MATH 1023
Honors Calculus I
2020-21 Fall

https://canvas.ust.hk/courses/32438

Lecture

Instructor	**Prof. Frederick Tsz-Ho FONG**
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Office	Room 3488, Department of Mathematics
Class Time	Tuesdays and Thursdays 3:00pm-4:20pm

Tutorial

Session	T1A and T1B	T1C and T1D
Teaching Assistant	**Nicholas CHIN**	**Yang CAO**
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Class Time	T1A Tue 1:30pm-2:20pm	T1C Mon 4:30pm-5:20pm
	T1B Mon 5:30pm-6:20pm	T1D Mon 12:00pm - 12:50pm

Course Description

Course outline: This is the first part of a one-year honors course on single-variable calculus, with strong emphasis on mathematical concepts and logical reasoning skills. Topics include: sequences and their limits, functions, continuity, extreme value theorem, intermediate value theorem, derivatives and differentiation rules, differentiability, mean value theorem, l'Hopital's rule, Taylor expansion, and applications of derivatives.

Credits: 3

Official Minimum Prerequisite: Level 5 or above in HKDSE Mathematics Extended Module M2.

Recommended Prerequisite:

- Level 5* or above in HKDSE Mathematics Extended Module M2; or
- 120 or above in Mainland JEE Mathematics.

Intended Learning Outcomes (ILOs)

Upon completion of the course, students are expected to:

(1) build a strong mathematical background, in both conceptual and computational aspects, for future studies in mathematically oriented majors, including mathematics, physics, engineering;
(2) be equipped with workable knowledge of single-variable calculus well beyond the level of HKDSE M2;
(3) get familiar with the rigorous approach of single-variable calculus; and
(4) develop logical reasoning and critical thinking skills necessary for potential math majors in the pure mathematics tracks.

Student Learning Resources

Major References: Lecture notes written by Prof. YAN Min, and instructor's supplementary notes.

Recommended References (for complementary or additional readings):

(1) *Introduction to Calculus and Analysis* by Richard Courant, Fritz John
(2) *Elementary Analysis: The Theory of Calculus* by Kenneth A. Ross
(3) Any former HKALE Pure Math (Calculus) textbook

GRADING

Homework: There will be about 10 problem sets. No late homework will be accepted. Each homework can be individual or collaborative: students can form a group of 1 to 3 people to discuss with each other on the homework problems, and submit one copy of the problem set as a team.

Every student in the same team will receive the same score for that problem set. To avoid "free-riders", students are allowed to form different groups in different problem sets.

Examinations: There will be one 3-hour midterm exam, and one 3-hour final exam.

Grading Scheme:

Total score

$$= \max\{\lambda\,\text{homework} + \mu\,\text{midterm} + \nu\,\text{final} : \lambda \in [0, 0.2], \mu \in [0, 0.4], \nu \in [0.4, 0.7], \lambda + \mu + \nu = 1\}$$

Letter Grades: Try to aim at getting a total of 75% or above for A-/A/A+, about 45% or above for B-/B/B+, and about 25% or above for C-/C/C+. The course will not be graded on a curve, yet homework and exams will be challenging to almost all, but not all, HKUST freshmen.

TENTATIVE SCHEDULE

Week #	Topics
1	limit of sequences, squeeze theorem (#1.1)
2	rigorous definition of sequential limits (#1.2)
3	monotone sequences (#1.3), Cauchy sequences (#1.3)
4	infinity (#1.4), limit of functions (#1.5)
5	rigorous definition of function limits (#1.6)
6	rigorous definition of function limits, con't (#1.6)
7	continuity (#1.7)
8	derivatives (#2.1), differentiability (#2.1)
9	chain rule (#2.2), implicit differentiations (#2.2)
10	monotonicity (#2.3), first derivative test (#2.3)
11	mean value theorem (#2.4), l'Hospital's rule (#2.4)
12	Taylor series (#2.5), higher-order Taylor approximation (#2.5)
13	higher derivative test, convexity and concavity (#2.6)