Linear Algebra

Fall 2023, Session 2

Dates / Synchronous meeting time:	MoWe: 12:00—14:30	ROOM: IB 1047
Recitation	Tu: 16:15—17:30	Zoom: **997 5192 0472** PASS**: MATH202**
Academic credit:	4	
Course format:	Lectures, Recitations	

Instructor's Information

Dr. Lin Jiu	Assistant Professor in Mathematics
Email:	lin.jiu@dukekunshan.edu.cn
Office:	WDR 3004
Office Hours:	Tu 13:00—14:30, We: 10:00—11:30, or **by appointment**

My main research area is number theory and combinatorics in mathematics. Some other projects involve computations, such as symbolic computation, i.e., computer proofs. Please check my personal website for more information: https://jiulin90.github.io/index.html

Teaching Assistant Information

Lanze Liu	Lanze.Liu@dukekunshan.edu.cn
Office Hours:	Th: 13:00—14:00 Zoom: 949 8505 9527 PASS: MATH202

What is this course about?

This is an introduction to linear algebra for students in the first or second year of university.   Linear algebra is the study of systems of linear equations, vector spaces, and linear transformations. Solving systems of linear equations is a basic tool in mathematics used for solving problems in science, engineering, business, and many other fields. Main topics of this course include systems of linear equations and elementary row operations, Euclidean n-space and subspaces, linear transformations and matrix representations, Gram-Schmidt orthogonalization process, determinants, eigenvectors and eigenvalues, and applications. The content of this course is essential to almost all areas of mathematics, engineering, computer science and other data-focused sciences and research.

What background knowledge do I need before taking this course?

Prerequisite: Math 101 or Math 105.

What will I learn in this course?

- Perform matrix algebra, apply Gaussian elimination, interpret the resulting matrix and describe the solution set to a system of linear equations.

- State, interpret, and apply key definitions and theorems, including vector spaces, subspaces, linear independence, basis, dimension, linear transformations and corresponding matrix representations, the Invertible Matrix Theorem, the Rank and Nullity Theorem, etc.
- Understand definition and properties of determinants and compute the determinant of a given matrix. Use Cramer's Rule to solve certain systems of linear equations, based on the calculations of determinants.
- Find eigenvalues and eigenvectors, and diagonalize matrices.
- Apply orthogonality and projections to solve geometric or algebraic problems, including Gram-Schmidt orthogonalization and least squares solutions.
- Use properties and results of matrix algebra, vector spaces, linear transformations, etc., to construct short proofs of statements in abstract settings.

What will I do in this course?
- You will attend two lectures per week.
- You will attend one recitation per week, except for Week 3 and Week 5, when we schedule two midterms.
- You will finish 6 sets of homework assignments via WeBWorK
- **You MUST attend the two midterm tests and the final exam**.
- Office hours, tutors from Academic Resource Center (see below on campus resources) will provide help on any questions.

What required texts, materials, and equipment will I need?
Free textbook: (uploaded to Sakai)
Matrix Theory and Linear Algebra, Peter Salinger
https://www.mathstat.dal.ca/~selinger/linear-algebra/downloads/LinearAlgebra.pdf

What optional texts or resources might be helpful?
Any textbook in linear algebra

How will my grade be determined?

Test I	20%	Nov. 7th IB 1047 Coverage: Week 1 + Week 2
Test II	20%	Nov. 21st IB 1047 Coverage: Week 3 + Week 4
Final Exam	40%	Dec. 13, AB 2103.
Homework Assignments	20%	See the description below

Tests: There are two tests during the recitation time of Weeks 3, and 5. Each is worth 20%.
Final Exam: Scheduled by the Registrar's Office, which is a 3-hour exam.40%
Homework Assignments: There are 6 sets of homework assignments, on WeBWorK. Each is worth 4% and the lowest will be dropped.

