

## M.Sc. Economics

<b>Code:</b>		<b>Type:</b>	M.Sc. 1 <sup>st</sup> semester lecture series
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<b>Title:</b>	Mathematics II (Linear Algebra)
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<b>Lecturer:</b>	Jan Mutl
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<b>ECTS:</b>	3	<b>Contact hours (per semester):</b>	12
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<b>Semester:</b>	Winter 2009/2010	<b>Frequency of the lecture:</b>	Twice a week
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<b>Dates:</b>	October 7 <sup>th</sup> , 2009 until November 13 <sup>th</sup> , 2009
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<b>Prerequisites:</b>	Basic high school mathematics
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<b>Learning objectives</b> (What are the intended learning outcomes? Which skills will be acquired?):
Understanding of the basic concepts of linear algebra. Introduction to a „mathematical“ way of thinking.

<b>Content</b> (Which professional competence and which contents will be imparted?):
<ul style="list-style-type: none"> <li>▪ Systems of Linear Equations (reduced) row-echelon form, Gaussian and Gauss Jordan elimination, (left/right) inverse of a matrix</li> <li>▪ Fields, Vector Spaces, examples, linear combinations of vectors, subspaces, row space, column space, null space of a matrix</li> <li>▪ Linear Independence, linearly independent vectors, basis of a vector space, dimension, bases for the row and column space, rank plus nullity theorem, coordinates with respect to an ordered basis</li> <li>▪ Determinants, permutation definition of a determinant, cofactor expansion of the determinant, adjoint of a matrix, Cramer's rule</li> <li>▪ Linear transformations rank, kernel, image, matrix representation of linear transformations</li> <li>▪ Eigenvalues, Eigenvectors characteristic polynomial, diagonalization (Jordan form, Cayley Hamilton theorem)</li> <li>▪ Norms and Inner Products orthogonality, orthonormal bases, Gram-Schmidt, QR decomposition, projection, least squares solutions</li> <li>▪ Symmetric (Hermitean) Matrices diagonalization of, bilinear forms, positive (semi) definite matrices, Cholesky decomposition</li> <li>▪ Singular Value Decomposition, Generalized inverse</li> </ul>

<b>Teaching approach</b> (Description of the learning and teaching methods):
Lecture with homeworks

<b>Workload</b> (Optional: definition of workload (ECTS), divided in pre-modules (e.g. pre-readings), core-modules (contact hours), post-modules (e.g. case studies)):
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**Language of instruction** (Information on the language of teaching):

English

**Obligatory literature** (E.g. scripts, books, articles, cases, papers):

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**Additional literature** (E.g. books, articles, cases, papers):

- Linear Algebra by Bill Jacob (1990)
- Introduction to the Mathematical and Statistical Foundations of Econometrics by Herman Bierens (2004); Appendix I only
- Mathematics for Econometrics by Pheobus Dhrymes (2000); chapters 1-4
- Matrix Analysis by Horn and Johnson (1985); more advanced reference

**Mode of examination** (Mode of the examinations and tests (e.g. oral or written examination, lecture, homework, papers, class participation)):

Written examination

**Grading:**

Written examination 100 %

**Special features** (E.g. excursion, guest speaker):

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**Contact information:**

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**Office hours:**

By appointment

**Course website:**

<https://cecnet.tuwien.ac.at/>