University of Gdańsk

Subject card

Subject name and code	Linear Algebra with Geometry II, PG_00204250		
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	2	ECTS credits	5.0
Learning profile	academic	Assessment form	exam
Conducting unit	Institute of Mathematics -> 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	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	3.0	62.0	125

Subject objectives

The aim of the course is to introduce students to the concepts, theorems and methods of linear algebra, including orthogonalization, quadratic forms and their applications in mathematical analysis and geometry.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[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 and linear and bilinear mappings.	[SW4] test/exam - oral or written
[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 of linear algebra and geometry, is able to apply the theorems and methods of these fields at a simple and medium level of difficulty, and is able to interpret the obtained results.	[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 create mathematical models of various phenomena using the language of linear algebra	[SU4] 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 geometry.	[SW4] test/exam - oral or written

<table>
<tr><td>Subject contents</td><td>1. Quotient spaces.
2. Linear mappings. Examples of linear mappings, kernel, image, structure theorem of linear mappings.
3. Matrices of linear mappings in various bases. Transition matrices.
4. Eigenvalues and eigenvectors. Characteristic polynomial.
5. Bilinear mappings and dot products. Symmetric bilinear mappings and their associated quadratic forms. Matrices of forms. Definiteness of a quadratic form.
6. Elements of geometry in Euclidean spaces - angle between vectors, orthogonality, norm, distance. Euclidean, normed, and metric spaces. Gram-Schmidt orthogonalization.
7. Hermitian product.
8. Classification of quadrics.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>egzam</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>observation of the student's attitude</td><td>51.0%</td><td>0.0%</td></tr>
<tr><td>activity</td><td>51.0%</td><td>10.0%</td></tr>
<tr><td>tests</td><td>51.0%</td><td>40.0%</td></tr>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. A. Białynicki-Birula, Algebra liniowa z geometrią, PWN W-wa, 1976
2. N. W. Jefimow, E. R. Rozendorn, Algebra liniowa wraz z geometrią wielowymiarową, PWN, W-wa 1974
3. J. Komorowski, Od liczb zespolonych do tensorów, spinorów, algebr Liego i kwadryk, PWN W-wa 1978
4. G. Banaszak, W. Gajda, Elementy algebry liniowej (cz. I i II) Wyd. Naukowo-Techniczne, W-wa 2002
5. Zbiór zadań z algebry, praca zbiorowa pod red. A. I. Kostrikina, PWN W-wa, 1995
6. T. Koźniewski, Wykłady z algebry liniowej I, Wydawnictwo Uniwersytetu Warszawskiego, 2008
7. J.Topp, Algebra liniowa, Wydawnictwo Uniwersytetu Gdańskiego, 2012</td></tr>
<tr><td>Supplementary literature</td><td>none</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>not included</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>

Document generated electronically. Does not require a seal or signature.