

Course Unit	Mathematics I	Field of study	Mathematics
Bachelor in	Management	School	School of Technology and Management
Academic Year	2023/2024	Year of study	1
Type	Semestral	Semester	1
Workload (hours)	162	Contact hours	T - 60 TP - 60 PL - TC - S - E - OT - O -
		Level	1-1
		ECTS credits	6.0
		Code	9147-707-1103-00-23

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s) Carla Sofia Veiga Fernandes, Florbela Alexandra Pires Fernandes, João Carlos Sampaio Maldonado Costa Mendes

### Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:

1. Perform arithmetic operations and use them to characterize the graphs of some elementary real functions of a real variable.
2. Decompose an elementary function into simplest elementary functions; understand the concepts of injectivity, surjectivity, bijectivity and inverse function.
3. Understand the concept of derivative and being able to deduce and use the rules of differentiation of elementary functions; solve optimization problems formalized by real functions of a real variable.
4. Relate the operations of integration and differentiation; compute primitives of elementary real functions of a real variable, using techniques of integration by parts and by substitution.
5. Know the rules of matrix algebra; solve systems of linear equations by the methods of Gauss and Gauss-Jordan; classify systems of linear equations with respect to the types of solutions.
6. Compute the inverse of a matrix using Gaussian elimination method.
7. Compute determinants using the method of Laplace and Gaussian elimination method.
8. Compute inverse matrices via the adjoint matrix; solve systems of linear equations by Cramer's rule.

### Prerequisites

Before the course unit the learner is expected to be able to:

1. Solve arithmetic operations.
2. Solve linear and quadratic equations and inequalities.
3. Add, subtract, multiply and divide polynomial expressions.
4. Identify both algebraically and geometrically, linear, exponential and logarithmic functions.

### Course contents

Linear algebra. Real functions of a real variable.

### Course contents (extended version)

1. Linear algebra.
  - Addition, multiplication and transposition of matrices.
  - Classification of square matrices.
  - Matricial form of a system of linear equations
  - Resolution of systems of linear equations by the methods of Gauss and Gauss-Jordan.
  - Computing the inverse matrix by Gauss method.
  - Computing determinants via Laplace and Gauss methods.
  - Properties of determinants; computing the inverse matrix using determinants.
  - Resolution of systems of linear equations by Cramer's rule.
2. Real functions of a real variable.
  - Defining real function of a real variable; domain, codomain, range, graphic.
  - Decomposition of an elementary function in simplest elementary functions.
  - Sequences of real numbers; limits; limit of a function; properties of limits.
  - Continuity of a function at a point and on an interval.
  - Higher order derivatives. Theorems on differentiable functions.
  - Higher order derivatives. Theorems on differentiable functions.
  - Unconstrained optimization problems.
  - Primitives of elementary functions; primitivation by substitution and by parts.

### Recommended reading

1. Carreira, A. & Pinto, G. (1999). Cálculo Matricial. Volume 1. Lisboa: Instituto Piaget.
2. N. Piskounov, N. (1993). Cálculo Diferencial e Integral. Volume I. Lopes da Silva Editora.
3. Lima, E. L. (2017). Curso de Análise (14ª ed. ). Volume 1. Rio de Janeiro: Projecto Euclides.

### Teaching and learning methods

The topics of the course unit will be introduced and explored during the lessons - resolution of exercises will complement the theoretical concepts. Outside the classes, the students must solve practical exercises and, whenever they consider useful, they should use computer and/or calculator.

### Assessment methods

1. Alternative 1 - (Regular, Student Worker) (Final)
  - Intermediate Written Test - 35% (First partial test assesses the acquired skills in Chapter 1 and is held during classes.)
  - Intermediate Written Test - 65% (Second partial test assesses the acquired skills in Chapter 3 and is held at the final exam's day.)
2. Alternative 2 - (Regular, Student Worker) (Supplementary)
  - Intermediate Written Test - 100% (Reproved student can repeat 1 or 2 of the partial tests referred on the Alternative 1.)
3. Alternative 3 - (Regular, Student Worker) (Supplementary, Special)
  - Final Written Exam - 100%

### Language of instruction

Portuguese, with additional English support for foreign students.

## Electronic validation

Carla Sofia Veiga Fernandes, Florbela Alexandra Pires Fernandes	António Borges Fernandes	José Carlos Rufino Amaro
09-10-2023	09-10-2023	20-10-2023