

**Subject card**

<b>Subject name and code</b>	Linear Algebra with Geometry I, PG_00204248						
<b>Field of study</b>	Mathematics						
<b>Date of commencement of studies</b>	October 2026	<b>Academic year of realisation of subject</b>			2026/2027		
<b>Education level</b>	Bachelor's studies	<b>Subject group</b>			Obligatory subject group in the field of study Subject group related to scientific research in the field of study		
<b>Mode of study</b>	full-time studies	<b>Mode of delivery</b>			at the university		
<b>Year of study</b>	1	<b>Language of instruction</b>			Polish		
<b>Semester of study</b>	1	<b>ECTS credits</b>			7.0		
<b>Learning profile</b>	academic	<b>Assessment form</b>			exam		
<b>Conducting unit</b>	Faculty of Mathematics, Physics and Informatics -> Rector						
<b>Name and surname of lecturer (lecturers)</b>	<b>Subject supervisor</b>		dr hab. Michał Stukow				
	<b>Teachers</b>						
<b>Lesson types</b>	<b>Lesson type</b>	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	<b>Number of study hours</b>	30.0	45.0	0.0	0.0	0.0	75
	E-learning hours included: 0.0						
<b>Learning activity and number of study hours</b>	<b>Learning activity</b>	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	<b>Number of study hours</b>	75		4.0		96.0	175
<b>Subject objectives</b>	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 analytic 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	<ol style="list-style-type: none"> <li>1. The field of complex numbers: algebraic and trigonometric form of a complex number, Moivre's formula, powers and roots of complex numbers.</li> <li>2. Construction of Euclidean spaces <math>R^n</math>. Elements of analytic geometry, operations on vectors, equations of lines and planes, basic properties of the dot product.</li> <li>3. Systems of linear equations and methods for solving them - the Gauss-Jordan elimination method.</li> <li>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.</li> <li>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.</li> <li>6. The rank of a system of vectors, the rank of a matrix. Methods for calculating rank and applications. The Kronecker-Capelli theorem.</li> <li>7. The determinant of a matrix. Properties and methods for calculating determinants. Applications of determinants. Cramer's formulas</li> </ol>		
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	<ol style="list-style-type: none"> <li>1. A. Białynicki-Birula, <i>Algebra liniowa z geometrią</i>, PWN W-wa, 1976</li> <li>2. Zbiór zadań z algebry, praca zbiorowa pod red. A. I. Kostrikin, PWN W-wa, 1995</li> <li>3. T. Koźniewski, <i>Wykłady z algebry liniowej I</i>, Wydawnictwo Uniwersytetu Warszawskiego, 2008</li> <li>4. J. Topp, <i>Algebra liniowa</i>, Wydawnictwo Uniwersytetu Gdańskiego, 2012</li> <li>5. N. W. Jefimow, E. R. Rozendorn, <i>Algebra liniowa wraz z geometrią wielowymiarową</i>, PWN, W-wa 1974</li> <li>6. J. Komorowski, <i>Od liczb zespolonych do tensorów, spinorów, algebr Liego i kwadryk</i>, PWN W-wa 1978</li> <li>7. G. Banaszak, W. Gajda, <i>Elementy algebry liniowej (cz. I i II)</i> Wyd. Naukowo-Techniczne, W-wa 2002</li> </ol>	
	Supplementary literature	Y. Manin, A. Kostrikin <i>Algebra liniowa i geometria</i> , PWN, W-wa, 1993	
	eResources addresses		

Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"><li>• Check the linear independence of the given vectors</li><li>• Calculate the determinant of the given matrix</li><li>• Solve the given system of linear equations</li></ul>
Work placement	Not applicable

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