Mathematics I

Course Outline
Academic Semester: 2025/26

1. General

School	**School of Finance and Statistics**		
Academic Unit	**Department of Banking and Financial Management**		
Level of Studies	**Undergraduate**		
Course Code	**XPMAΘ06**		
Semester	**1st**		
Course Title	**Mathematics I**		
Idependent Teaching Activities		Weekly Teaching Hours	Credits
	Lectures	**4**	**7,5**
Course Type	**Compulsory / Background Knowledge**		
Prerequite Courses			
Language of Instruction and Examinations	**Greek**		
Is the course offered to Erasmus Students?	**Yes (in Greek)**		
Url (Eclass)	**https://eclass.unipi.gr/courses/XTD206/**		

2. Learning Outcomes

Learning Outcomes

The course constitutes an introduction to the fundamental notions of mathematical analysis that are extensively used in financial theory and analysis. Aim of the course is to present the analytic foundations needed for all the quantitative courses of the undergraduate program of studies, as well as the techniques required for the solution of a wide range of theoretical and analytical problems related to economics. The course also aims for the students to obtain a deeper understanding of the mathematical notions that will be presented during the lectures.

Upon successful completion of the course, the students will be able to

- prove mathematical relationships via the method of Mathematical Induction.
- interpret algebraically, numerically and graphically functions, and perform operations with them.
- compute, graphically, algebraically and via definition, limits of functions.
- interpret and apply, graphically, algebraically and via definition, the notion of continuity.
- interpret and compute the supremum and the infimum of a set.
- interpret graphically and compute algebraically the derivative of a function.
- compute the monotonicity, the convexity and the extreme points of non-trivial functions, concluding to the construction of their graph.
- interpret and compute via definition the definite integral of a function, as well as to apply it for finding areas of sectors.
- compute indefinite integrals via elementary methods, such as integration-by-parts and change-of-variable.
- interpret, graphically and via definition, the convergence of a sequence, and to compute its limit by L' Hopital's Rule.
- decide on the convergence of an infinite series subject to suitable convergence criteria.

General Competences

3. Syllabus

The following sections will be presented:

- Sets of Numbers: Principle of Mathematical Induction.
- Functions: Definition of a Function, Notation, Basic Functions, Calculus of Functions, Alternative Definition of a Function.
- Graphs: Intervals, Distance Between Points, Graph of a Function, Linear Function, Power Functions – Rational Functions, Even and Odd Functions, Relationships Between Graphs, One-to-One and Onto Functions – Inverse Function.
- Limits: The Limit Intuitively, Definition of Limit of a Function, Geometric Interpretation of Limit, Properties of Limit, One-Sided Limits, Limits at Infinity.
- Continuous Functions: Definition of Continuity of Functions, Calculus of Continuous Functions, Continuity of Composite Functions, Continuity and Sign Preservation.
- Suprema and Infima: Definition of Supremum, Definition of Infimum, Properties.
- Continuity and Applications: Bolzano Theorem, Bounded Function Theorem, Maximum and Minimum Value Theorem, Intermediate Value Theorem (IVT).
- Derivatives: Ratio of Change, Rate of Change, Derivative Function, Derivative Vs Continuity.
- Differentiation: Simple Rules of Differentiation, Derivative of Sum of Functions, Derivative of Product of Functions, Derivative of Product of a Function with a Scalar, Derivative of a Power – Polynomial, Derivative of Quotient of Functions, Derivative of Composition of Functions.
- Usage of Derivative: Extrema of a Function, Fermat's Theorem, Local Extrema of a Function, Finding Extrema of a Function in a Closed Space, Rolle's Theorem, Mean Value Theorem (MVT), Monotonicity of a Function, Finding Local Extrema, Graphing a Function, Cauchy's Mean Value Theorem (CMVT), L' Hôpital's Rule.
- Curvature: Convex Functions, Concave Functions, Characterization of Convex Functions, Curvature and Differentiation.
- Integrals: Partition of an Interval, Upper and Lower Sum of a Function with respect to a Partition, Definition of Integral, Integral as Area Under a Curve, Integral Properties, Mean Value Theorem of Integral Calculus (MVTIC), Riemann Sum, Fundamental Theorem of Calculus.
- Logarithmic and Exponential Function: Powers, Logarithmic Function, Properties of Logarithmic Function, Exponential Function, Properties of Exponential Function, Power Function.
- Elementary Methods of Integration: Indefinite and Definite Integrals, Basic Indefinite Integrals, Properties of Indefinite Integrals, Integration by Parts, Substitution Rule.
- Infinite Sequences: Sequences of Real Numbers, Convergence of Sequences, Properties of Sequences, Monotonicity and Bounds of Sequences, Convergence Criterion of Sequences, Limits as Upper or Lower Sums of Functions.
- Infinite Series: Series of Real Numbers, Properties of Series, Zero Convergence Condition, Geometric Series, Exponential Series, Boundedness Criterion, Comparison Criterion, Ratio Criterion, Integral Criterion.

4. Teaching and Learning Methods - Evaluation

Delivery	**In-class lecturing**
Use of Information and Communications Technology	• **Use of lecture slides via PowerPoint.** • **Distribution of lecture slides to the students via an educational electronic platform.** • **Communication with students via e-mail**

Teaching Methods	**Activity**	**Semester Workload**
	Lectures	52
	Studying	135,5
	Course Total	**187,5**
Student Performance Evaluation	Written exam (100%) that includes: • Choice of questions. • Questions on theory. • Problem solving questions. This is a 2-hour written exam. The individual evaluation grades are explicitly written next to each question.	

5. Attached Bibliography

Suggested Bibliography

- Spivak, Διαφορικός Ολοκληρωτικός Λογισμός, ΙΤΕ – Πανεπιστημιακές Εκδόσεις Κρήτης, Ηράκλειο, 2010.
- Μ. Φιλιππάκης, Εφαρμοσμένη Ανάλυση και Στοιχεία Γραμμικής Άλγεβρας, Εκδόσεις Τσότρας, Αθήνα, 2017.
- Θ. Ρασσιάς, Μαθηματικά Ι, Εκδόσεις Τσότρας, Αθήνα, 2017.
- Δ. Κραββαρίτης, Μαθήματα Ανάλυσης, Εκδόσεις Τσότρας, Αθήνα, 2017.

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