University of Gdańsk

Subject card

Subject name and code	Linear Algebra with Geometry I, PG_00204248		
Field of study	Mathematics		
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 Subject group related to scientific research 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	Faculty of Mathematics, Physics and Informatics -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Michał Stukow	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	45.0	0.0	0.0	0.0	75
	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	75	4.0	96.0	175

Subject objectives	
	The aim of the course is to familiarize students with concepts, theorems, and methods of elementary algebra, vector spaces, and systems of linear equations. This is the student's first encounter with pure abstract methods.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[MATL3_U03] is able to correctly use the concepts of linear algebra and analytic geometry, is able to apply the theorems and methods of these fields and is able to interpret the obtained results	The student is able to correctly use the concepts learned from the theory of linear spaces, analytic geometry and matrices when solving practical problems.	[SU4] test/exam - oral or written [SU6] demonstration of practical skills
[MATL3_U06] can formulate definitions and theorems in an understandable manner, both orally and in writing, and present correct mathematical reasoning on the learned topics	The student is able to formulate definitions and theorems and present correct mathematical reasoning concerning linear algebra and alalytic geometry.	[SU4] test/exam - oral or written
[MATL3_W03] knows and understands at an advanced level selected concepts, methods and theorems of linear algebra and analytic geometry, as well as basic examples both illustrating specific concepts in this field and allowing to refute false hypotheses or invalid reasoning	The student knows and understands selected concepts, methods and theorems concerning linear spaces, analytic geometry and matrices.	[SW4] test/exam - oral or written
[MATL3_W07] knows and understands at an advanced level the role and importance of proof in mathematics, as well as the concept of the importance of assumptions	The student knows proofs and understands their significance for selected theorems in linear algebra and analytic geometry.	[SW4] test/exam - oral or written

Subject contents

1. 1. The field of complex numbers: algebraic and trigonometric form of a complex number, Moivre's formula, powers and roots of complex numbers.
2. Construction of Euclidean spaces R^n. Elements of analytic geometry, operations on vectors, equations of lines and planes, basic properties of the dot product.
3. Systems of linear equations and methods for solving them - the Gauss-Jordan elimination method.
4. Matrices and operations on them. The inverse matrix and the algorithm for determining the inverse matrix. Matrix equations and their connection to systems of linear equations.
5. The concept of an abstract linear space over a field. Linear independence of vectors, linear subspaces generated by systems of vectors, the basis and dimension of a linear space.
6. The rank of a system of vectors, the rank of a matrix. Methods for calculating rank and applications. The Kronecker-Capelli theorem.
7. The determinant of a matrix. Properties and methods for calculating determinants. Applications of determinants. Cramer's formulas

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
tests	51.0%	30.0%
exam	51.0%	40.0%
quizzes	51.0%	20.0%
activity in classes	51.0%	10.0%
observation of the student's attitude	51.0%	0.0%

Recommended reading

Basic literature	1. A. Białynicki-Birula, *Algebra liniowa z geometrią*, PWN W-wa, 1976 2. Zbiór zadań z algebry, praca zbiorowa pod red. A. I. Kostrikina, PWN W-wa, 1995 3. T. Koźniewski, Wykłady z algebry liniowej I, Wydawnictwo Uniwersytetu Warszawskiego, 2008 4. J.Topp, Algebra liniowa, Wydawnictwo Uniwersytetu Gdańskiego, 2012 5. N. W. Jefimow, E. R. Rozendorn, *Algebra liniowa wraz z geometrią wielowymiarową*, PWN, W-wa 1974 6. J. Komorowski, *Od liczb zespolonych do tensorów, spinorów, algebr Liego i kwadryk*, PWN W-wa 1978 7. G. Banaszak, W. Gajda, *Elementy algebry liniowej* (cz. I i II) Wyd. Naukowo-Techniczne, W-wa 2002
Supplementary literature	Y. Manin, A. Kostrikin Algebra liniowa i geometria, PWN, W-wa, 1993
eResources addresses	

Example issues/ example questions/ tasks being completed	• Check the linear independence of the given vectors • Calculate the determinant of the given matrix • Solve the given system of linear equations
Work placement	Not applicable

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