

NYU LONDON

Linear Algebra

MATH-UA-140

Blended

Tuesday 9.00 – 12.45

Greenwich Mean Time

Spring 2021

We know that you may be taking courses at multiple locations this semester. If you are enrolled in this course 100% remotely and are not a Go Local/Study Away student for this course site, please make sure that you've completed the online academic orientation via NYU Classes so you are aware of site specific support structure, policies and procedures. **Please contact the site academic staff (nyul.academics@nyu.edu)** if you have trouble accessing the NYU Classes site.

Currently all teaching is remote, so the following does not apply at the moment:

[If you are attending in person, you will be assigned a seat on the first day and are expected to use that seat for the entire semester due to NYU COVID-19 safety protocol.]

Instructor Information

- TBA
- Office hours: TBA

Course Information

- MATH-UA-140
- Linear Algebra
- Normal prerequisite: Calculus 1 with a C or higher (or equivalent)
- *This course is currently remote and takes place on Tuesdays 9.00 – 12.45 (GMT) on the zoom link . The first class is on Tuesday 2 February.*

- London Academic Calendar: <https://www.nyu.edu/london/calendar.html>

Course Overview and Goals

This is an introductory course on linear algebra, one of the most important and basic areas of mathematics, with many real-life applications. The course introduces students to both the theory of vector spaces and linear transformations and the techniques such as row-reduction of matrices and diagonalisation, which can be applied to problems in areas such as engineering, economics, and mathematical biology.

As well as mastering techniques, it is important that the students get to grips with the more abstract ideas of linear algebra and learn to understand and write correct mathematical arguments. Taking an active approach to problem-solving is also important.

The class will consist of a mixture of lectures, working on problems and class discussions. Each class will correspond to two or three sections of the recommended text, which students will be expected to read. There will be weekly assignments, which are a very important part of the learning process: actively engaging with the mathematics is crucial.

Upon Completion of this Course, students will be able to:

- Understand the basic theory of vector spaces: linear independence, spanning, bases, dimension, subspaces.
- Understand the basic theory of linear transformations: matrix representation, diagonalisation, orthogonal diagonalisation
- Carry out the basic techniques of the following: row-reduction and LU decomposition to solve systems of linear equations; calculating determinants; finding eigenvalues and eigenvectors and diagonalising matrices; orthogonally diagonalising matrices.
- Apply linear algebra to solve some real-life problems.
- Work with formal mathematical arguments.

Course Requirements

Class Participation

You are expected to attend class in person or remote synchronously. Your active participation in class and attendance will be reflected in this part of the course requirements.

Grading of Assignments

The grade for this course will be determined according to these assessment components:

Assignments/ Activities	Description of Assignment	% of Final Grade	Due
Homework	Weekly homework, given out at one class and handed in at the class a week later	30%	At each class
Mid-term 1	Test on material from Chapters 1 – 3 (75 minutes)	15%	Oct 20
Mid-term 2	Test on material from Chapters 4 – 5 (75 minutes)	15%	Nov 24
Final exam	Exam on all material (from Chapters 1 – 7) (2 hours)	40%	Dec 15

Grades

- Letter grades for the entire course will be assigned as follows:
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Letter Grade	Percent	Description
A/A-	90 - 100%	Good understanding of ideas: ability to carry out calculations accurately: ability to produce and understand proofs and solve unseen conceptual problems.
B-/B/B+	80 - 89%	Reasonable understanding of ideas: ability to carry our calculations accurately: some ability to produce proofs.
C-/C/C+	70 - 79%	Some understanding of ideas: ability to carry our calculations fairly accurately.
D/D+	65 – 69%	Some basic understanding of ideas and ability to carry our calculations with some degree of success
F	0 – 64%	Ideas not understood and inability to do calculations

Course Materials

Required Textbooks & Materials

- Linear Algebra and its applications (3rd, 4th or 5th edition) by David Lay

Optional Textbooks & Materials

You may like to look at other Linear Algebra text-books, e.g. by Linear Algebra by Strang. However, we will follow the notation and presentation of material used in the text by Lay.

