THE UNIVERSITY OF SYDNEY
Semester 1, 2017

Information Sheet for **MATH1901 Differential Calculus (Advanced)**

Websites: It is important that you check both the Junior Mathematics website and the MATH1901 website regularly.

Junior Mathematics webpage: `http://www.maths.usyd.edu.au/u/UG/JM/`
MATH1901 webpage: `http://www.maths.usyd.edu.au/u/UG/JM/MATH1901`

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 MATH1901 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:

Times	Location	Lecturer
8 am Thu, Weeks 1–13 8 am Fri, Weeks 1–5 & 7–13	Seymour Centre LT S301 (York) ABS Auditorium (B2010)	A/Prof Daniel Daners

Lectures run for 13 weeks. The first lecture will be on Thursday 9 March. The last lecture will be on Friday 9 June.

Consultation times: Consultation times will be posted on the MATH1901 webpage.

Tutorials: Tutorials (one per week) start in Week 2. You should attend the tutorial given on your personal timetable. Attendance at tutorials will be recorded.

Tutorial and exercise sheets: The question sheets for a given week will be available on the MATH1901 webpage. Solutions to tutorial exercises for week n will usually be posted on the web by the afternoon of the Friday of week n.

Course notes: *MATH1901 and MATH1906: Differential Calculus (Advanced)*, by Jenny Henderson. Available for purchase from Kopystop, 55 Mountain St, Broadway. See the Junior Mathematics Handbook for other references.

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

70%:	Exam at end of Semester 1.
10%:	Quiz 1 mark (using the better mark principle).
10%:	Quiz 2 mark (using the better mark principle).
5%:	Assignment 1 mark.
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 10%, and the assignments will count for 10% of your overall mark. The assignment marks count for 10% 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. Students intending to continue with further advanced units of study should be aiming to obtain a credit or higher.

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	Mon 13 Mar	11:59 pm Thu 23 Mar	11:59 pm Thu 30 Mar	9 am Mon 3 Apr
Quiz 1		24 & 27 Apr (Week 7)		1 & 4 May (Week 8)
Assignment 2	Mon 1 May	11:59 pm Thu 11 May	11:59 pm Thu 18 May	9 am Mon 22 May
Quiz 2		29 May & 1 Jun (Week 12)		5 & 8 Jun (Week 13)

* 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. You may also email questions about the subject to `MATH1901@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.

Aims and learning outcomes: *MATH1901 Differential Calculus (Advanced)* is the beginning of a natural hierarchy of mathematics units of study, the first continuation being *MATH1903 Integral Calculus and Modelling (Advanced)* in Semester 2, followed by advanced units in the intermediate year, which also build upon *MATH1902 Linear Algebra*. The unit of study begins with an introduction to the field of complex numbers, where, for example, every quadratic equation has two roots or a double root and every number except zero has a logarithm. All of modern mathematics and its applications to physics and engineering would grind to a screeching halt without complex numbers. Next, the familiar notation for functions gets an upgrade. Then the main theme of the unit is introduced, namely, the concept of a limit. Limits will be treated rigorously (the "epsilon-delta" definition), although enough rules will be developed to allow the student to calculate and manipulate limits without having to reach for the epsilons and deltas except on special occasions. With the concept of limit in place, one can now start endowing functions with nice properties such as continuity or differentiability, and derive consequences of these properties. In particular, a strong form of l'Hôpital's rule for calculating certain types of limits will be proved. You are now in the land of differential calculus. The later part of the unit deals with the powerful theory of Taylor polynomials and the extension of continuity and differentiability to functions of two or more variables and their graphs in space, borrowing some vector theory from MATH1902.

By the end of the semester, students should be able to:

- apply mathematical logic and rigour to solving problems and express mathematical ideas coherently in written and oral form;
- demonstrate fluency in manipulating complex numbers, functions of one or more variables, inverse functions, limits, derivatives, maxima and minima, and polynomial approximations;
- understand and know how to use the theorems that apply specifically to continuous functions (intermediate value theorem, extreme value theorem) and to differentiable functions (chain rule, Rolle's theorem, mean value theorem, l'Hôpital's rule, Taylor's formula with remainder);
- understand the differential calculus of functions of two or more variables, continuity, partial differentiation, directional differentiation, full differentiability, chain rule, implicit differentiation;
- be able to represent surfaces in space by contour lines (level curves) in the plane, and be able to construct tangent planes on surfaces as well as tangent lines on surfaces in given directions and in the steepest direction.

Proposed week-by-week outline:

Week	Topics
1	Complex numbers in Cartesian and polar form. Complex powers and De Moivre's Theorem.
2	nth roots. The complex exponential function. Representing complex functions.
3	Injective and bijective functions. Inverse functions. Hyperbolic functions.
4	Limits and the limit laws.
5	Continuity. Intermediate Value Theorem.
6	Differentiability. Rolle's Theorem.
7	Mean Value Theorem. L'Hôpital's Rule.
8	Taylor polynomials.
9	Curves and surfaces in 3D space. Functions of 2 variables. Level curves.
10	Limits of functions of 2 variables. Partial derivatives. Tangent planes.
11	Linear approximations. Chain rule for functions of 2 variables.
12	Implicit differentiation. Directional derivative and gradient.
13	Revision.