Faculty of Science
School of Mathematics and Statistics

MATH3570

FOUNDATIONS OF CALCULUS

SEMESTER 1, 2013
MATH3570 – Course Outline

Information about the course

Course Authority & Lecturer:  Dr. Dmitriy Zanin, Office RC-5112, phone 9385-5281, email d.zanin@unsw.edu.au

Consultation: Consultation hours will be announced in Week 1. Please use email if you wish to arrange an appointment.

Credit, Prerequisites, Exclusions:

This course counts for 3 Units of Credit (3UOC).

Course prerequisites are at least 12 units of credit in second year mathematics courses. MATH3570 is a compulsory course for all students intending to teach High School Mathematics. It is also relevant to applications of mathematics in physics and engineering.

Exclusions: MATH3610, MATH3611, MATH3620, MATH5705

Students with a strong background in mathematics should consider taking the course MATH3611 Higher Analysis instead which serves as a higher equivalent to MATH3570.

Lectures and Tutorials: There will be two classes a week:

<table>
<thead>
<tr>
<th>Monday</th>
<th>11am–12noon</th>
<th>OMB-113</th>
<th>Weeks 2 to 13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thursday</td>
<td>11am–12noon</td>
<td>OMB-113</td>
<td>Weeks 2 to 13</td>
</tr>
</tbody>
</table>

Note that classes start in week 2.

UNSW Blackboard: The MATH3570 web pages on UNSW Blackboard will have links to PDFs of any printed materials for this course - Outline Lecture Notes, Problem sheets, Assignments, Assignment Solutions, Past Mid-Session Tests and Exams and Solutions.

A link in Blackboard called “Maths & Stats Marks” will allow students to check their assessment and test marks have been correctly recorded.

Course aims

This course aims to re-examine the key ideas behind the Calculus and to give a deeper understanding of the notions of limit, continuity, differentiability and integrability. We may also deal with sequences and series of functions and examine the concept of uniform convergence. Students will gain an understanding of the underlying concepts of Calculus and rigorously justify ideas which they have previously met at an intuitive level. The emphasis throughout will be on proof rather than applications.
Relation to other mathematics courses

This course which is compulsory for Mathematics Education majors is designed to give the theoretical background that underpins high school and University Calculus.

Student Learning Outcomes

Students taking this course will develop an appreciation for the theoretical and logical basis for the main results of one variable Calculus.

The ability to provide logical and coherent proofs of Calculus results, and the ability to solve Calculus problems via abstract algebraic methods will be paramount.

Through regularly attending lectures and applying themselves in tutorial exercises, students will develop competency in mathematical presentation, written and verbal skills.

Relation to graduate attributes

The above outcomes are related to the development of the Science Faculty Graduate Attributes, in particular: 1. Research, inquiry and analytical thinking abilities, 4. Communication, 6. Information literacy

Teaching strategies underpinning the course

New ideas and skills are introduced and demonstrated in lectures, then students develop these skills by applying them to specific tasks in tutorials and assessments.

Rationale for learning and teaching strategies

We believe that effective learning is best supported by a climate of enquiry, in which students are actively engaged in the learning process. To ensure effective learning, students should participate in class as outlined below.

We believe that effective learning is achieved when students attend all classes, have prepared effectively for classes by reading through previous lecture notes, in the case of lectures, and, in the case of tutorials, by having made a serious attempt at doing for themselves the tutorial problems prior to the tutorials.

Furthermore, lectures should be viewed by the student as an opportunity to learn, rather than just copy down lecture notes. Effective learning is achieved when students have a genuine interest in the subject and make a serious effort to master the basic material.
Assessment

Assessment in this course will consist of

1. two assignments (10% each), due at the end of weeks 5 and 11;

2. one 50 minute mid-semester test (15%) at the Monday 12 noon class of week 8, covering approximately the first 3 topics of the course;

3. a 2 hour final examination (65%) in the June examination period covering the entire course.

In the assignments and the mid-semester test, marks will be awarded for correct working, logical setting out and appropriate explanations and not just the final answer. The main rationale for the assignments and test is to give students practice and feedback on logic and the setting out of proofs and arguments in the context of calculus.

Assignments

**Rationale:** Assignments will give an opportunity for students to try their hand at more difficult problems requiring more than one line of argument and also introduce them to aspects of the subject which are not explicitly covered in lectures.

The Assignments will be distributed by the second class of weeks 3 and 9 and are due no later than Thursday 4pm of weeks 5 and 11. If assignments are not handed in at class, they must be handed to me in person at my office or uploaded to Blackboard. Late assignments will not normally be accepted.

After the assignments are returned an opportunity to resubmit improved solutions will be given. Only questions for which you made a reasonable attempt in the first submission can be resubmitted. If your mark for the first submission is $M_1$ and for the resubmission is $M_2$, then your mark for the assignment will be $\max(M_1, \frac{1}{3}M_1 + \frac{2}{3}M_2)$.

Assignments must be YOUR OWN WORK, or severe penalties will be incurred. You will have to sign the University’s plagiarism declaration for each assignment, declaring that the assignment is your own work.

Mid-Session Test

**Rationale:** The Mid-Session Test will give students feedback on their progress and mastery of the material.

There will be short answer questions in which correct answers are sought and there will be some longer questions requiring clear and logical presentation of correct solutions as well as some simple proofs and verbal explanations.
The test will be held in the second class of Week 8, ie 11am Thursday 26th April.
You may bring your own UNSW approved Scientific Calculator to the test. Calculators will not be provided for you.

