



## MATH1023 : Multivariable Calculus and Modelling

Semester 1, 2019 | 3 Credit points | Mode of delivery: Normal (lecture/lab/tutorial) day | Unit type: Standard

**Coordinator:** A/Prof Sharon Stephen

Faculty of Science , Mathematics and Statistics Academic Operations

### Unit description

Calculus is a discipline of mathematics that finds profound applications in science, engineering, and economics. This unit investigates multivariable differential calculus and modelling. Emphasis is given both to the theoretical and foundational aspects of the subject, as well as developing the valuable skill of applying the mathematical theory to solve practical problems. Topics covered in this unit of study include mathematical modelling, first-order differential equations, second-order differential equations, systems of linear equations, visualisation in two and three dimensions, partial derivatives, directional derivatives, the gradient vector, and optimisation for functions of more than one variable.

**Prohibitions:** MATH1013 or MATH1903 or MATH1907 or MATH1003 or MATH1923 or MATH1933

**Pre-requisites:** NSW HSC 2 unit Mathematics or equivalent or a credit or above in MATH1111

**Co-requisites:** None

**Assumed knowledge:** MATH1X21, HSC Mathematics Extension 1 or equivalent

### Unit aims

This unit is designed to provide a thorough preparation for further study in mathematics, statistics, and science, extending what you know from high school mathematics by introducing a level of rigour and broader scope of applications of Calculus.

### Learning outcomes

**At the completion of this unit, you should be able to:**

- LO1.** apply mathematical logic and rigor to solving problems
- LO2.** express mathematical ideas and arguments coherently in written form
- LO3.** set up differential equations which arise from mathematical models of interest to scientists and engineers
- LO4.** understand the relationship between a first-order differential equation, its direction field, and its solution curves
- LO5.** solve separable and first-order linear differential equations
- LO6.** solve second-order homogeneous linear differential equations with constant coefficients
- LO7.** calculate partial derivatives and understand their geometric significance
- LO8.** find equations of tangent planes to surfaces
- LO9.** optimise functions of two or more variables
- LO10.** calculate the directional derivative and gradient vector, and understand their physical significance.

### Graduate qualities

The graduate qualities are the qualities and skills that all University of Sydney graduates must demonstrate on successful completion of an award course. As a future Sydney graduate, the set of qualities have been designed to equip you for the contemporary world. For more information go to [sydney.edu.au/students/graduate-qualities](http://sydney.edu.au/students/graduate-qualities)

- GQ1** Depth of disciplinary expertise
- GQ2** Critical thinking and problem solving
- GQ3** Communication (oral and written)
- GQ4** Information & digital literacy
- GQ5** Inventiveness
- GQ6** Cultural competence
- GQ7** Interdisciplinary effectiveness
- GQ8** Integrated professional, ethical and personal identity
- GQ9** Influence



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### Study commitment

For a 3 credit point unit, this equates to roughly 60-75 hours of student effort in total.

### Teaching staff and contact details

**Coordinator:** A/Prof Sharon Stephen,  
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**Teaching staff:** Dr. Jonathan Spreer, [jonathan.spreer@sydney.edu.au](mailto:jonathan.spreer@sydney.edu.au)  
Dr. Yusra Naqvi, [yusra.naqvi@sydney.edu.au](mailto:yusra.naqvi@sydney.edu.au)

**Administrative and professional staff:** [MATH1023@sydney.edu.au](mailto:MATH1023@sydney.edu.au)

### Weekly schedule

Week	Topic	Learning activity type	Learning outcomes
Week 1	Introduction to models and differential equations	Lecture	
Week 2	Separable equations	Lecture and tutorial	
Week 3	Applications of separable equations	Lecture and tutorial	
Week 4	Linear differential equations	Lecture and tutorial	
Week 5	Second-order differential equations	Lecture and tutorial	
Week 6	Resonance and coupled differential equations	Lecture and tutorial	
Week 7	Curves and surfaces in three-dimensional space	Lecture and tutorial	
Week 8	Partial derivatives and tangent planes	Lecture and tutorial	
Week 9	Second-order partial derivatives and continuity	Lecture and tutorial	
Week 10	Directional derivatives and the gradient vector	Lecture and tutorial	
Week 11	Further applications of the partial derivative	Lecture and tutorial	
Week 12	Optimizing functions of two variables	Lecture and tutorial	
Week 13	Revision/further applications	Lecture and tutorial	

### Assessments

Assessment title	Assessment category	Assessment type	Description of assessment type	Individual or group	Length / duration	Weight	Due date & time	Closing date	Learning outcomes
Assignment 1	Submitted work	Assignment		Individual		2.5%	Thu 21 Mar 11:59pm	Thu 28 Mar 11:59pm	
Assignment 2	Submitted work	Assignment		Individual		2.5%	Thu 9 May 11:59pm	Thu 16 May 11:59pm	
Quiz 1	In-class assessment	Tutorial quiz, small test or online task		Individual		15%	Mon 8- Wed 10 Apr	Wed 10 Apr	
Quiz 2	In-class assessment	Tutorial quiz, small test or online task		Individual		15%	Mon 20- Wed 22 May	Wed 22 May	
Exam	Exam	Final exam		Individual	1.5 hours	65%			

### Overview of assessments



Below are brief assessment details. Further information can be found on Canvas.

- **Assignments:** There are two assignments, which must be submitted electronically, as PDF files only, via Canvas. 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.
- **Quizzes:** Quizzes will be held during tutorials. You must sit for the quiz during the tutorial in which you are enrolled, unless you have permission 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. The better mark principle will be used for the quizzes so do not submit an application for Special Consideration or Special Arrangements if you miss a quiz. 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.
- **Examination:** Further information about the exam will be made available at a later date on Canvas.

