THE UNIVERSITY OF SYDNEY
Semester 2, 2017

Information Sheet for **MATH1903 Integral Calculus and Modelling (Advanced)**

Websites: It is important that you check both the Junior Mathematics website and the MATH1903 website regularly.

Junior Mathematics webpage: `http://www.maths.usyd.edu.au/u/UG/JM/`
MATH1903 webpage: `http://www.maths.usyd.edu.au/u/UG/JM/MATH1903`

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 MATH1903 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	Office
8am Thu & Fri	ABS Aud B2010	David Easdown/Daniel Daners	Carslaw 619/715

Lectures run for 13 weeks. The first lecture will be on Thursday 3rd August. The last lecture will be on Friday 3rd November.

Consultation times: Consultation times will be posted on the MATH1903 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. 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 MATH1903 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: Luckock and Dullin. *Lecture notes for MATH1903: Integral Calculus and Modelling (Adv).* School of Mathematics and Statistics, University of Sydney, Australia 2017. Available from Kopystop.

Reference book: James Stewart. *Calculus.* Cengage Learning. 7th Edition, International Edition, 2012, ISBN 978-0-538-49884-5 or 8th Edition, Metric Version, 2015, ISBN 978-1-305-26672-8. Available from the Co-op Bookshop.

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

70%: Exam at end of Semester 2.
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 which are dependent on this unit of study.

Examination: There is one examination of 1.5 hours' duration during the examination period at the end of Semester 2. 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. Quizzes will only be returned in the tutorial you sat the quiz and must be collected by week 13.

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 (check that you can view each page).

Assessment and feedback schedule:

Task	**Available**	**Deadline/date**	**Latest extension***	**Feedback**
Assignment 1	Mon 7 Aug	5pm Thu 17 Aug	5pm Thu 24 Aug	9am Mon 28 Aug
Quiz 1		5 Sep (Week 6) 7 Sep (SSP)		12 & 14 Sep (Week 7)
Assignment 2	Mon 18 Sep	5pm Thu 5 Oct	5pm Thu 12 Oct	9am Mon 16 Oct
Quiz 2		17 Oct (Week 11) 19 Oct (SSP)		24 & 26 Oct (Week 12)

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

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/students/special-consideration-and-arrangements.html`. Applications must be made using the University's formal online application process.
>
> 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.
>
> 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".

If you are granted a "mark adjustment" for a quiz or an assignment, any marks obtained will not count and the weighting will be added to the examination weighting.

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, 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 `MATH1903@sydney.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: This unit of study builds on your first semester calculus course, and is an important part of your transition into intermediate units of study. The unit has two components: Integral Calculus (Weeks 1–6) and Differential Equations and Modelling (Weeks 7–12), with Week 13 reserved for revision lectures.
The integral calculus component of the course puts the notion of the Riemann integral onto a solid footing and builds on the intuitive understanding you have of integration from high school. This part of the course also contains an introduction to sequences and series, and a careful study of Taylor polynomials and Taylor series. This is a beautiful area of mathematics, with many remarkable formulae and theorems, and it is essential for your later studies in both pure and applied mathematics.
The component on differential equations and modelling introduces the notion of a differential equations and applies them to a variety of modelling problems. Differential equations are the fundamental tools in describing change. The solution of a differential equation is a family of functions, depending on arbitrary constants that are fixed by initial or boundary conditions. In some cases solving a differential equation can be reduced to integration, and a variety of such methods will be derived.

Objectives: By the end of semester, students should:

- appreciate the significance of Integral Calculus, and in particular appreciate the powerful interplay between Integral and Differential Calculus (via the Fundamental Theorem of Calculus);
- be comfortable working with functions defined by integrals, and have an intuitive understanding of how these functions behave;
- have a basic understanding of sequences and series;
- understand the notion of convergence of sequences and series, and be able to construct proofs of convergence;
- appreciate the beauty of calculus by working through tutorial exercises on some mathematical gems: π is irrational, e^r is irrational for all $r \in \mathbb{Q}\backslash\{0\}$, Stirling's asymptotic formula for $n!$, Wallis' product formula for π, Leibnitz' series, Euler's series, and many more;
- understand the concept of a differential equation geometrically (direction field) and analytically (general solution versus particular solution);
- appreciate the power of modelling with differential equations, and be familiar with a variety of examples of modelling in the sciences;
- be able to solve simple first-order differential equation by either separation of variables or using an integrating factor;

- understand how to change variables in a differential equation;
- solve second-order linear equations with constant coefficients (homogeneous and inhomogeneous) with ease;
- have a basic understanding of systems of first-order differential equations.

Proposed week-by-week outline:

Week	**Topic**	**Contents**
1	Riemann sums and integrals	Evaluation of Riemann sums. Definition of the Riemann integral.
2	Fundamental theorem of calculus	Fundamental Theorem of Calculus. Functions defined by integrals.
3	Applications of the integral	Areas, volumes, lengths and surface areas.
4	Improper integrals	Integrals of unbounded functions. Integrals over unbounded intervals. Comparison tests. p-integrals.
5	Sequences and series	Convergence of sequences and series. Comparison tests for sequences and series. p-series.
6	Taylor polynomials and series	The remainder term. Taylor's Theorem. Taylor series. Applications of Taylor series.
7	Introduction to differential equations and modelling	Exponential growth. Order, general solution. Simple solutions. Direction Fields. Visualisation of solution curves.
8	First-order separable DEs	Separable Equations. Uniqueness. Equilibrium solutions. Logistic model. Partial Fractions.
9	First-order linear DEs	Classification. Integrating Factor. Superposition principle. Change of variables. Families of curves and exact DEs.
10	Second-order DEs	IVPs and BVPs. Linear DEs: Superposition principle. Linear homogeneous constant coefficients.
11	Second-order linear inhomogeneous DEs	Method of undetermined coefficients. Simple harmonic motion without and with damping, resonance.
12	Systems of differential equations	Predator-prey system. Reduction to Second-order. Eigenvalues and stability. Matrix exponential.
13	Review	