MATH 1012/1013 Calculus IA/IB

Course Outline – Spring Term 2024/2025

1. Instructor: (L1) Dr ***YAO Jing***

Email: majyao@ust.hk **Office**: Room 3450 (near Lifts 25/26)

Office hours: Appointments via email

2. Lecture/Tutorial Hours and Venues:

MATH1012:

Instructor / Email	Section	Date/Time		Venue
YAO, Jing / majyao@ust.hk	L1	Wed/Fri	13:30-14:50	Rm 2407
CHENG, Kei Tsi Daniel / madcheng@ust.hk		Thu	17:00-17:50	Rm 2404
WANG, Hongrui / hwangfb@connect.ust.hk	T1A	Mon	11:00-11:50	Rm 5583
SHEN, Xuanyu / xshenar@connect.ust.hk	T1B	Tue	18:00-18:50	Rm 4620

MATH1013:

Instructor / Email	Section	Date/Time		Venue
YAO, Jing / majyao@ust.hk	L1	Wed/Fri	13:30-14:50	Rm 2407
WANG, Hongrui / hwangfb@connect.ust.hk	T1A	Mon	11:00-11:50	Rm 5583
SHEN, Xuanyu / xshenar@connect.ust.hk	T1B	Tue	18:00-18:50	Rm 4620

3. COURSE DESCRIPTION

MATH 1012:

Credits 4
Exclusion Level 3 or above in HKDSE Mathematics Extended Module M1 or M2; MATH 1003, MATH 1013, MATH 1014, MATH 1020, MATH 1023, MATH 1024
Co-List with MATH 1013
Description This is an introductory course in one-variable calculus, the first in the Calculus I and II sequence, designed for students that have not taken HKDSE Mathematics Extended Module M1 or M2. Topics include functions and their limits, continuity, derivatives and rules of differentiation, applications of derivatives, and basic integral calculus.

MATH1013:

Credits 3
Pre-Requisite Level 3 or above in HKDSE Mathematics Extended Module M1/M2
Exclusion MATH 1012, MATH 1014, MATH 1020, MATH 1023, MATH 1024
Co-List with MATH 1012
Description This is an introductory course in one-variable calculus, the first in the Calculus I and II sequence, designed for students that have taken HKDSE Mathematics Extended Module M1/M2. Topics include functions and their limits, continuity, derivatives and rules of differentiation, applications of derivatives, and basic integral calculus.

4. INTENDED LEARNING OUTCOMES (ILOs)

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

1	Compute limits, derivatives and simple integrals of functions in one variable;
2	Express quantitative relationships using the language of functions;
3	Apply conceptual knowledge of differential calculus in modeling and problem solving for further studies in science, engineering or other mathematically related fields.

5. ASSESSMENT SCHEME

Scheme 1: HW (15%) + Midterm Exam (25%) + Final Exam (60%)

Scheme 2: HW (15%) + Midterm Exam (0%) + Final Exam (85%)

The maximum of the total scores between schemes (1) and (2) will be taken to determine the final grades.

- WeBWorK homework, Course ILOs: 1, 2, 3.
- Midterm exam: **ONE hour exam, April 9 (Wednesday), 13:40-14:40.** No make-up exams for midterm exam.
- Final Exam: Two-hour exam, to be arranged by ARO. **Final exam is comprehensive**, i.e., all the materials taught in the whole semester will be tested.

All exams are Closed-book, no notes and no calculators. More information will be given prior to the exams.

Letter Grades will be assigned based on the total marks achieved in the above assessments.

Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	The student has mastered almost all concepts and techniques of one-variable calculus taught in the course, has excellent understanding of the deepest content of the subject, and acquired workable knowledge for further studies of analysis, differential and partial differential equations, optimization and related fields.
B	Good Performance	The student has mastered most computational techniques of one-variable calculus taught in the course, yet the understanding of some challenging concepts may not be deep enough for further studies on related advanced subjects.
C	Satisfactory Performance	The student meets the minimum expectation of the instructor, has acquired some basic computational techniques of the subject, yet some concepts were not clearly understood.
D	Marginal Pass	The student is only able to recall some fragments of topics and is able to complete some of the easiest computations.
F	Fail	The student does not have sufficient understanding of even some fragments of topics, and is not even able to complete some of the easiest computations.

6. Student Learning Resources

Main reference: Lecture slides prepared by instructors.

Study reference:

1. *Calculus for Scientists and Engineers: Early Transcendentals* – Briggs, Cochran and Gillett. Pearson New International Edition.
2. *Calculus* – James Stewart. BROOKS/COLE

7. Teaching and learning Activities

Scheduled activities:

- **MATH1012**: 5 hours (Lecture for 4 hours & Tutorial for 1 hour) each week
- **MATH1013**: 4 hours (Lecture for 3 hours & Tutorial for 1 hour) each week

8. Tentative TEACHING SCHEDULE

Week 01:
1.1 Review of functions
1.2 Representing functions
1.3 Inverse, exponential and logarithmic functions
Week 02:
1.4 Trigonometric functions and their inverses
2.1 The idea of limits
2.2 Definitions of limits
Week 03:
2.3 Techniques for computing limits
2.4 Infinite limits
2.5 Limits at infinity
2.6 Continuity
Week 04:
3.1 Introducing the derivatives
3.2 Rules of differentiation
Week 05:
3.3 The product and quotient rules
3.4 Derivatives of trigonometric functions
3.5 Derivatives as rates of change
3.6 The chain rule
Week 06:
3.7 Implicit differentiation
3.8 Derivatives of logarithmic and exponential functions
3.9 Derivatives of inverse trigonometric functions
Week 07:
3.10 Related rates,
4.1 Maxima and minima
Week 08:
4.2 What derivatives tell us
4.3 Graphing functions
4.4 Optimization problems
Week 09:
4.5 Linear approximation and differentials
4.6 Mean value theorem
Week 10:
4.7 L'Hopital's rule
4.8 Newton's method (*optional)
4.9 Antiderivatives
Week 11:
5.1 Approximating areas under curves
5.2 Definite integrals
Week 12:
5.3 Fundamental theorem of calculus
5.4 Working with integrals
Week 13:
5.5 Substitution rule
Review (if there is time available)

9. Course AI Policy

Students are required to complete their homework independently, although they are allowed to consult any person (including the use of ChatGPT or other generative AI) for understanding the course materials.
Please be warned that at the current stage of development of AI, the response to problems may not be reliable. Students should be critical of the response generated by AI.

10. 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. Please refer to Academic Integrity | HKUST – Academic Registry for the University's definition of plagiarism and ways to avoid cheating and plagiarism.