Math 1023 Honors Calculus I
Course Outline - Fall 2024-2025

1. Instructor(s)

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2. Teaching Assistant(s)

Name: Yuji Li (T1A)
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3. Meeting Time and Venue

Lecture: L1
Date/Time: Monday 13:30 - 14:50, Friday 9:00 - 10:20
Venue: Lecture Theatre C

Tutorial: T1A
Date/Time: Tuesday 17:00-17:50
Venue: Room 4579

Tutorial: T1B
Date/Time: Monday 12:00-12:50
Venue: LG3009

Tutorial: T1C
Date/Time: Monday 15:00-15:50
Venue: Room 1410

4. Course Description

Credit Points: 3

Pre-requisite: Level 5 or above in HKDSE Mathematics Extended Module M2

Exclusion: MATH 1012, MATH 1013, MATH 1014, MATH 1020

Brief Information/synopsis:
This is the first in the sequence MATH 1023 – MATH 1024 of honors courses in one-variable calculus, with particular emphasis on rigorous mathematical reasoning. Topics include inequalities, functions and their graphs, vectors, limit and continuity, extreme value theorem, intermediate value theorem derivatives and differentiation rules, mean value theorem, l'Hôpital's rule, Taylor expansion, and applications of derivatives.

5. Intended Learning Outcomes

Upon successful completion of this course, students should be able to:

1. Understand and calculate the approximations in four settings: sequence, limit of function, derivative of function, high order approximations of function.
2. Understand the important theorems in analysis, and prove the calculation related theorems.
3. Able to argue approximations or the convergence of concrete sequences, series, and functions in rigorous way.
4. Apply approximation technique to model, solve, and analyse real-world problems.

6. Assessment Scheme

Composition:
20% homework (~10 assignments, ILO 1, 2, 3, 4)
30% midterm exam (3 hours, ILO 1, 2, 3, 4)
50% final exam (3 hours, ILO 1, 2, 3, 4)

Grading scheme:
A: 85 points, the student has fully mastered all the concepts and theorems, and can do all the corresponding calculations and arguments.
B: 60 points, the student has mastered enough concepts and theorems, but may have missed some more advanced parts, and can do most of the corresponding calculations and arguments.
C: 35 points, the student has mastered the minimum concepts and theorems, and can do minimum of the corresponding calculations and arguments.
D and F: the student does not understand some major parts, and cannot do most calculations or arguments. The line between D and F is whether the student shows enough effort. If the gap in grade from C is too much, or the student did not submit most of the homework, then he/she gets F. Otherwise the student gets D.

7. Student Learning Resources

Text(s): Calculus, lecture note by the instructor.

8. Teaching and Learning Activities

Lecture:
Listen to the lectures delivered by the instructor. Learn the concepts through definitions, examples, and discussions.

Tutorial:
Learn how to solve problems. Instructor my provide additional material not covered in the lecture.

Online:
A WeChat group is set up, where the students, the instructor, and the TA can discuss and communicate all things about the course.

9. Course Schedule

1. *Sequence*: intuition of limit, rigorous definition of limit, basic limit, convergence criteria, infinity, series, multivariable limit
2. *Constant approximation*: continuity, limit, one sided approximation, basic limit, infinity, property of continuous function, inverse continuous function, multivariable limit

3. *Linear approximation*: differentiability, derivative, one sided differentiability, basic derivative, technique for derivative, mean value theorem, monotone property, multivariable differentiability
4. *Higher approximation*: high order differentiability, Taylor expansion, calculate high order approximation, convexity, multivariable high order differentiability