Formula Sheet: For **each midterm test**, you are allowed to bring **ONE A4 size formula sheet (double sided)** and for the **final exam**, you are allowed to bring **TWO pieces.**

A+= 98% - 100% **A** = 93% - 97.99%; **A-** = 90% - 92.99%;
B+ = 87% - 89.99%; **B** = 83% - 86.99%; **B-** = 80% - 82.99%;
C+ = 77% - 79.99%; **C** = 73% - 76.99%; **C-** = 70% - 72.99%;
D+ = 67% - 69.99%; **D** = 63% - 66.99%; **D-** = 60% - 62.99%;
F = 59.99% and below
As you can see, the final percentage will be rounded DOWN to the closest integer.

Your course grade will not be lower than your final exam percentage. For example, if you obtained an A in the final exam; but overall course calculation, from the table above, shows an A-, you will still receive an A, not an A-.

Your grades will NOT be curved.

What are the course policies?

Language: English

The official language in this course is English.

- Communications during or after the class on course materials should use English
- Your answers to tests should be in English. Each time, if I see another language other than English appearing in your answers, I will take 1% off from your COURSE GRADE.

In case of documented illness or family emergency or documented University sponsored trips, you may miss the test, but the supporting documentation must be submitted to the instructor in advance. **With the document, your missing midterm score can be counted as the same as your final**. Do remember: let me know **BEFORE** the exam. An unexcused absence from any exam will be counted as a zero.

Academic Integrity:

As a student, you should abide by the academic honesty standard of Duke Kunshan University. The DKU Community Standard states: "Duke Kunshan University is a community comprised of individuals from diverse cultures and backgrounds. We are dedicated to scholarship, leadership, and service and to the principles of honesty, fairness, respect, and accountability. Members of this community commit to reflecting upon and upholding these principles in all academic and non-academic endeavors, and to protecting and promoting a culture of integrity and trust." For all graded work, students should pledge that they have neither given nor received any unacknowledged aid.

Please also include an indication of your typical penalties for an academic integrity violation (such as resubmitting for a reduced grade, 0 on the problem or the assignment, etc.). While the actual penalty might depend on the details of the specific situation, including some indication will help students understand that DKU takes academic integrity seriously. Please also be clear about your policies regarding the use of any online resources, including language translation tools, problem-solving tools, **artificial intelligence**, etc.

Academic Policy & Procedures:

You are responsible for knowing and adhering to academic policy and procedures as published in the University Bulletin and Student Handbook. Please note, an incident of behavioral infraction or academic dishonesty (cheating on a test, plagiarizing, **unauthorized use of online tools**, etc.) will result in immediate action from me, in consultation with university administration (e.g., Dean or Associate Dean of Undergraduate Studies, Student Conduct, Academic Advising). Please visit the Undergraduate Studies website for additional guidance related to academic policy and procedures. Academic integrity is everyone's responsibility.

Academic Disruptive Behavior and Community Standard:

Please avoid all forms of disruptive behavior, including but not limited to: verbal or physical threats, repeated obscenities, unreasonable interference with class discussion, making/receiving personal phone calls, text messages or pages during class, excessive tardiness, leaving and entering class frequently without notice of illness or other extenuating circumstances, and persisting in disruptive personal conversations with other class members. Please turn off phones, pagers, etc. during class unless instructed otherwise. Laptop computers may be used for class activities allowed by the instructor during synchronous sessions. If you choose not to adhere to these standards, I will take action in consultation with university administration (e.g., Dean of Undergraduate Studies, Student Conduct, Academic Advising).

Academic Accommodations:

Duke Kunshan University makes reasonable academic accommodations for qualified students with disabilities. All undergraduate accommodations must be approved through the Student Accommodation Services. Students requesting accommodation for this course should forward their official accommodation letter to the instructor and ask to schedule a time to meet and discuss the implementation of their accommodation(s). It is the student's responsibility to meet, discuss, and provide an electronic copy of the Instructor Accommodation Letter to each instructor. Accommodation will not be granted retroactively. Accommodations for test, quiz, or exam taking must be arranged with the professor at least a week before the date of the quiz, test, or exam, including finals.

What campus resources can help me during this course?

