THE UNIVERSITY OF SYDNEY

MATH1111 : Introduction to Calculus

Semester 1, 2019 | 6 Credit points | Mode of delivery: Normal (lecture/lab/tutorial) day | Unit type: Standard

Coordinator: A/Prof Sharon Stephen

Faculty of Science , School of Mathematics and Statistics

Unit description

This unit is an introduction to the calculus of one variable. Topics covered include elementary functions, differentiation, basic integration techniques and coordinate geometry in three dimensions. Applications in science and engineering are emphasized.

Prohibitions: MATH1011 or MATH1901 or MATH1906 or MATH1001 or HSC Mathematics Extension 1 or HSC Mathematics Extension 2 or ENVX1001 or MATH1021 or MATH1921 or MATH1931

Pre-requisites: None

Co-requisites: None

Assumed knowledge: HSC General Mathematics.

Unit aims

The discovery of calculus, independently by Newton and Leibniz, in the 17th century, was one of the most profound and influential human intellectual achievements of all time, setting off chain reactions of scientific progress and developments that continue to accelerate into the 21st century. Calculus and its ramifications form the backbone of almost all applications of mathematics to physical and biological sciences and engineering. Students taking MATH1111 Introduction to Calculus will experience all of the key ideas and ingredients of calculus and start to see clearly how differential and integral calculus fit together and how they are applied to solve problems. They will develop sufficient fluency and mathematical literacy to undertake further studies in mathematics and statistics. They will have taken the first important steps to becoming confident users and interpreters of calculus in their own scientific disciplines. At the same time, students will start to gain an appreciation of the power, unity and beauty of mathematics that evolved over thousands of years, yet is indispensable to our modern way of life.

Learning outcomes

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

- **LO1.** Apply mathematical logic and rigour to solving problems, and express mathematical ideas coherently in written and oral form.
- **LO2.** Demonstrate fluency in manipulating real numbers, their symbolic representations, operations, and solve associated algebraic equations and inequalities.
- **LO3.** Become conversant with elementary functions, including trigonometric, exponential, logarithmic and hyperbolic functions and be able to apply them to real phenomena and to yield solutions of associated equations.
- **LO4.** Perform operations on functions and be able to invert functions where appropriate.
- **LO5.** Understand the definitions of a derivative, definite and indefinite integral and be able to apply the definitions to elementary functions.
- **LO6.** Develop fluency in rules of differentiation, such as the product, quotient and chain rules, and use them to differentiate complicated functions.
- **LO7.** Understand and apply the Fundamental Theorem of Calculus; and develop fluency in techniques of integration, such as integration by substitution, the method of partial fractions and integration by parts.
- **LO8.** Develop some fluency with coordinate geometry in three dimensions, planes, surfaces, ellipsoids, paraboloids, level curves and qualitative features such as peaks, troughs and saddle points.

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

- **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

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GQ7 Interdisciplinary effectiveness

GQ8 Integrated professional, ethical and personal identity

GQ9 Influence

Study commitment

For a 6 credit point unit, this equates to roughly 120-150 hours of student effort in total.

Teaching staff and contact details

Coordinator: A/Prof Sharon Stephen, Sharon.stephen@sydney.edu.au

Teaching staff: Pantea Pooladvand, P.Pooladvand@maths.usyd.edu.au
Dr. Brad Roberts, brad.roberts@sydney.edu.au

Administrative and professional staff: MATH1111@sydney.edu.au

Weekly schedule

Week	Topic	Learning activity type	Learning outcomes
Week 1	Number systems, equations, and the Theorem of Pythagoras. The real number line, inequalities and intervals.	Lecture and tutorial	
Week 2	Coordinate geometry in the real plane, lines, and curves. Quadratics and polynomials.	Lecture and tutorial	
Week 3	Functions, their graphs, and operations on functions. Inverse functions and review of trigonometry.	Lecture and tutorial	
Week 4	Exponential functions, logarithms, exponential growth and decay. Introduction to hyperbolic functions.	Lecture and tutorial	
Week 5	Introduction to coordinate geometry in space. Spheres and paraboloids. Planes, surfaces, level curves, peaks, troughs and saddles.	Lecture and tutorial	
Week 6	Limits, tangent lines, speed, and acceleration. Derivatives and simple properties.	Lecture and tutorial	
Week 7	Leibniz notation and common derivatives. Differentials and applications.	Lecture and tutorial	
Week 8	Product, Quotient and Chain Rules.	Lecture and tutorial	
Week 9	Applications of 1st and 2nd derivatives. Optimisation. Limits, asymptotes and curve sketching.	Lecture and tutorial	
Week 10	Areas under curves. Relationship between velocity and distance. Definite integrals and simple properties.	Lecture and tutorial	
Week 11	Antidifferentiation and the Fundamental Theorem of Calculus. Indefinite integrals.	Lecture and tutorial	
Week 12	Integration by substitution. Introduction to advanced methods: partial fractions and integration by parts.	Lecture and tutorial	
Week 13	Introduction to improper integrals. Introduction to calculus of curves and surfaces in space. Revision.	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	Skills based assessment	Assignment		Individual		5%	Thu 28 Mar 11:59pm	Thu 4 Apr 11:59pm	

