

COURSE OUTLINE: MH1100-MH110S

Course Title	Calculus I		
Course Code	MH1100-MH110S		
Offered	Study Year 1, Semester 1		
Course Coordinators	Tong Ping (Asst Prof)	tongping@ntu.edu.sg	6513 7457
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Pre-requisites	None		
Mutually exclusive	MH110S, MH1800, MH1801, MH1802, MH1805, MH1810, MH1811, CY1601		
AU	4		
Contact hours	Lectures: 39, Tutorials: 12		
Approved for delivery from	AY 2020/21 semester 2		
Last revised	25 Nov 2020, 10:49		

Course Aims

This core mathematical course aims to provide an introduction to the fundamental mathematical concepts (functions, limits, continuity, derivatives and integrals). Computation of derivatives (sum, product, and quotient formulas, chain rule, and implicit differentiation), and application of derivatives to optimization problems and related rates of change problems will also be discussed. This course lays the foundation for more advanced studies in mathematics, physics, engineering, and other related subjects.

Intended Learning Outcomes

Upon successfully completing this course, you should be able to:

1. Interpret the basic concepts in calculus, such as functions, limits, continuity, derivatives and integrals.
2. Evaluate limits, rates of change, derivatives, extreme values, etc.
3. Prove the limit and continuity of a function at a certain point or infinity.
4. Use the basic calculus techniques, such as chain rules, curve sketching, and optimization.
5. Use mean value theorem to prove a result.
6. Select the right mathematical concepts and models for real problems, such as those related to velocity and curve properties.
7. Apply the calculus techniques to solve related rate and optimization problems.

Course Content

Functions

Introduction to the concept of limit, limit laws, squeeze theorem

Precise definition of limit: the epsilon-delta definition

Limits: Advanced topics such as the uniqueness of the limit, one-sided limits, limits to positive or negative infinity.

Introduction to the concept of continuity, continuous functions and limits, intermediate value theorem

The definition of derivative, continuous and differentiable properties of a function

Differentiation rules, the calculus of the trigonometric functions

Chain rule

The theory of extreme values, mean value theorem

Limits at infinity, curve sketching, Optimization problems

Newton's method

Antiderivatives

Review

Assessment

Component	Course ILOs tested	SPMS-MAS Graduate Attributes tested	Weighting	Team / Individual	Assessment Rubrics
Continuous Assessment					
Lectures					
Assignment 1	1, 2, 3	1. a 5. a	10	individual	See Appendix for rubric
Assignment 2	1, 2, 3, 4, 5, 6	1. a 5. a	10	individual	See Appendix for rubric
Mid-semester Quiz					
Short Answer Questions	1, 2, 3, 4	1. a	20	individual	See Appendix for rubric
Examination (2 hours)					
Short Answer Questions	1, 2, 3, 4, 5, 6, 7	1. a	60	individual	See Appendix for rubric
Total			100%		

These are the relevant SPMS-MAS Graduate Attributes.

1. Competence

- a. Independently process and interpret mathematical theories and methodologies, and apply them to solve problems

5. Character

- a. Act in socially responsible and ethical ways in line with the societal expectations of a mathematics professional, particularly in relation to analysis of data, computer security, numerical computations and algorithms

Formative Feedback

Components 2 and 4: Formative feedback written beside your homework solution will be returned to you.

Component 3: Feedback on common mistakes and your midterm test scripts will be provided.

Component 1: An examiner's report will be issued to give formative feedback on common mistakes.

You will also receive formative feedback for all learning outcomes (including LO 7 tested in the final exam) during weekly tutorial classes from Week 2-Week 13.

