MATH 1003 Calculus and Linear Algebra

Course Outline - Fall 2024

1. Instructors

- (L1) Dr. YAO, Jing
  - Office: 3450, email: majyao@ust.hk
- (L2 and L3) Dr. WU, Yueping
  - Office: 3486, email: maypwu@ust.hk
- (L4) Dr. HE, Jialin
  - Office: 3478, email: majlhe@ust.hk

2. Teaching Assistants

- (T1A, T1B) SUN, Lei/lsunak
- (T1C, T1D) ZHOU, Rijiang/rzhouau
- (T2A, T2B) SHEN, Xuanyu/xshenar
- (T2C, T2D, T3A, T3B) KWOK, Cheuk Yin Felix
- (T3C, T3D) CHEN, Lizhong/lchendh
- (T4A, T4B) HUANG, Zhanmiao/zhuangdj
- (T4C, T4D) WU, Shuang/swucg

3. Meeting Time and Venue

- Lectures
  - L1: Tue/Thu 13:30 - 14:50 (CYT-LTL)
  - L2: Mon 16:30 - 17:50, Fri 12:00 - 13:20 (LTE)
  - L3: Mon 15:00 - 16:20, Fri 10:30 - 11:50 (LTE)
  - L4: Tue/Thu 10:30 - 11:50 (LTE)

- Tutorials
  - T1A: Wed 13:30 - 14:20 (6580)
  - T1B: Wed 09:30 - 10:20 (6580)
  - T1C: Tue 15:30 - 16:20 (6580)
  - T1D: Tue 17:30 - 18:20 (6580)
  - T2A: Tue 18:00 - 18:50 (2404)
  - T2B: Mon 12:00 - 12:50 (6580)
  - T2C: Tue 13:30 - 14:20 (6580)
  - T2D: Wed 18:00 - 18:50 (CYTG009A)
  - T3A: Tue 18:00 - 18:50 (5583)
  - T3B: Mon 17:00 - 17:50 (6580)
  - T3C: Fri 13:30 - 14:20 (LSK1034)
  - T3D: Thu 18:00 - 18:50 (LSK1011)
  - T4A: Wed 12:30 - 13:20 (6580)
  - T4B: Wed 17:00 - 17:50 (1104)
  - T4C: Wed 09:30 - 10:20 (LG3008)
  - T4D: Tue 12:30 - 13:20 (6580)

4. Course Description

Duration: one semester. Credits: 3 units.

This course teaches basic application techniques in single-variable calculus and linear algebra.

Key topics include: systems of linear equations and matrices, functions and graphing, derivatives andoptimization, integration and applications.

Exclusion(s): B or above in HKCEE Additional Mathematics; AS Mathematics and Statistics; AL/AS Applied Mathematics; AL Pure Mathematics; MATH 1013, MATH 1014, MATH 1018, MATH 1020, MATH 1023, MATH 1024; any MATH course at or above 100-/2000-level.

Prerequisite(s): HKCEE Mathematics

5. Intended Learning Outcomes (ILOs)

Upon the end of the course, students should be able to:

1. Solve basic mathematical problems related to interest rate and annuity
2. Formulate and solve typical problems by using systems of linear equations and matrices
3. Understand various properties of typical functions
4. Find the derivatives of typical functions
5. Apply differentiation to find optimization conditions
6. Use basic techniques of integration

6. Assessment Scheme

Based on one midterm examination, one final examination, and online homework (WeBWork).

Assessment	Assessing Course ILOs
Online homework (WeBWork): 10 %	1,2,3,4,5,6
Midterm Exam: 25 %	1,2
Final Exam: 65 %	3,4,5,6

Only legitimate excuses (such as illness with official medical record) will be considered for a make-up exam.

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

Grade Descriptors:

Grades	Short Description	Elaboration on subject grading description
A	Excellent Performance	The student has mastered almost all concepts and techniques of mathematics of finance, linear algebra, and single-variable calculus taught in the course, has excellent understanding of the deepest content of the subject, and acquired workable knowledge for further studies of calculus, linear algebra, and related fields.
B	Good Performance	The student has mastered most computational techniques of mathematics of finance, linear algebra, and single-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.

Course AI Policy:

The use of ChatGPT or other generative AI is not allowed in homework and exams.

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.

7. Student Learning Resources

Lecture Notes:

Lecture notes can be downloaded at the course website.

Textbook:

College Mathematics for Business, Economics, Life Sciences, and Social Sciences (Fourteenth Edition), byRaymond A. Barnett, Michael R. Ziegler and Karl E. Byleen.

8. Teaching and Learning Activities

Scheduled activities per week: 4 hours (lecture + tutorial)

9. Tentative Course Schedule (Subject to change)

Week	Content	Remarks
1	2.1 Simple Interest 2.2 Compound Interest, Growth and Time 2.3 Future Value of an Annuity, Sinking Fund	
2	2.4 Present Value of an Annuity, Amortization 3.1 System of Linear Equations in 2 Variables 3.2 Augmented Matrices	
3	3.3 Gauss-Jordan Elimination and Applications 3.4 Matrices, Addition and Subtraction, Multiplication	
4	3.5 Inverse of a Matrix 3.6 Matrix Equations	
5	3.7 Leontief Input-Output Analysis 8.1, 8.4 Rate of Change, Slope of the Tangent Line, Derivative	
6	8.5 Differentiation Properties, Power Rule 9.1 Continuous Compound Interest 9.2 Derivative of Exponential Function and Logarithmic Function	
7	9.3 Product Rule and Quotient Rule 9.4 Chain Rule	
8	9.5 Implicit Differentiation 9.6 Related Rates 10.1 First Derivative and Graph	
9	10.2 Second Derivative and Graph 8.2 Infinite Limits and Limits at Infinity 10.4 Curve-Sketching	
10	10.5 Absolute Maxima and Minima 10.6 Optimization	
11	11.1 Anti-derivatives and Indefinite Integrals 11.2 Integration by Substitution 11.4 Definite Integrals	
12	11.5 Fundamental Theorem of Calculus 11.6 Area Between Curves	
13	[Optional Topics]	