University of Gdańsk

Subject card

Subject name and code	Mathematical Methods in Bioinformatics - Calculus, PG_00193510		
Field of study	Bioinformatics		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2026/2027
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	1	ECTS credits	7.0
Learning profile	academic	Assessment form	exam
Conducting unit	Institute of Theoretical Physics and Astrophysics -> Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Waldemar Kłobus	
	Teachers	dr hab. Piotr Gnaciński mgr Mateusz Kowalczyk dr hab. Waldemar Kłobus	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	45.0	0.0	0.0	0.0	90
	E-learning hours included: 0.0						

Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
	Number of study hours	90	0.0	85.0	175

Subject objectives	The aim of the course is to introduce the tools for studying and analyzing functions of a single variable provided by differential calculus and to present the applications of these tools in the analysis of specific physical and natural phenomena.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOINL3_U03] Graduate applies mathematical and statistical methods to describe phenomena and analyze data; has the ability to perform data analysis in professional databases used in bioinformatics	The student is able to: Calculate derivatives of functions given by formulas Use Lagrange's theorem in proving simple inequalities Apply differential calculus methods to analyze functions Solve simple ordinary differential equations Use differential calculus to describe and analyze physical and natural models.	[SU3] text preparation/written work [SU4] test/exam - oral or written
[BIOINL3_W03] Has sufficient knowledge of mathematical and statistical methods in order to describe and model biological phenomena and processes	The student knows: The concept of the derivative and its interpretations Formulas for the derivatives of elementary functions Lagrange's theorem and its applications Methods for determining local extrema, intervals of monotonicity, the shape of the graph, and the asymptotes of a function Methods for solving simple ordinary differential equations Applications of differential calculus in simple physical and natural models.	[SW4] test/exam - oral or written [SW3] text preparation/written work
[BIOINL3_W02] Has advanced scientific knowledge necessary to understand the basic processes in living organisms.	The student knows: The concept of the derivative and its interpretations Formulas for the derivatives of elementary functions Lagrange's theorem and its applications Methods for determining local extrema, intervals of monotonicity, the shape of the graph, and the asymptotes of a function Methods for solving simple ordinary differential equations Applications of differential calculus in simple physical and natural models.	[SW4] test/exam - oral or written [SW3] text preparation/written work

Subject contents

1. Definition of the derivative as the rate of change of the function's value, physical interpretation: instantaneous velocity, geometric interpretation: slope of the tangent to the graph, examples of non-differentiable functions
2. Formulas for the derivatives of elementary functions, formulas for the derivative of the sum, product, quotient, and composition of functions, calculation of derivatives
3. Lagrange's Mean Value Theorem, the sign of the derivative and monotonicity, determining intervals of monotonicity
4. Application of the derivative to find local extrema, setting the derivative to zero as a necessary condition for the existence of an extremum, change of sign of the derivative as a necessary and sufficient condition for the existence of an extremum
5. Concept of the second derivative, application to study the shape of the graph, investigation of intervals of convexity and concavity
6. Vertical and oblique asymptotes of the function's graph
7. Analysis of the behavior of functions
8. Simple ordinary differential equations: separable equations, linear equations, Bernoulli equations
9. Higher-order derivatives, Taylor series and its applications for approximating the value of functions
10. Analysis of simple classical mechanics models: principles of dynamics, harmonic oscillator
11. Analysis of natural models: simple population models

Prerequisites and co-requisites

Knowledge of mathematics at the high school level (advanced level)

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
	51.0%	60.0%
	51.0%	40.0%

Recommended reading

Basic literature	not applicable
Supplementary literature	n
eResources addresses	

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable

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