University of Gdańsk

Subject card

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|---|---|---|---|---|---|---|---|
| Subject name and code | Mathematical Methods in Bioinformatics - Integral Calculus, PG_00193518 | | | | | | |
| 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 | 2 | | ECTS credits | | 2.0 | | |
| Learning profile | academic | | Assessment form | | credit | | |
| Conducting unit | Institute of Theoretical Physics and Astrophysics -> Faculty of Mathematics, Physics and Informatics -> Rector | | | | | | |
| Name and surname of lecturer (lecturers) | Subject supervisor | | dr Adrian Kołodziejski | | | | |
| | Teachers | | | | | | |
| Lesson types | Lesson type | Lecture | Tutorial | Laboratory | Project | Seminar | SUM |
| | Number of study hours | 15.0 | 15.0 | 0.0 | 0.0 | 0.0 | 30 |
| | 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 | 30 | | 0.0 | | 20.0 | 50 |
| Subject objectives | The aim of the course is to familiarize students with the methods and tools for investigating and analyzing functions of a single variable provided by integral calculus, and to present applications of these tools in the analysis of specific physical and natural phenomena. The course will also introduce the concept of multiple integrals. | | | | | | |

## 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:<br><br>Compute integrals using basic integration methods.<br>Apply integral calculus to solve specific problems in geometry, physics, and natural sciences. | [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:<br><br>Concept of an antiderivative (indefinite integral) and definite integral.<br>Basic methods for calculating integrals: integration by parts, substitution, universal substitutions.<br>Fundamental applications of integral calculus in geometry and describing physical and natural models. | [SW4] test/exam - oral or written |
| [BIOINL3_W02] Has advanced scientific knowledge necessary to understand the basic processes in living organisms. | The student knows:<br><br>Concept of an antiderivative (indefinite integral) and definite integral.<br>Basic methods for calculating integrals: integration by parts, substitution, universal substitutions.<br>Fundamental applications of integral calculus in geometry and describing physical and natural models. | [SW4] test/exam - oral or written |

## Subject contents

Definition of an antiderivative and indefinite integral, formulas for integrals of elementary functions, integral of a sum of functions and product of a function by a constant. Methods for computing indefinite integrals: by parts and by substitution, integration of rational and trigonometric functions. Definite integral, properties, formulas for integration by parts and by substitution. Applications of the definite integral: geometric (formulas for arc length, areas of surfaces, and volumes of solids of revolution), physical (calculating distance, work, etc.), biological and bioinformatical. Double integrak, Fubini's theorem.

## Prerequisites and co-requisites

Basic knowledge of differential calculus of functions of a single variable.

Mathematical Methods in Bioinformatics Calculus (formal prerequisite).

## Assessment methods and criteria

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| test | 51.0% | 50.0% |
| test | 51.0% | 50.0% |

## Recommended reading

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| Basic literature | • W. Kołodziej, Analiza matematyczna, PWN, Warszawa 2009.<br>• F. Leja, Rachunek różniczkowy i całkowy, Państwowe Wydawnictwo Naukowe, Warszawa 1969.<br>• G.I. Fihtenholz, Rachunek różniczkowy i całkowy, t. II<br>• W. Krysicki, L. Włodarski, Analiza matematyczna w zadaniach, część I i II, Państwowe Wydawnictwo Naukowe, Warszawa 1986. |
| Supplementary literature | • P.G. Higgs, T.K. Attwood, Bioinformatyka i ewolucja molekularna, Wydawnictwo Naukowe PWN |
| eResources addresses | |

## Example issues/ example questions/ tasks being completed

## Work placement

Not applicable

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