the Faculty Guidelines on Examinations from the EPSA student page at http://www.epsa.uq.edu.au/index.html?page=7640&pid=7563

Feedback on assessment:

You may request feedback on assessment in this course progressively throughout the semester from the course coordinator. Feedback on assessment may include discussion, written comments on work, model answers, lists of common mistakes and the like.

Students may peruse examinations scripts and obtain feedback on performance in a final examination provided that the request is made within six months of the release of final course results. After a period of six months following the release of results, examination scripts may be destroyed.

Information on the University’s policy on access to feedback on assessment may be found at http://www.uq.edu.au/hupp/index.html?page=25114&pid=25075

EPSA Faculty policy on assessment feedback and re-marking may be found at http://www.epsa.uq.edu.au/index.html?page=7674&pid=7564

Textbook and references

The major teaching resources for this course are the lecture notes. Carefully read the following paragraphs.

Each lecture, we will work through a number of pages of notes in the form of slides, and will write various hints, solutions and comments on the notes. We urge you as strongly as we can to obtain a copy of these slides. They are on sale at the University Copy Shop, in a nice, bound format, at a cost of around $12. Alternately, a full set of slides is available on the web; you can print these yourself if you like, but they are more than 260 pages long! Assignments, solutions and sample exams will all be distributed in lectures.

There is no compulsory text book for this course. If you wish to read more books on mathematics, then the following ones are recommended for reference:
Calculus 4th or 5th ed., 1999 or 2003, by Stewart, Brooks/Cole publishing
(Physical Sciences & Engineering library QA303.S8825 2003)

(Physical Sciences & Engineering library QA184.A575 2005)

These textbooks are also currently the textbooks for MATH1051 and MATH1052 so you may
wish to buy them if you intend further study.

**Library contact:**

The liaison librarian for the physical sciences disciplines is located in the Physical Sciences
and Engineering Library in the Hawken Building and may be consulted for assistance in the
course:

Leith Woodall
Email: lwoodall@library.uq.edu.au
Extension: 52367

**Students with disabilities:**

Any student with a disability who may require alternative academic arrangements in the
course is encouraged to seek advice at the commencement of the semester from a Disability
Adviser at Student Support Services.

**Assistance for Students:**

Students with English language difficulties should contact the course coordinator or tutors for
the course.

Students with English language difficulties who require development of their English skills
should contact the Institute for Continuing and TESOL Education on extension 56565.

The Learning Assistance Unit located in the Relaxation Block in Student Support Services.
You may consult learning advisers in the unit to provide assistance with study skills, writing
assignments and the like. Individual sessions are available. Student Support Services also
offers workshops to assist students. For more information, phone 51704 or on the web

**Student Liaison Officer:**

The School of Physical Sciences has a Student Liaison Officer as an independent source of
advice to assist students with resolving academic difficulties.

The Student Liaison officer during 2006 will be Prof. Peter Adams, Room 547 Priestley
building, (email pa@maths.uq.edu.au)
Program of work for the semester:
The following is intended as a rough guide only. The time spent on each section will vary (depending on the importance of that section), but we will cover roughly 7-8 pages of slides per lecture.

- Matrices: addition and scalar multiplication, transpose, inverse, determinants, solving simultaneous equations
- Vectors: representations of vectors, addition and scalar multiplication, scalar product, vector product, applications of vectors
- Sequences and series: arithmetic and geometric progression, applications to compound interest and population growth, proof by mathematical induction
- Complex numbers: representations, Argand diagram, de Moivres’s theorem, Euler’s identity, roots of polynomials
- Functions: review of functions, inverse functions, composition of functions, logarithmic and exponential functions
- Differentiation: limits, derivative from first principles, derivative rules, applications of the derivative to curve sketching and rate of change problems
- Integration: indefinite and definite integrals, the fundamental theorem of calculus, integration by substitution