Learning and Teaching Approach

Lectures (39 hours)	Derivation and demonstration: Explain the motivation behind mathematical concepts. Present systematic ways to solve problems related to the concepts developed. Derive important formulas and theorem that are fundamental in the study of Calculus. Problem solving: Develop competence in solving a variety of problems related to rates of change and optimization.
Tutorials (12 hours)	Derivation and demonstration: Explain the motivation behind mathematical concepts. Present systematic ways to solve problems related to the concepts developed. Derive important formulas and theorem that are fundamental in the study of Calculus. Problem solving: Develop competence in solving a variety of problems related to rates of change and optimization. Peer Instruction: Develop communication and presentation skills and deepen understanding. You have the opportunity to work with peers and present your solutions to the class.

Reading and References

James Stewart, Calculus (8th edition) ISBN: 978-1285740621

Course Policies and Student Responsibilities

Absence due to medical or other reasons

If you are sick and unable to attend a midterm test or missed the deadlines for your assignments, you must:

1. Send an email to the instructor regarding the absence.
2. Submit the original Medical Certificate* to an administrator.

*The Medical Certificate mentioned above should be issued in Singapore by a medical practitioner registered with the Singapore Medical Association.

The missed component will not be counted towards the final grade.

Collaboration Policy

Collaboration is encouraged for your homework because peer-to-peer learning helps you understand the subject better and working in a team trains you to better communicate with others in your profession. As part of academic integrity, crediting others for their contribution to your work promotes ethical practice.

You must write up your solutions by yourself and understand anything that you hand in.

If you do collaborate, you must write on your solution sheet the names of the students you worked with. If you did not collaborate with anyone, please explicitly write, "No collaborators."

Failure to do so constitutes plagiarism.

Use of materials outside the course is strongly discouraged. If you use outside source, you must reference it in your solution.

Academic Integrity

Good academic work depends on honesty and ethical behaviour. The quality of your work as a student relies on adhering to the principles of academic integrity and to the NTU Honour Code, a set of values shared by the whole university community. Truth, Trust and Justice are at the core of NTU's shared values.

As a student, it is important that you recognize your responsibilities in understanding and applying the principles of academic integrity in all the work you do at NTU. Not knowing what is involved in maintaining academic integrity does not excuse academic dishonesty. You need to actively equip yourself with strategies to avoid all forms of academic dishonesty, including

plagiarism, academic fraud, collusion and cheating. If you are uncertain of the definitions of any of these terms, you should go to the [Academic Integrity website](#) for more information. Consult your instructor(s) if you need any clarification about the requirements of academic integrity in the course.

Course Instructors

Instructor	Office Location	Phone	Email
Xia Kelin (Asst Prof)	SPMS-MAS-05-18	6513 7464	XIAKELIN@ntu.edu.sg
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Planned Weekly Schedule

Week	Topic	Course ILO	Readings/ Activities
1	Functions	1	
2	Introduction to the concept of limit, limit laws, squeeze theorem	1, 2	
3	Precise definition of limit: the epsilon-delta definition	1, 2, 3	
4	Limits: Advanced topics such as the uniqueness of the limit, one-sided limits, limits to positive or negative infinity.	1, 2, 3	
5	Introduction to the concept of continuity, continuous functions and limits, intermediate value theorem	1, 2, 3	CA 1: Homework 1
6	The definition of derivative, continuous and differentiable properties of a function	1, 2	
7	Differentiation rules, the calculus of the trigonometric functions	1, 2	
8	Chain rule	4	CA 2: Midterm Test
9	The theory of extreme values, mean value theorem	5	
10	Limits at infinity, curve sketching, Optimization problems	6, 7	
11	Newton's method	6	CA 3: Homework 2
12	Antiderivatives	1	
13	Review		

Appendix 1: Assessment Rubrics

Rubric for Lectures: Assignment 1 (10%)

Point-based marking (not rubrics based)

Rubric for Lectures: Assignment 2 (10%)

Point-based marking (not rubrics based)

Rubric for Mid-semester Quiz: Short Answer Questions (20%)

Point-based marking (not rubrics based)

Rubric for Examination: Short Answer Questions (60%)

Point-based marking (not rubrics based)