Resources

- **Access your course materials:** [NYU Classes](https://nyu.edu/its/classes) (nyu.edu/its/classes)
- **Databases, journal articles, and more:** [Bobst Library](https://library.nyu.edu) (library.nyu.edu)
- **Assistance with strengthening your writing:** [NYU Writing Center](https://nyu.mywconline.com) (nyu.mywconline.com)
- **Obtain 24/7 technology assistance:** [IT Help Desk](https://nyu.edu/it/servicedesk) (nyu.edu/it/servicedesk)

Course Schedule

Reminder: Links to join class Zoom meetings will all be available in NYU Classes.

Topics and Assignments

Week/Date	Topic	Reading	Assignment Due
Session 1: Feb 2	1.1 Systems of linear equations 1.2 Row reduction and echelon form 1.3 Vector equations	Text by Lay Sections: 1.1, 1.2, 1.3	CW 1: Sept 15
Session 2: Feb 9	1.4 Matrix equations 1.5 Solutions sets of linear systems 1.7 Linear independence	Sections 1.4, 1.5, 1.7	CW 2: Sept 22
Session 3: Feb 16	1.8 Introduction to linear transformations 1.9 The matrix of a linear transformation 2.1 Matrix operations	Sections 1.8, 1.9, 1.10	CW 3: Sept 29
Session 4: Feb 23	2.2 The inverse of a matrix 2.3 Characterizations of invertible matrices 2.4 Partitioned matrices	Sections 2.2, 2.3, 2.4	CW 4: Oct 6
Session 5: March 2	2.5 Matrix factorizations	Sections 2.3, 3.1, 3.2	CW 5: Oct 13

Week/Date	Topic	Reading	Assignment Due
	3.1 Introduction to determinants 3.2 Properties of determinants		
Session 6: March 9	4.1 Vector Spaces 4.2 Null spaces, column spaces, linear transformations 4.3 Linearly independent sets; bases	Sections 4.1, 4.2, 4.3	n/a
Session 7: March 16	<i>Mid-term 1 (on Chapters 1 – 3)</i> 4.4 Coordinate systems	Section 4.4	CW 6: Oct 27
Session 8: March 23	4.5 The dimension of a vector space 4.6 Rank 4.7 Change of basis	Sections 4.5, 4.6, 4.7	CW 7: Nov 3
Session 9: March 30	Applications Revision/catch up	n/a	CW 8: Nov 10
Session 10: Apr 6	5.1 Eigenvectors and eigenvalues 5.2 The characteristic equation 5.3 Diagonalisation	Sections 5.1, 5.2, 5.3	CW 9: Nov 17
Session 11: Apr 13	5.4 Eigenvectors and linear transformations 6.1 Inner products 6.2 Orthogonal sets	Section 5.4, 6.1, 6.2	n/a
Session 12: Apr 20	<i>Mid-term 2 (on Chapters 4 – 5)</i> 6.3 Orthogonal projections	Section 6.3	CW 10: Dec 1
Session 13: Apr 27	6.4 Gram-Schmidt process 6.5 Least squares problem 7.1 Diagonalization of symmetric matrices	Sections 6.4, 6.5, 7.1	CW 11: Dec 8

Week/Date	Topic	Reading	Assignment Due
Session 14: May 4	7.2 Quadratic forms Catch-up/Revision	Section 7.2	n/a
Session 15: May 11	<i>Final test (on all material covered)</i>	n/a	n/a

Course Policies

[Hygiene/Physical Distancing policies

Currently all teaching is remote, so the following does not apply at the moment:

- Students will be assigned/choose a seat on the first day of class. For NYU COVID-19 Safety protocols, please use the same seat for the duration of the semester.]

Attendance and Tardiness

Studying at Global Academic Centers is an academically intensive and immersive experience, in which students from a wide range of backgrounds exchange ideas in discussion-based seminars. Learning in such an environment depends on the active participation of all students. And since classes typically meet once or twice a week, even a single absence can cause a student to miss a significant portion of a course. **To ensure the integrity of this academic experience, class attendance at the centers or online through NYU Classes if the course is remote synchronous/blended, is expected promptly when class begins. Unexcused absences will affect students' semester participation grade.** Students are responsible for making up any work missed due to absence. Repeated absences in a course may result in failure.