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Assessment title	Assessment category	Assessment type	Description of assessment type	Individual or group	Length / duration	Weight	Due date & time	Closing date	Learning outcomes
Mid-semester test	Exam	In-semester exam		Individual		10%	Mon 15 - Tue 16 Apr (week 8)	Tue 16 Apr	
Assignment 2	Skills based assessment	Assignment		Individual		5%	Thu 9 May 11:59pm	Thu 16 May 11:59pm	
Online Homework 1	Skills based assessment	Tutorial quiz, small test or online task		Individual		4%	Fri 22 Mar 11:59pm	Fri 29 Mar 11:59pm	
Online Homework 2	Skills based assessment	Tutorial quiz, small test or online task		Individual		4%	Fri 12 Apr 11:59pm	Fri 19 Apr 11:59pm	
Online Homework 3	Skills based assessment	Tutorial quiz, small test or online task		Individual		4%	Fri 3 May 11:59pm	Fri 10 May 11:59pm	
Online Homework 4	Skills based assessment	Tutorial quiz, small test or online task		Individual		4%	Fri 17 May 11:59pm	Fri 24 May 11:59pm	
Online Homework 5	Skills based assessment	Tutorial quiz, small test or online task		Individual		4%	Fri 31 May 11:59pm	Fri 7 Jun 11:59pm	
Final Exam	Exam	Final Exam		Individual	2 hours	60%	Final Exam Period		

Overview of assessments

Below are brief assessment details. Further information can be found in the Canvas site for this unit.

- **Assignments:** There are two assignments, which must be submitted electronically**, as PDF files only** via Canvas, 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.
- **Mid-semester test:** The mid-semester test, worth 10%, will be held in the Monday-Tuesday tutorials in Week 8. It will last 40 minutes. The better mark principle will apply so do not submit an application for Special Consideration or Special Arrangements if you miss the test. Further information about the test, topics to be covered and practice questions will be distributed about two weeks before the test is held.
- **The better mark principle** means that for the mid-semester test, the test counts if and only if it is better than or equal to your exam mark. If your test mark is less than your exam mark, the exam mark will be used for that portion of your assessment instead. The assignment marks count for 10% regardless of whether they are better than your exam mark or not.
- **Online homework:** A series of online homework exercises have been set using the online MOOC Introduction to Calculus available from Coursera. These exercises are self-paced and allow multiple attempts, so that a diligent student may be able to progressively master all of them. If a student opts not to complete online homework exercises, for any reason, then credits will be transferred to other components of the assessment.
- **Final Exam:** Further details will be published on Canvas at a further date.

Readings

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

- **Textbook:** Anton, Bivens and Davis. Calculus Early Transcendentals Single Variable. 11th edition, Wiley 2016. Available from the Co-op Bookshop.

Other resources

- **Tutorials:** You should attend two tutorials per week, starting in Week 2, as shown on your personal timetable. One tutorial will be on Monday or Tuesday, in the form of a practice class, and the second tutorial will be on Thursday or Friday. Please note,

however, that there will be no classes on Good Friday (19 April). Attendance at tutorials is 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 Arrangements, since there is no assessment associated with the missed tutorial.

- **Tutorial sheets:** The tutorial exercise sheets will be available from the MATH1111 webpage. Solutions to tutorial exercises for any given week will normally be posted later that week or early the following week.
- **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

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/students/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

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/students/academic-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/

Other requirements for this unit

- **Attendance Requirements:** 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.

Site visit guidelines

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

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/study/student-administration
- Wellbeing and support: sydney.edu.au/students/health-wellbeing
- Study resources: sydney.edu.au/students/learning-services
- Expectations of student conduct: sydney.edu.au/students/student-responsibilities
- Learning and Teaching Policy: sydney.edu.au/policies/
- Academic appeals: sydney.edu.au/students/academic-appeals
- Libraries: 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
- Mathematics and Statistics student portal: canvas.sydney.edu.au/courses/7913