Repeat Mid-semester Test:

A repeat mid-semester test will be offered for students who are ill or who perform poorly in the original test. It will be held the week following the original test at a time and place to be determined and announced on Blackboard. The following rules will apply:

- The topics examinable for the repeat test will be the same as for the original test. However within these topics different questions may be asked.
- Students who sit the original test and receive a mark of less than 70% may sit the repeat test. The maximum mark that can be achieved in the repeat test will be 70% of the total.
- Students who miss the original test and have a reasonable excuse (eg medical) must sit the repeat test and may get any mark up to 100%.
- Students who miss the original test and do not have a reasonable excuse must sit the repeat test but may only get up to 70%.
- If a student’s mark on the repeat test is worse than on the original test, the previous mark will count.

If you are absent from the original test, in order to be eligible to score more than 70% in the Repeat test, you must provide a medical certificate or other appropriate documentation.

If you miss both tests, you must provide documentation (eg a medical certificate) for both tests in order to gain a re-weighted assessment based only on the exam and assignments.

Examination

Duration: Two hours.

Rationale: The final examination will assess student mastery of the material covered in the lectures.

Weighting: 65% of your final mark.

Further details about the final examination will be available in class closer to the time.
Syllabus and Class Schedule

Printed lecture notes will be available on Blackboard. These should be read in advance of the class where the material will be presented and discussed.

<table>
<thead>
<tr>
<th>Week</th>
<th>Lecture Topic/Tutorial/Test</th>
<th>Hrs</th>
<th>Classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Introduction and 1. Inequalities and Real Numbers</td>
<td>3</td>
<td>W2C1–W3C1</td>
</tr>
<tr>
<td>3</td>
<td>Tutorial 1</td>
<td>1</td>
<td>W3C2</td>
</tr>
<tr>
<td>4-5</td>
<td>2. Sequences</td>
<td>3</td>
<td>W4C1–W5C1</td>
</tr>
<tr>
<td>5</td>
<td>Tutorial 2</td>
<td>1</td>
<td>W5C2</td>
</tr>
<tr>
<td>5</td>
<td>Assignment 1 due end Week 5</td>
<td></td>
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<tr>
<td>6-7</td>
<td>3. Continuity</td>
<td>3</td>
<td>W6C1–W7C1</td>
</tr>
<tr>
<td>7</td>
<td>Tutorial 3</td>
<td>1</td>
<td>W7C2</td>
</tr>
<tr>
<td>8</td>
<td>Mid-Session Test Preparation Tutorial</td>
<td>1</td>
<td>W8C1</td>
</tr>
<tr>
<td>8</td>
<td>Mid-Session Test on topics 1 – 3</td>
<td>1</td>
<td>W8C2</td>
</tr>
<tr>
<td>9</td>
<td>4. Differentiability</td>
<td>2</td>
<td>W9C1–W9C2</td>
</tr>
<tr>
<td>10</td>
<td>Tutorial 4</td>
<td>1</td>
<td>W10C1</td>
</tr>
<tr>
<td>10-11</td>
<td>5. Integration</td>
<td>2</td>
<td>W10C2–W11C1</td>
</tr>
<tr>
<td>11</td>
<td>Tutorial 5</td>
<td>1</td>
<td>W11C2</td>
</tr>
<tr>
<td>11</td>
<td>Assignment 2 due end of Week 11</td>
<td></td>
<td></td>
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<tr>
<td>12-13</td>
<td>6. Series</td>
<td>3</td>
<td>W12C1–W13C1</td>
</tr>
<tr>
<td>13</td>
<td>Tutorial 6</td>
<td>1</td>
<td>W13C2</td>
</tr>
</tbody>
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Additional resources and support

Tutorial Problems

A set of tutorial problems for each topic will be available from UNSW Blackboard. These problems are for YOU to do to enhance mastery of the course. Students should attempt most of the problems BEFORE the tutorial when they will be considered.

SOME of the problems will be done in tutorials, but you will learn a lot more if you try to do them before the tutorial.
Textbooks

There is no set text for this course.

The content of the course will be defined by the lectures. Any book on elementary calculus (such as the standard first & second year text *Calculus: One and Several Variables* by Salas, Hille and Etgen) may prove useful. (This course is concerned only with one variable calculus).

For books more closely connected to the themes of this course, you may consult any of:

- *Elementary Mathematical Analysis* by Colin Clark (2nd ed. Belmont, 1982), previously published as *The Theoretical Side of Calculus*.

Also there are many books related to some of the topics. The short books “Infinite series” by Knopp and Hyslop are classics.

All these are available in the UNSW library. Further suggestions may be mentioned in lectures.

The book by Spivak is a classic text with a chatty, readable style but is also quite rigorous on proofs. It was written as a first University level calculus text for advanced students who had seen calculus at high school, but has fallen out of favour for that purpose as most first year calculus courses have become less theoretical.

The book by Gaughan covers most of the material of this course and is closest to the aims of this course.

The books by Rudin and Marsden are a bit more advanced.

Course Evaluation and Development

The School of Mathematics and Statistics evaluates each course each time it is run. We carefully consider the student responses and their implications for course development. It is common practice to discuss informally with students how the course and their mastery of it are progressing.
Administrative matters

Additional Assessment

Important information on

- Additional Assessment
- School Rules and Regulations

can be found on the School’s website at

http://www.maths.unsw.edu.au/currentstudents/assessment-policies

Please carefully read this page and the documents two which it links.

Note that students with poor class attendance (ie below 70%) or sub-par pre-exam assessment of below 40% will **not** be granted normal additional assessment if they miss the final exam due to illness or misadventure or are ill at the final exam.

Plagiarism and academic honesty

Plagiarism is the presentation of the thoughts or work of another as one’s own. Issues you must be aware of regarding plagiarism and the university’s policies on academic honesty and plagiarism can be found at

http://www.lc.unsw.edu.au/plagiarism

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