MATH 2023
Multivariable Calculus
Spring 2024–25
https://canvas.ust.hk/courses/62259

Lectures

Time	TuTh 01:30PM – 02:50PM
Venue	Rm 2407, Lift 17-18
Instructor	**Prof. Quoc Ho**
E-mail	quoc.ho@ust.hk
Office	Room 3477, Department of Mathematics
Office hours	Tuesdays, 10:00AM – 11:00AM

Tutorials

Session	T1A	T1B	T1C
Location	Rm 1410	Rm 2463	LG426 (LIB)
Teaching Assistant	**YOU, Lei**	**HU, Yang**	**HE, Jiayi**
E-mail	lyou	yhucx	jhecy

Course Description

Course outline. We will (tentatively) cover the following topics (possibly with a different order):

1. Review of Vectors in 3D, Cross Product, Dot Product, Lines and Planes
2. Vector-valued Functions, Curves and Arc Length
3. Multivariable Functions, Limits and Continuity, Partial Derivatives
4. Tangent Planes, Linear Approximation, Chain Rules
5. Directional Derivatives, Gradient Vector
6. Optimization Problems, Lagrange Multipliers
7. Double Integrals, Polar Coordinates, Surface Area
8. Triple Integral, Cylindrical and Spherical Coordinates
9. Vector Fields, Conservative Fields
10. Line Integrals
11. Green's Theorem, Curl and Divergence
12. Parametric Surface
13. Surface Integral Stokes' Theorem, Divergence Theorem

Credits. 4

Intended Learning Outcomes (ILOs)

Upon completion of this course, students are expected to:

(1) Understand the core concepts of multivariable calculus.

(2) Be able to recognize the power of abstraction and generalization, and to carry out mathematical work with independent judgment.
(3) Be able to apply rigorous, analytic, and numeric approach to analyze and solve problems.
(4) Be able to explain clearly concepts and calculations from multivariable calculus.
(5) Develop mathematical maturity to undertake higher level studies in mathematics and related fields.

Textbooks and References

References. The main reference is the instructor's lecture notes posted on Canvas. However, the notes might contain only the main points. Lecture attendance is necessary to get the full treatment of the topics.

Other resources:

(i) **Textbook:** *Calculus: Early transcendentals, Metric version*, 9th edition, James Stewart, Daniel Clegg, Saleem Watson (chapters 12 to 16).
(ii) **Course notes (from a different iteration of the course taught by Prof. Frederick Fong):** https://frederickfong.me/wp-content/uploads/2024/06/calc3.pdf

Assessment and Grading

Homework. Homework problems will be assigned on WeBWork. Although homework counts for only 10% of the final grade, please do not take them lightly. They are designed to help you have a good grasp of the materials and will ultimately prepare you for the exams. You are advised to attempt the homework problems as early as possible as they will also prepare you for a better understanding of the lectures. You may work in groups and discuss homework problems with other students, but it is crucial to make sure that you understand how to do the problems yourself. **No** late homework is accepted.

Examinations. There will be a midterm exam during Week 6–8 (exact date to be confirmed), and a final exam arranged by ARO. The final exam can cover everything in the course.

All exams are closed-book, and no electronic devices are allowed.

Make-up midterm policy.

- Under any circumstance, students who are unable to attend the midterm exam will **not** be offered a make-up midterm that takes place after the regular exam session. Note also that only in **exceptional circumstances** are examinees permitted to join an examination after the first 30 minutes.
- For students who have valid reasons for missing the midterm, the instructor may approve an early midterm, or assign the midterm scores according to the final exam performance.[1]
- For students who miss the midterm without a valid reason, the midterm score will be regarded as 0. This includes self-claimed sickness without any medical statement.

[1]The assigned score might be adjusted according to the relative overall performance of the midterm and the final exams.

Make-up final policy. The course will follow the make-up exam policy set by ARO for the final exam. Approval from the instructor, the dean, and ARO will be needed for applying for a make-up final exam.

Grading scheme. This course will be assessed using **criterion-referencing**, and grades will **not** be assigned using a curve.

Component	Weight	ILOs
Homework	10%	1, 2, 3, 4, 5
Midterm	40%	1, 2, 3, 4, 5
Final	50%	1, 2, 3, 4, 5
Course Total	100%	

Remark. As this course aims to build a strong foundation for further studies in mathematics, students are expected to both have a good understanding of the materials covered in the course (as expected) and to be able to communicate their understanding in a coherent and precise manner. Students will thus be assessed equally on both aspects.

Letter Grades. Students should aim at getting a course total of 90% or above for A–/A/A+, and about 60% or above for B–/B/B+. These numbers are suggestive only and might not reflect the actual cut off at the end of the semester. Please consult the grade descriptors below for more information.

Grade descriptors.

Grades	**Short Description**	**Elaboration on subject grading description**
A	Excellent Performance	The student has mastered almost all concepts and techniques taught in the course, has excellent understanding of the deepest content of the subject, are able to present their understanding in a coherent and precise manner, and acquired workable knowledge for further studies in more advanced mathematics courses.
B	Good Performance	The student has mastered most techniques taught in the course but still needs to improve (1) their understanding of some of the more challenging and subtle concepts or (2) their skills in presenting their understanding in a coherent and precise manner.
C	Satisfactory Performance	The student meets the minimum expectation of the instructor and has acquired some basic techniques, but some concepts were not clearly understood, or the writing skills need serious improvements.
D	Marginal Pass	The student is only able to recall some fragments of the materials covered and is able to carry out only some of the easiest computations or arguments.
F	Fail	The student does not have sufficient understanding of even some fragments of the topics covered and is not even able to carry out some of the easiest computations or arguments.

Generative AI Policy. Students are allowed to consult any person (including the instructor, TAs, classmates, friends outside HKUST) in any homework for ideas and hints, but are required to write up the solutions by themselves and understand them. Students are also required to list the persons and references they have consulted in every homework.

The use of ChatGPT or other generative AI is allowed, and they can be regarded as "persons" consulted, and therefore must be listed in the homework.

However, please be warned that at the current stage of development of AI, the response to problems – especially those in pure mathematics – is not reliable (although a lot of the time, it looks legitimate at the first glance). Students should thus be very critical of the response generated by AI and do not blindly copy the generated responses.

Academic Integrity

Students are expected to adhere to the university's academic integrity policy. Students are expected to uphold HKUST's Academic Honor Code and to maintain the highest standards of academic integrity. The University has zero tolerance of academic misconduct.