Academic Resource Center

The Academic Resource Center provides tutoring services, and there will be tutors especially for our MATH202 course: https://www.dukekunshan.edu.cn/academics-advising/tutoring-service/

Academic Advising and Student Support

Please consult with me about appropriate course preparation and readiness strategies, as needed. Consult your academic advisors on course performance (i.e., poor grades) and academic decisions (e.g., course changes, incompletes, withdrawals) to ensure you stay on track with degree and graduation requirements. In addition to advisors, staff in the Academic Resource Center can provide recommendations on academic success strategies (e.g., tutoring, coaching, student learning preferences). Please visit the Office of Undergraduate Advising website for additional information related to academic advising and student support services.

Writing and Language Studio

For additional help with academic writing—and more generally with language learning—you are welcome to make an appointment with the Writing and Language Studio (WLS). You can register for an account, make an appointment, and learn more about WLS services, policies, and events on the WLS website. You can also find writing and language learning resources on the Writing & Language Studio Sakai site.

IT Support

If you are experiencing technical difficulties, please contact IT:

- China-based faculty/staff/students 400-816-7100, (+86) 0512- 3665-7100
- US-based faculty/staff/students (+1) 919-660-1810
- International-based faculty/staff/students can use either telephone option (recommend using tools like Skype calling)
- Live Chat: https://oit.duke.edu/help
- Email: service-desk@dukekunshan.edu.cn

What is the expected course schedule?

We will cover most of the following materials from the textbook (*Tentatively, may up to some perturbation*).

Week 1	Systems of Linear Equations (Chapter 1)
	● Geometric and Algebraic view of System of equations.(1.1, 1.2)
	● Elementary Operations (1.3)
	● Gaussian and Gauss-Jordan Elimination (1.4, 1.5) ● Homogeneous Systems (1.6)

	● Uniqueness of the Reduced Echelon Form (1.7)
Week 2	Vectors in n-dim space (Chapter 2)
	● Points and Vectors (2.1)
	● Vector addition, scalar multiplication, linear combination (2.2---2.4)
	● Length of a vector (2.5)
	● Dot product (2.6.1---2.6.4)
	Matrices (Chapter 4)
	● Definition, Matrix addition, scalar multiplication (4.1—4.3)
	● Matrix Multiplication (4.4)
	● Matrix Inverse (4.5.1, 4.5.2)
Week 3	● Matrix Inverse (4.5.3, 4.5.4)
	● Elementary matrices (4.6)
	● Transpose (4.7)
	● Trace: Definition
	Spans, Linear Independence and Bases in R^n (Chapter 5)
	● Spans (5.1)
	● Linear Independence (5.2)
	Midterm I: Coverage: Week 1 + Week 2
Week 4	● Subspaces of R^n (5.3)
	● Basis and Dimension (5.4)
	● Null Spaces, Column Spaces, and Linear Transformations (5.5)
	● Orthogonal and Orthonormal Basis (11.2, 11.3 but only for R^n)
	Linear Transformations (Chapter 6)
	● Definition (6.1)

	• The Matrix of a Linear Transformations (6.2)
	• Properties of Linear Transformations (6.4)
Week 5	Determinants (Chapter 7)
	• 2*2 and 3*3 (7.1)
	• Determinants of a Triangular Matrix (7.3)
	• Determinants and Row Operations (7.4
	• Minors and Cofactors (7.2)
	• A formular for the Inverse of a Matrix (7.6)
	• Properties of Determinants (7.5)
	• Cramer's Rule (7.7)
	Midterm II: Coverage: Week 3 + Week 4
	Eigenvectors and Eigenvalues (Chapter 8)
	• Eigenvectors and Eigenvalues (8.1)
	• The Characteristic Equation, Find Eigenvalues and Eigenvectors (8.2)
Week 6	• Diagonalization (8.4)
	• Matrix Powers (8.5)
	• Properties of Eigenvalue and Eigenvectors (8.9)
	• Quadratic Form (11.9)
	• Trace
	• Jordan Canonical Form
Week 7	• Selected Topics
	• Review

Final Exam: Dec. 13th, 2023 15:30—18:30 @ AB 2103