



## Subject card

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| Subject name and code                       | MATHEMATICS 2, PG_00058493                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                   |                                     |            |                                                                                                                                                                                    |         |     |
| Field of study                              | Economic Analytics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                   |                                     |            |                                                                                                                                                                                    |         |     |
| Date of commencement of studies             | October 2024                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Academic year of realisation of subject                                                                                                           |                                     |            | 2024/2025                                                                                                                                                                          |         |     |
| Education level                             | first-cycle 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                                                                                                                                      |                                     |            | 5.0                                                                                                                                                                                |         |     |
| Learning profile                            | general academic profile                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Assessment form                                                                                                                                   |                                     |            | exam                                                                                                                                                                               |         |     |
| Conducting unit                             | Mathematics Center -> Vice-Rector for Education                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                   |                                     |            |                                                                                                                                                                                    |         |     |
| Name and surname of lecturer (lecturers)    | Subject supervisor                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | dr Lech Kujawski                                                                                                                                  |                                     |            |                                                                                                                                                                                    |         |     |
|                                             | Teachers                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                   |                                     |            |                                                                                                                                                                                    |         |     |
| Lesson types and methods of instruction     | 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                                |            | 55.0                                                                                                                                                                               |         | 125 |
| Subject objectives                          | Uses the apparatus of linear algebra and mathematical analysis to solve theoretical and practical problems occurring in social sciences                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                   |                                     |            |                                                                                                                                                                                    |         |     |
| Learning outcomes                           | Course outcome                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Subject outcome                                                                                                                                   |                                     |            | Method of verification                                                                                                                                                             |         |     |
|                                             | [K6_U04] formulates logical solutions to complex or unstructured problems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | integrates the information obtained from solving complex problems, interpreting them, drawing conclusions and formulating and justifying opinions |                                     |            | [SU2] Assessment of ability to analyse information<br>[SU3] Assessment of ability to use knowledge gained from the subject<br>[SU4] Assessment of ability to use methods and tools |         |     |
|                                             | [K6_W02] demonstrates comprehensive preparation in the field of methods, techniques for formulating and solving problems                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | uses a mathematical apparatus to solve economic problems, combining knowledge of mathematics with knowledge of social sciences                    |                                     |            | [SW1] Assessment of factual knowledge                                                                                                                                              |         |     |
| Subject contents                            | Linear geometry of 3-dimensional space. Vectors. Conics and quadrics.<br>Complex numbers.<br>Vector spaces and subspaces. Linear independence. Basis and dimension. Linear maps. Quadratic forms. Eigenvectors and eigenvalues. Sylvester's criterion. LSM.<br>The process of finding antiderivatives and integration formulas the methods of substitution and integration by parts. Integration of basic families of functions.<br>Fundamental Theorem of Calculus. Methods of evaluations of definite integrals. Integration formulas, the methods of substitution and integration by parts for definite integrals. Improper integrals. Selected applications of definite integrals.<br>Functions of two variables: Partial derivatives. Total differential. Maxima and minima of a function of several variables.<br>Number series.<br>Differential and difference linear equations.<br>Constrained extrema. |                                                                                                                                                   |                                     |            |                                                                                                                                                                                    |         |     |
| Prerequisites and co-requisites             | Knowledge of the subject: Mathematics 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                   |                                     |            |                                                                                                                                                                                    |         |     |
| Assessment methods and criteria             | Subject passing criteria                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Passing threshold                                                                                                                                 |                                     |            | Percentage of the final grade                                                                                                                                                      |         |     |
|                                             | Exam                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 50.0%                                                                                                                                             |                                     |            | 60.0%                                                                                                                                                                              |         |     |
|                                             | Activity                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 50.0%                                                                                                                                             |                                     |            | 20.0%                                                                                                                                                                              |         |     |
|                                             | Tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 50.0%                                                                                                                                             |                                     |            | 20.0%                                                                                                                                                                              |         |     |

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|----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Recommended reading                                            | Basic literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Jankowska, K., Jankowski, T. Zbiór zadań z matematyki. Gdańsk: Wydawnictwo PG,<br>Jankowska, K., Jankowski, T., Funkcje wielu zmiennych - Całki wielokrotne - Geometria analityczna. Gdańsk: Wydawnictwo PG,<br>Dymkowska, J., Beger, D. (2015). Rachunek całkowy w zadaniach, Gdańsk: Wydawnictwo PG<br>Gurgul, H., Suder, M. Matematyka dla kierunków ekonomicznych, Warszawa: Oficyna a Wolters Kluwer business.                                                                                                     |
|                                                                | Supplementary literature                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Banaś, J., Podstawy matematyki dla ekonomistów. Warszawa: Wydawnictwa Naukowo-Techniczne<br>Gewert, M., Skoczylas, Z. Analiza matematyczna 1, Przykłady i zadania. Wrocław: Wydawnictwo GiS.<br>Gewert, M., Skoczylas, Z. Analiza matematyczna 2, Definicje, twierdzenia wzory. Wrocław: Wydawnictwo GiS.<br>Gewert, M., Skoczylas, Z. Analiza matematyczna 2, Przykłady i zadania. Wrocław: Wydawnictwo GiS.<br>Sozański, B., Dziedzic, I. Algebra i analiza w zagadnieniach ekonomicznych. Rzeszów: Wydawnictwo Bila. |
|                                                                | eResources addresses                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Adresy na platformie eNauczanie:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Example issues/<br>example questions/<br>tasks being completed | <p>Show the series convergence ... and find its sum.<br/> Check the linear dependence of a given system of vectors.<br/> Find the integral of the rational function ...<br/> Find the improper integral ... or demonstrate its divergence.<br/> Find the local extremes of the function <math>f(x, y) = \dots</math><br/> Solve the differential equation using the constant variation method.<br/> Find the general solution of the third order differential equation ... using the prediction</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Work placement                                                 | Not applicable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |