

FUNDAMENTALS OF MATHEMATICS

Code: 322049

Main Scientific Area: Mathematics and Applied Statistics

Lecturer: Ana Sofia do Rego Miranda

Language of Instruction: Portuguese

Regime: S1

Contact Hours: 60h Total Workload: 108h

ECTS: 6,0

Objectives

The teaching of Geometry is of the utmost importance and must develop in the student a geometric intuition and a spatial reasoning as well as capacities to explore, to conjecture, to think logically, to use and to apply Mathematics, to formulate and to solve abstract problems or in a perspective of mathematical modelling. He must also develop in the student oral and written communication and organization skills.

The knowledge about functions, indispensable to the world understanding in which we live, will be enlarged based on numerical and graphical study, privileging intuitive work with functions such as trigonometric functions. This theme has a great emphasis on the connection between formulas and geometric representations. This connection is very important for everyone who uses math. The capacity to relate them is a fundamental capacity for the today's world and the future, therefore this theme should provide a life-long training as basic as the multiplication table.

Learning Outcomes

At the end of the course unit, students should: understanding elementary concepts of geometry; represent sections; establish metric relations between figures; use the Cartesian and analytical method to solve problems in two or three dimensions; understand the definition of a real function of real variable and know how to interpret and apply concepts associated with it: calculating domains of functions, calculating limits of functions, continuity of a function, derivation rules, continuity theorems and differential calculus theorems. Calculate angles and solve problems involving trigonometry.

Course Contents

1. Analytical Geometry in Plane and Space

1.1. Elementary Concepts

1.2. Represent sections

1.3. Establish metric relations between figures:

1.3.1. linear measurements;

1.3.2. areas;

1.3.3. volumes.

- 1.4. Use the Cartesian method to solve problems in plane and space
- 1.5. Identify sets of points of the plane and space from conditions and reciprocally
- 1.6. Solve geometric and / or analytical problems, involving:
 - 1.6.1. line segment midpoint;
 - 1.6.2. vectors;
 - 1.6.3. straight lines;
 - 1.6.4. geometric places.
- 2. General functions
 - 2.1. Definition and Properties
 - 2.2. Graphic study
 - 2.2.1. Domain, contradomain, monotony, intersection with coordinate axes
 - 2.2.2. Limits:
 - 2.2.2.1. Intuitive notion of limit (geometric interpretation);
 - 2.2.2.2. Points of accumulation, isolated;
 - 2.2.2.3. Definition and operations with limits;
 - 2.2.2.4. Indeterminations.
 - 2.3. Continuity
 - 2.3.1. Intuitive notion
 - 2.3.2. Definition: continuity at one point and at intervals (limited and unlimited)
 - 2.4. Differentiability
 - 2.4.1. Definition of derivative at a point and interval
 - 2.4.1.1. Side Derivatives
 - 2.4.1.2. Differentiability and continuity
 - 2.4.2. Geometric interpretation and its applications
 - 2.4.3. Derivation rules
 - 2.4.4. Derivatives of functions and their applications

2.4.4.1. Study of extremes and monotony

3. Trigonometric Functions

3.1. Sine, cosine, and tangent function

3.1.1. Definition and Properties

3.1.1.1. Domain, Contradomain, zeros, periods, parity, asymptotes and monotony

3.1.1.2. Relations between trigonometric functions

3.1.1.3. Trigonometric equations

3.1.1.4. Problem solving with trigonometric functions

Recommended Bibliography

Spivak, M: Cálculos, New York, W. A. Benjamim

Learning and Teaching Methods

The understanding, manipulation and application of geometric concepts and continuity of differentiability of real functions of a real variable provide a base set of mathematical knowledge required for the proper functioning of other units of the course curriculum. They also allow to develop the scientific reasoning and the mathematical ability to the application of the mathematical concepts.

Assessment Methods

2 Written Tests (whose average weight is 80% of the evaluation) and a Practical Evaluation Work with a weight of 20%. All the elements of evaluation will be carried out in person and have no minimum score.