
Information Sheet for **MATH2921: Vector Calculus and Differential Equations (Advanced)**

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TIMETABLE: Classes meet on Mondays at 1pm (Carslaw 175) , Wednesdays at 10am (Carslaw 175), Thursdays at 11am (Carslaw 175) and 2pm (Carslaw 157). Starting in week 2 you are also required to attend one tutorial each week (see your personal timetable).

WEBSITES:

- The main website for the course will be the School of Mathematics and Statistics' course website <http://www.maths.usyd.edu.au/u/UG/IM/MATH2921>.
- You are required to turn in your assignments via the similarity detection software turnitin, through the Canvas website: <https://canvas.sydney.edu.au>.
Lecture recordings will also be automatically posted here (in theory anyway).
- I will also be using the ed website <https://edstem.org> for announcements/discussions etc.
- You might also find some useful information via the School's Intermediate Mathematics webpage: <http://www.maths.usyd.edu.au/u/UG/IM/>

The course page will be continuously updated with resources and other useful links. Announcements and assessment tasks will also be made via the ed page at various times throughout the semester.

CONSULTATION TIMES: My consultation hour is Monday 2-3pm. I am happy to meet at other times as well, but please email me to make an appointment.

TUTORIAL AND EXERCISE SHEETS: The tutorial question and solution sheets will be available on the course webpage. Tutorial solutions will be posted one week after the tutorial.

RESOURCES: In lieu of course notes this, course will be using two open source text books.

- *Calculus III*, by Jerrold Marsden and Alan Weinstein. Undergraduate Texts in Mathematics. Springer-Verlag, New York. 1985.
Available for free download at <https://authors.library.caltech.edu/25043/>
- *Elementary Differential Equations with Boundary Value Problems*, by William F. Trench. Free Online edition 1.01 December 2013.
Available for free download at <https://digitalcommons.trinity.edu/mono/9/>

Each of these books is available via the American Institute of Mathematics' "Free Textbook Initiative." You can find the books (and student solutions manuals) via the above links, or through the Free Textbook Initiative website <https://aimath.org/textbooks/approved-textbooks/>
Some additional material will also come from Chapter 2 of the book

- *Introduction to Partial Differential Equations* by Peter. J. Olver. Undergraduate Texts in Mathematics. Springer, New York. 2016.

This book is freely available to University of Sydney students via the University Library.

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

- 70%: Exam at end of Semester 1,
- 10%: Assignment: **due Sunday, 31st of March at 23:59** (end of week 5),
- 10%: Quiz 1: **Thursday, 18th April at 2:00pm** (week 8),
- 10%: Quiz 2: **Thursday, 23rd of May at 2:00pm** (week 12).

EXAMINATION: There is one 2 hour examination held 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.

IN CLASS QUIZZES: There will be two 50 minute in class quizzes. One in week 8 and one in week 12's Thursday 2:00pm class meetings:

QUIZ 1: Thursday, 18th April at 2:00pm

QUIZ 2: Thursday, 23rd May at 2:00pm

ASSIGNMENTS: There will be one assignment.

- The assignment will be posted in week 2, and due:

Sunday, the 31st of March, at the end of week 5, by 23:59 pm.

Assignments must be **typed** and a pdf copy must be submitted via the turnitin system on the Canvas website for this course. **Hand written assignments or photographs thereof will not be accepted.**

Late work: As per University policy, no late work is accepted.

Assignments must be typed: For typing mathematics, I recommend learning the markup language LaTeX. This is already on the computers in the Carslaw labs. If you wish to get it yourself, for Windows/Linux machines you can find it here: <http://miktex.org> for a Mac: <http://tug.org/mactex>. I will provide a LaTeX template on the course website. You are welcome to use another means of typing your assignment, but, I can only really help you if you use LaTeX (I don't know how to use Word), and if you plan on continuing in mathematics (or physics or computer science), you should use LaTeX.

COMPUTER CLASSES: Computer classes will be held on Thursdays in weeks 1-13. I will be giving demonstrations of (interesting?) problems relating to the course material using the computer software package Mathematica. You can access Mathematica via the University's student software portal. Notebooks will be published on the course website.

COURSE TOPICS:

We will begin with a review partial differentiation, and move on to gradients, maxima and minima. We'll then cover, double and triple integrals and their computation, both in traditional and transformed coordinates. We will then move into line integrals and the basic theory of differentials, and the famous (important?) theorems from vector calculus in two and three dimensions: Green's theorem, Stoke's theorem, the circulation theorem, and the Flux and Divergence theorem. We will then review some techniques used to solve first order ordinary differential equations. We'll then move onto linear second order equations with constant coefficients, and their applications. We'll move onto higher order ODEs, as well as some basic theory of homogeneous linear systems and the method of variation of parameters for solving them. Then we'll move onto series methods for solving ODEs, and we'll conclude the first part of the course with applications of series methods in solving some famous (important?) linear partial differential equations.