Key information on NYU London's absence policy, how to report absences, and what kinds of absences can be excused can be found on our [website](http://www.nyu.edu/london/academics/attendance-policy.html) (<http://www.nyu.edu/london/academics/attendance-policy.html>)

Classroom Etiquette/Expectations

Things to consider:

- Please be mindful of your microphone and video display during synchronous class meetings. Ambient noise and some visual images may disrupt class time for you and your peers.
- If you are not using your cell phone to follow the lesson, cell phones should be turned off or in silent mode during class time.
- Make sure to let your classmates finish speaking before you do.
- Please do not eat during class and minimize any other distracting noises (e.g. rustling of papers and leaving the classroom before the break, unless absolutely necessary)

- If deemed necessary by the study away site (ie COVID related need), synchronous class sessions may be recorded and archived for other students to view. This will be announced at the beginning of class time.
- Students should be respectful and courteous at all times to all participants in class. Consider using the chat function or “raise hand” function in order to add your voice to class discussions especially if leaving the video on presents challenges.

Final Exams

Final exams must be taken at their designated times. Should there be a conflict between final exams, please bring it to the attention of the London Academics team (nyul.academics@nyu.edu) as soon as this is known to facilitate alternate arrangements. Final exams may not be taken early, and students should not plan to leave the site before the end of the finals period.

Incomplete Grade Policy

An “incomplete” is a temporary grade that indicates that the student has, for good reason, not completed all of the course work. This grade is not awarded automatically nor is it guaranteed; rather, the student must ask the instructor for a grade of “incomplete,” present documented evidence of illness, an emergency, or other compelling circumstances, and clarify the remaining course requirements with the instructor.

In order for a grade of “incomplete” to be registered on the transcript, the student must fill out a form, in collaboration with the course instructor and the academic administration at the site; it should then be submitted to the site’s academic office. The submitted form must include a deadline by which the missing work will be completed. This deadline may not be later than the end of the following semester.

Academic Honesty, Plagiarism and Late Work

As the University's policy on "[Academic Integrity for Students at NYU](#)" states: "At NYU, a commitment to excellence, fairness, honesty, and respect within and outside the classroom is essential to maintaining the integrity of our community. By accepting membership in this community, students take responsibility for demonstrating these values in their own conduct and for recognizing and supporting these values in others." **Students at Global Academic Centers must follow the University and school policies.**

The presentation of another person’s words, ideas, judgment, images, or data as though they were your own, whether intentionally or unintentionally, constitutes an act of plagiarism.

You can find details on these topics and more on this section of our NYUL website (<https://www.nyu.edu/london/academics/academic-policies.html>) and on the Policies and Procedures section of the NYU website for students studying away at global sites (<https://www.nyu.edu/academics/studying-abroad/upperclassmen-semester-academic-year-study-away/academic-resources/policies-and-procedures.html>).

Inclusion, Diversity, Belonging and Equity

NYU is committed to building a culture that respects and embraces diversity, inclusion, and equity, believing that these values – in all their facets – are, as President Andrew Hamilton has said, “...not only important to cherish for their own sake, but because they are also vital for advancing knowledge, sparking innovation, and creating sustainable communities.” At NYU London, we are committed to creating a learning environment that:

- fosters intellectual inquiry, research, and artistic practices that respectfully and rigorously take account of a wide range of opinions, perspectives, and experiences; and
- promotes an inclusive community in which diversity is valued and every member feels they have a rightful place, is welcome and respected, and is supported in their endeavours.

Moses Accommodations Statement

Academic accommodations are available for students with documented and registered disabilities. Please contact the Moses Center for Student Accessibility (+1 212-998-4980 or mosescsd@nyu.edu) for further information. Students who are requesting academic accommodations are advised to reach out to the Moses Center **as early as possible in the semester for assistance**. Accommodations for this course are managed through the site sponsoring the class once you request it.

Instructor Bio/About Your Instructor

Departmental Tutor and lecturer in the Mathematics Department at UCL. I currently teach first year algebra and Galois Theory to undergraduates at UCL. My research interests are in abstract algebra, in particular non-commutative ring theory.