### Readings

All readings for this unit can be accessed on the Library eReserve link available on Canvas.

- Course Notes for MATH1023 Multivariable Calculus and Modelling are available for purchase from Kopystop, 55 Mountain St, Broadway.
- Reference book: James Stewart. Calculus. Cengage Learning. 8th Edition, Metric Version, 2015, ISBN 978-1-305-26672-8. Available from the Co-op Bookshop.

### Other resources

- **Tutorials:** Tutorials 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. If you are absent from a tutorial do not apply for Special Consideration or Special Arrangement, since there is no assessment associated with the missed tutorial.
- **Tutorial and exercise sheets:** The question sheets for a given week will be available on the MATH1023 webpage. Solutions to tutorial exercises for week n will usually be posted on the web by the afternoon of the Friday of week n.
- **Ed Discussion forum:** <https://edstem.org>

### Late penalties

All assignments must be submitted by the due date. Students are expected to manage their time and to prioritise tasks to meet deadlines. Assessment items submitted after the due date without an approved extension using a special consideration or special arrangement form or request will incur penalties.

If you encounter a problem submitting your work on time, you may be able to arrange a simple extension. A simple extension is an informal arrangement between you and your unit of study coordinator. You may be able to receive an extension of up to two working days for non-examination tasks, as outlined in clause 66A of the Coursework Policy 2014. If you need an extension for a longer period, you may be eligible to apply for special consideration. [sydney.edu.au/students/simple-extensions](https://sydney.edu.au/students/simple-extensions)

### Special consideration

A special consideration application can be made for short-term circumstances beyond your control, such as illness, injury or misadventure, which affect your preparation or performance in an assessment. [sydney.edu.au/special-consideration-and-arrangements](https://sydney.edu.au/special-consideration-and-arrangements)

### Assessment grading

The University awards common result grades, set out in the [Coursework Policy 2014](#) (Schedule 1).

As a general guide, a High distinction indicates work of an exceptional standard, a Distinction a very high standard, a credit a good standard, and a pass an acceptable standard.

Result name	Mark range	Description
High distinction	85 - 100	Representing complete or close to complete mastery of the material.
Distinction	75 - 84	Representing excellence, but substantially less than complete mastery.



Credit	65 - 74	Representing a creditable performance that goes beyond routine knowledge and understanding, but less than excellence.
Pass	50 - 64	Representing at least routine knowledge and understanding over a spectrum of topics and important ideas and concepts in the course.
Fail	0 - 49	When you don't meet the learning outcomes of the unit to a satisfactory standard.

For more information see: [sydney.edu.au/students/guide-to-grades](https://sydney.edu.au/students/guide-to-grades)

### Educational integrity

While the University is aware that the vast majority of students and staff act ethically and honestly, it is opposed to and will not tolerate academic dishonesty or plagiarism and will treat all allegations of dishonesty seriously.

All written assignments submitted in this unit of study will be submitted to the similarity detecting software program known as Turnitin. Turnitin searches for matches between text in your written assessment task and text sourced from the Internet, published works and assignments that have previously been submitted to Turnitin. If such matches indicate evidence of plagiarism to your teacher, they are required to report your work for further investigation.

Further information on academic honesty and the resources available to all students can be found on the Academic Integrity page of the current students' website: [sydney.edu.au/educational-integrity](https://sydney.edu.au/educational-integrity)

### Work, health and safety requirements for this unit

- We are governed by the Work Health and Safety Act 2011, Work Health and Safety Regulation 2011 and Codes of Practice. Penalties for non-compliance have increased. Everyone has a responsibility for health and safety at work. The University's [Work Health and Safety policy](#) explains the responsibilities and expectations of workers and others, and the procedures for managing WHS risks associated with University activities.

### General Laboratory Safety Rules

- No eating or drinking is allowed in any laboratory under any circumstances
- A laboratory coat and closed-toe shoes are mandatory
- Follow safety instructions in your manual and posted in laboratories
- In case of fire, follow instructions posted outside the laboratory door
- First aid kits, eye wash and fire extinguishers are located in or immediately outside each laboratory

As a precautionary measure, it is recommended that you have a current tetanus immunisation. This can be obtained from University Health Service: [unihealth.usyd.edu.au/](https://unihealth.usyd.edu.au/)

### Other requirements for this unit

- There are no other requirements for this unit.

### Site visit guidelines

- There are no site visit guidelines for this unit.

### Additional costs

- There are no additional costs for this unit.

### Closing the loop

- Please check the Canvas site for this unit for any information.

### Links to policies and other information for students

- Student administration: [sydney.edu.au/student-centre](https://sydney.edu.au/student-centre)
- Wellbeing and support: [sydney.edu.au/students/health-wellbeing](https://sydney.edu.au/students/health-wellbeing)
- Study resources: [sydney.edu.au/students/learning-services](https://sydney.edu.au/students/learning-services)



- Expectations of student conduct: [sydney.edu.au/student-responsibilities](https://sydney.edu.au/student-responsibilities)
- Learning and Teaching Policy: [sydney.edu.au/policies/](https://sydney.edu.au/policies/)
- Academic appeals: [sydney.edu.au/students/academic-appeals](https://sydney.edu.au/students/academic-appeals)
- Libraries: [sydney.edu.au/students/libraries](https://sydney.edu.au/students/libraries)

**Other relevant information**

- Please check the Canvas site for this unit for any information.

**Other links**

- Science student portal: [canvas.sydney.edu.au/courses/7114](https://canvas.sydney.edu.au/courses/7114)
- Mathematics and Statistics student portal: [canvas.sydney.edu.au/courses/7913](https://canvas.sydney.edu.au/courses/7913)