University of Gdańsk

Subject card

Subject name and code	Software for Mathematics Education, PG_00174483						
Field of study	Mathematics						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2025/2026			
Education level	Master's studies		Subject group	Optional subject group			
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	6.0			
Learning profile	academic		Assessment form	exam			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr Adrian Karpowicz				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	30.0	0.0	0.0	0.0	60
	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	60		10.0	80.0	150	
Subject objectives	The aim of the course is to familiarize students with selected software tools that support the work of a mathematician and to apply them in mathematics teaching.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATMU2_K01] is willing to acknowledge the limitations of his or her own knowledge and is willing to pursue further education	The student is willing to acknowledge the limitations of their own knowledge and is ready to continue their education in the use of information technology for solving mathematical problems.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[MATMU2_K02] is ready to precisely formulate questions to deepen his/her understanding of a given topic or find missing elements of reasoning	The student is willing to formulate precise questions aimed at deepening their own understanding of a given topic or identifying missing elements in reasoning with regard to the content discussed during the classes.	[SK1] oral statement/conversation/ discussion
[MATMU2_U04] is able, at an advanced level and including modern mathematics, to apply and present, orally and in writing, methods of at least one selected branch of mathematics	The student is able, at an advanced level encompassing modern mathematics, to apply and present methods of mathematical analysis both orally and in writing.	[SU2] presentation/project/paper/ report [SU4] test/exam - oral or written [SU5] implementation of a problem task
[MATMU2_W01] knows and understands in-depth the theory of selected areas of mathematics	The student has an in-depth knowledge and understanding of algorithmic methods for selected mathematical problems.	[SW4] test/exam - oral or written [SW5] implementation of a problem task
[MATMU2_U07] is able to define his/her interests and develop them; in particular, is able to establish contact with specialists in his/her field, e.g. understand their lectures intended for young mathematicians	The student is able to identify and develop their mathematical interests, recognizing the potential of using information technology in this area.	[SU1] oral statement/conversation/ discussion [SU8] observation of student's independent or team work
[MATMU2_U03] can understand mathematical texts of various types from selected fields of mathematics	The student is able to understand texts related to the algorithmization of selected mathematical problems.	[SU1] oral statement/conversation/ discussion [SU8] observation of student's independent or team work
[MATMU2_U05] can perform proofs in a selected field and, if necessary, also use tools from other areas of mathematics	The student is able to construct geometric proofs, applying when necessary tools from other areas of mathematics.	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task
[MATMU2_K04] is ready to understand and appreciate the importance of intellectual honesty in one's own and other people's actions; ethical conduct	The student is willing to understand and appreciate the importance of intellectual honesty in their own actions and those of others, as well as ethical behavior.	[SK8] observation of student's independent or team work
[MATMU2_W02] knows and understands well the role and importance of the construction of mathematical reasoning	The student knows and understands well the role and significance of constructing mathematical reasoning in the areas of elementary geometry and mathematical analysis.	[SW4] test/exam - oral or written [SW5] implementation of a problem task
[MATMU2_K05] is ready to independently search for information in literature, also in foreign languages	The student is willing to independently search for information in the literature regarding the mathematical foundations of the applied algorithms.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[MATMU2_U06] is able to apply methods and examples from a selected field of mathematics in related fields	The student is able to apply methods and examples from a selected field of mathematics in data analysis.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written
[MATMU2_W03] knows and understands in-depth a selected field of theoretical or applied mathematics and is able to understand the formulations of issues in this field that are still at the research stage and knows the connections of issues in this field with other areas of mathematics	The student has an in-depth knowledge and understanding of the mathematical foundations of algorithmics and is able to comprehend the formulation of problems in this field.	[SW2] presentation/project/paper/ report [SW5] implementation of a problem task
[MATMU2_K06] is ready to formulate opinions on basic mathematical issues	The student is willing to formulate opinions on the algorithmization of selected mathematical problems.	[SK1] oral statement/conversation/ discussion

Course outcome	Subject outcome	Method of verification
[MATMU2_U01] can construct mathematical reasoning: prove theorems and refute hypotheses through construction and selection of counterexamples	The student is able to construct mathematical reasoning: to prove theorems as well as to refute hypotheses through constructions and the selection of counterexamples in the fields of elementary geometry and number theory.	[SU2] presentation/project/paper/ report [SU5] implementation of a problem task

Subject contents

1. The use of DGS (e.g., GeoGebra software) in learning and teaching mathematics at primary, secondary, and higher education levels. In particular: creating dynamic presentations of definitions, theorems, and mathematical proofs; formulating mathematical hypotheses and their justification and generalization; constructing geometric figures; solving tasks experimentally (dynamically) in geometry, algebra, and mathematical analysis and developing their mathematical solutions; creating animations and computer simulations.

2. The use of programming languages (e.g., Scratch or Python) and spreadsheets in learning and teaching mathematics at primary, secondary, and higher education levels. Specifically, for algorithmizing simple mathematical problems and presenting mathematical content; investigating properties of natural numbers (including comparing different algorithms solving the same problem); solving selected probabilistic and statistical problems; and data analysis.

3. The application of artificial intelligence tools in learning and teaching mathematics. Familiarization with selected artificial intelligence algorithms.

4. The use of selected multimedia content in learning and teaching mathematics, e.g., selected resources from Khan Academy.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
observation of the student's attitude	51.0%	0.0%
project	51.0%	20.0%
activity	51.0%	10.0%
exam	51.0%	35.0%
test	51.0%	35.0%

Recommended reading

Basic literature	Winkowska Nowak Katarzyna , Pobiega Edyta i in. ABC GeoGebry . Poradnik dla początkujących, OEKP, 2016. Farrell Peter, Matematyczne przygody z Pythonem, PWN, 2021
Supplementary literature	Amit Saha, Matematyka w Pythonie. Algebra, statystyka, analiza matematyczna i inne dziedziny, Helion, 2021.
eResources addresses	

Example issues/ example questions/ tasks being completed	Here are the English translations of your tasks: **Task in GeoGebra** Create an applet that allows answering the question: Why does the sum of the interior angles of any convex pentagon equal 540 degrees? Assume the known fact that the sum of the angles in a triangle is 180 degrees. Include, among other things, a hint related to dividing the pentagon into triangles. **Task in GeoGebra** a) Create an applet visualizing the following definition of an ellipse (as a locus). An ellipse is a curve consisting of all points for which the sum of the distances from two fixed points, called the foci of the ellipse, is constant. b) Create an animation showing the surface generated by rotating the ellipse around its axis of symmetry. **Task in Scratch or Python** Program the drawing of the Peano curve. Discuss its basic properties. **Task in Excel** Use Excel to demonstrate the operation of a simple neural network.
Work placement	Not applicable

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