Mathematics – Introductory course

Level: Undergraduate
Attributes: Mathematical Sciences
Language of instruction: English
Lecturer: Beata Ciałowicz, Ph.D.

Course structure: Lecture and Classes (60 hours)

Objective

The aim of this course is to give a review of basic mathematical concepts from secondary school, to refresh students' mathematical skills. This means that throughout the course, careful attention is given to the presentation of concepts that will become important in upcoming *Mathematcs* course.

Course description

This course is particularly intended for students with only elementary algebra and analysis background and for students who need a review of intermediate algebra and calculus before proceeding further.

Main topics

Section 1 Preliminaries

1.1 Basic symbols and notation in mathematics

1.2 Logic

- Logic sentence and sentential formula
- Basic logical operations
- Quantifiers

1.2 Set theory

- Operations with sets and their basic properties: union of sets, difference of sets, intersection of sets, complement to set
- Cartesian product of sets

Section 2 Basic properties of function

2.1 Domain
2.2 Range
2.3 x −intersept and y −intersept
2.4 Monotonicity
2.5 Odd and even functions
2.6 One-to-one function
2.7 operations on graphs

Section 3 Linear functions

3. 1 Graph
3. 2 Basic properties: root, monotonicity
3. 3 Equations and inequalities
3. 4 Half-planes in Cartesian coordinate system
3. 5 Absolute value: definition, graph, basic properties, equations and inequalities with absolute value

Section 4 Quadratic functions

4.1 Graph
4.2 Basic properties: domain, range, roots, monotonicity
4.3 Related forms of quadratic function
4.4 Quadratic equations and inequalities
4.5 Viete's rules

Section 5 Polynomials

5.1 Graph
5.2 Basic properties: domain, range, roots
5.3 Polynomial equations and inequalities

Section 6 Power functions

- Main examples with basic properties

Section 7 Rational functions

6.1 Graph
6.2 Basic properties: domain, range, roots, asymptotes
6.3 Rational equations and inequalities
6.4 Homographic function - basic form and canonical form

Section 8 Trigonometric functions

8.1 Sine function - basic properties and graph
8.2 Cosine function - basic properties and graph
8.3 Tangent function - basic properties and graph
8.4 Cotangent function - basic properties and graph
8.5 Special values in trigonometric functions
8.6 Fundamental trigonometric identities
8.7 Trigonometric equations and inequalities

Section 9 Exponential functions

9.1 Definition and graph
9.2 Basic properties
9.3 Exponential equations and inequalities

Section 10 Logarithmic functions

10.1 Definition of logarithm and its properties
10.2 Logarithmic function and its basic properties
10.3 Logarithmic equations and inequalities

Section 11 Sequences

11.1 Definition of a sequence and its basic properties
- Monotonic sequences
- Bounded and unbounded sequences

11.2 Arithmetic sequences
- Definition and basic properties
- n-th term formula
- Sum formula

11.3 Geometric sequence
- Definition and basic properties
- n-th term formula
- Sum formula
- Sum of infinite geometric series