MATH1021: Calculus Of One Variable

Semester 2, 2019 | 3 Credit points | Mode of delivery: Normal (lecture/lab/tutorial) day | Unit type: Standard

Coordinator: Sharon Stephen

Faculty of Science (SCIE), 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 differential calculus and integral calculus of one variable and the diverse applications of this theory. 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 complex numbers, functions of a single variable, limits and continuity, differentiation, optimisation, Taylor polynomials, Taylor's Theorem, Taylor series, Riemann sums, and Riemann integrals.

Prohibitions: MATH1011 or MATH1901 or MATH1906 or ENVX1001 or MATH1001 or MATH1921 or MATH1931

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

Co-requisites : None

Assumed knowledge: HSC Mathematics Extension 1 or equivalent.

Unit aims

The aims of this unit are to: introduce the concept of a complex number; consolidate your understanding of functions of one variable, limits and continuity; illustrate applications of differentiation to solve practical problems; introduce Taylor polynomials and Taylor series; show the relationship between integration and summation; illustrate how the Fundamental Theorem of Calculus can be used both to evaluate integrals and to define new functions, and determine their basic properties; develop standard techniques for finding anti-derivatives; improve your ability to think logically, analytically, and abstractly; enhance your problem-solving skills; provides students with a solid foundation for further studies in mathematics and/or other scientific disciplines.

Learning outcomes

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

LO1. apply mathematical logic and rigour to solve problems
LO2. read and write basic set notation
LO3. demonstrate competency in arithmetic operations with complex numbers in Cartesian, polar, and exponential form
LO4. use de Moivre's theorem to find powers and roots of complex numbers
LO5. solve simple polynomial equations involving complex numbers
LO6. apply an intuitive understanding of a limit and knowledge of basic limit laws to calculate the limits of functions
LO7. use the differential of a function to calculate critical points and apply them to optimise functions of one variable
LO8. find inverse functions
LO9. use L'Hopital's rule to find limits of indeterminate forms
LO10. find Taylor polynomials and the Taylor series expansion of a function
LO11. approximate definite integrals by finite sums and vice versa
LO12. express areas, and volumes of revolution, as definite integrals
LO13. apply standard integration techniques to find anti-derivatives and definite integrals
LO14. determine properties of a function defined by an integral using the graph of its integrand
LO15. express mathematical ideas and arguments coherently in written form.

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. Please see https://sydney.edu.au/students/graduate-qualities.html

Study commitment

- Typically, there is a minimum expectation of 1.5-2 hours of student effort per week per credit point for units of study offered over a full semester. For a 3 credit point unit, this equates to roughly 60-75 hours of student effort in total.

Teaching staff and contact details

Coordinator : Sharon Stephen, sharon.stephen@sydney.edu.au

Teaching staff : Fernando Viera, fernando.viera@sydney.edu.au

Administrative and professional staff: MATH1021@sydney.edu.au

Learning activities schedule

Week	Topic	Learning activity type	Learning outcomes
Week 1	1. Set notation, the real number line; 2. Complex numbers in Cartesian form; 3. Complex plane, modulus	Lecture	LO2, LO3
Week 2	1. Complex numbers in polar form; 2. De Moivre's theorem; 3. Complex powers and nth roots	Lecture and tutorial	LO3, LO4, LO5
Week 3	1. Definition of e^iθ and e^z for z complex; 2. Applications to trigonometry; 3. Revision of domain and range of a function	Lecture and tutorial	LO5
Week 4	1. Limits and continuity; 2. Vertical and horizontal asymptotes	Lecture and tutorial	LO6
Week 5	1. Differentiation and the chain rule; 2. Implicit differentiation; 3. Hyperbolic and inverse functions	Lecture and tutorial	LO8
Week 6	1. Optimising and sketching functions of one variable; 2. Linear approximations and differentials; 3. L'Hopital's rule	Lecture and tutorial	LO7, LO9
Week 7	1. Taylor polynomials; 2. The remainder term	Lecture and tutorial	LO10
Week 8	Taylor series	Lecture and tutorial	LO10
Week 9	1. Riemann sums; 2. Definition of definite integral; 3. Non-positive functions	Lecture and tutorial	LO11, LO12
Week 10	1. Fundamental theorem of calculus (parts 1 and 2); 2. Functions defined by integrals; 3. Natural logarithm and exponential functions	Lecture and tutorial	LO14
Week 11	1. Integration by substitution; 2. Integration by parts; 3.Trigonometric substitutions	Lecture and tutorial	LO13
Week 12	1. Areas and volumes by slicing; 2. The disk and shell methods	Lecture and tutorial	LO12
Week 13	Revision	Lecture and tutorial	LO1, LO2, LO3, LO4, LO5, LO6, LO7, LO8, LO9, LO10, LO11, LO12, LO13, LO14, LO15

Assessments

Assessment title	Assessment category	Assessment type	Assessment type description	Individual or group	Weight	Due date & time	Closing date	Length/duration	Learning outcomes
Assignment 1	Submitted work	Assignment	n/a	Individual	2.5%	Week 3 22 August 2019 11.59pm	01/09/19 23:59	n/a	LO1, LO2, LO3, LO4
Quiz 1	In-class assessment	Tutorial quiz, small test or online task	n/a	Individual	15%	Week 6		40 minutes	LO1, LO2, LO3, LO4, LO5, LO6
Assignment 2	Submitted work	Assignment	n/a	Individual	2.5%	Week 8 26 September 2019 11.59pm	06/10/19 23:59	n/a	LO7, LO8, LO9, LO10
Quiz 2	In-class assessment	Tutorial quiz, small test or online task	n/a	Individual	15%	Week 12		40 minutes	LO8, LO9, LO10, LO11, LO12
Exam	Exam	Final exam	n/a	Individual	55%	Formal exam period		1.5 hours	LO1, LO2, LO3, LO4, LO5, LO6, LO7, LO8, LO9, LO10, LO11, LO12, LO13, LO14, LO15
Online quizzes	Submitted work	Assignment	n/a	Individual	10%	Weekly		n/a	LO1

Assessment summary

- **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 (Canvas) 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). Late submisions will receive a penalty.
- **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, granted 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.
- **Online quizzes:** There are twelve weekly online quizzes. Each online quiz consists of a set of randomized questions. The best 10 of your 12 quizzes will count, making each worth 1%. You cannot apply for special consideration for the quizzes. The better mark principle will apply for the total 10% - i.e. if your overall exam mark is higher, then your 10% for quizzes will come from your exam. The deadline for completion of each quiz is 11:59 pm Thursday (starting in week 2). We recommend that you follow the due dates outlined above to gain the most benefit from these quizzes.
- **Examination:** There is one examination 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.

Prescribed readings

- Course Notes for MATH1021 Calculus of One Variable are available for purchase from Kopystop, 55 Mountain St, Broadway.
- See the Junior Mathematics Handbook for other useful references.

Other resources

- **Tutorial and exercise sheets:** The question sheets for a given week will be available on the MATH1021 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

The Assessment Procedures 2011 provide that any written work submitted after 11:59pm on the due date will be penalised by 5% of the maximum awardable mark for each calendar day after the due date. If the assessment is submitted more than ten calendar days late, a mark of zero will be awarded.
However, a unit of study may prohibit late submission or waive late penalties only if expressly stated below.

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.

If you are eligible for special consideration, you must submit an online application and supporting documents within three working days of the assessment, unless exceptional circumstances apply.

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	
Distinction	75 - 84	
Credit	65 - 74	
Pass	50 - 64	
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.

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 detection software known as Turnitin. Turnitin searches for matches between text in your written assessment task and text sourced from the Internet, published works and assignments previously submitted to Turnitin. If such matches indicate evidence of plagiarism or other forms of dishonesty to your teacher, they are required to report your work for further investigation.

Further information on academic honesty, academic dishonesty, and the resources available to all students can be found on the academic integrity pages on the current students website: https://sydney.edu.au/students/academic-integrity.html

Work, health and safety requirements

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.

Other requirements

- **Attendance:** Unless otherwise indicated, students are expected to attend a minimum of 80% of timetabled activities for a unit of study, unless granted exemption by the Associate Dean. For some units of study the minimum attendance requirement, as specified in the relevant table of units or the unit of study outline, may be greater than 80%. The Associate Dean may determine that a student has failed a unit of study because of inadequate attendance.
- **Tutorial attendance:** 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. While there is no penalty if 80% attendance is not met we strongly recommend you attend tutorials regularly to keep up with the material and to engage with the tutorial questions. Since there is no assessment associated with the tutorials do not submit an application for Special Consideration or Special Arrangements for missed tutorials.

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

No changes have been made since this unit was last offered.

Links to policies and other information for students

The following information and services are available to all students:

- Student administration: sydney.edu.au/study/student-administration.html
- Wellbeing and support: sydney.edu.au/students/health-wellbeing.html
- Study resources: sydney.edu.au/students/learning-services.html
- Expectations of student conduct: sydney.edu.au/students/student-responsibilities.html
- Learning and Teaching Policy: sydney.edu.au/policies/
- Academic appeals: sydney.edu.au/students/academic-appeals.html
- Libraries: sydney.edu.au/students/libraries.html
- Financial support: sydney.edu.au/students/financial-support.html

Other relevant information

More information can be found on Canvas.

Other links

Science student portal (canvas.sydney.edu.au/courses/7114)

Mathematics and Statistics student portal (canvas.sydney.edu.au/courses/7913)