

# Linear Algebra MATH 201

Sabancı University, Summer 2021

**Lecturer :** Leyla Işık

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Office Hours: Thursday 13:40-14:30 or by an appointment.

**Lecture hours :**

Monday 14.40 - 16.30

Thursday 10.40 - 12.30

Friday 14.40 - 17.30

**Lecture format :** Lectures will be live-streamed unless a technical difficulty occurs. You can find the Zoom link for the lecture on SUCourse+. In order to have access, you must be logged in with your Sabancı account. The online lectures will be recorded and uploaded afterwards, so that you can also watch them at a later time. They are going to be published on SUCourse+. Supplementary materials will also be uploaded on SUCourse+ to study before/after the lectures.

**Recitation hours :** Friday 17.40 - 19.30: A1 - A2

**Recitation format :** Recitations will be live-streamed and held as discussions with the TAs via Zoom. You can find the Zoom links for recitations on SUCourse+. In order to have access to them, you must be logged in with your Sabancı account. Students must attend the online recitation classes to which they are registered.

**You are responsible for every announcement made in class or in SUCourse+. Not attending the class or not following SUCourse+ regularly is not an excuse, in case you miss something.**

## Course Content

Systems of linear equations, Gaussian elimination, vector spaces, subspaces, linear independence, dimension, change of bases, linear transformations, inner product, orthogonality, eigenvalues, eigenspaces and diagonalization.

## Objectives

This course aims to introduce basic concepts of linear algebra such as vector spaces, bases, linear transformations, eigenvalues and eigenspaces. The course gives students training to develop their mathematical skills, analytical and critical thinking abilities, their ability to apply these capabilities to practical problems, and to communicate their knowledge of these areas.

## Textbook

G. Strang, Introduction to Linear Algebra. Fifth edition (2016), Wellesley-Cambridge Press and SIAM.

## Further reading

- Anton H., Rorres C., Elementary Linear Algebra with Supplemental Applications, Wiley International Student Version, 11th edition, 2015.
- Axler, A., Linear Algebra Done Right. Springer.
- Leon, S. J., Linear Algebra with Applications, Prentice Hall.

## Course Outline

- Week 1 (01-02 July): Introduction to vectors, Solving linear equations (Ch 1, Ch 2)
- Week 2 (05-09 July): Matrices and their operations, Invertible matrices (Ch 2)
- Week 3 (12 July): Vector Spaces, Subspaces (Ch 3)
- Week 4 (26-30 July): Basis, Dimension, The four subspaces (Ch 3)
- Week 5 (02-06 August): The Linear Transformations (Ch 8)
- Week 6 (09-13 August): Determinants, Eigenvalues, Eigenvectors, Diagonalization (Ch 5, Ch 6)
- Week 7 (16-20 August): Orthogonality (Ch 4).

## Learning Outcomes

On completion of this course the student should be able to:

- Understand the notion of mathematical thinking, mathematical proofs, and able to apply them in problem solving.
- Present simple proofs in a precise and formally correct way.
- Solve a system of linear equations using matrix reduction.
- Do basic arithmetical operations with matrices.
- Understand the notions of linear independence, basis and dimension of a vector space.
- Find a basis and dimension of Euclidean or abstract vector spaces.
- Geometrically interpret the above concepts.
- Represent linear transformations as matrices and, conversely, interpret matrices as linear maps.
- Compute eigenvalues and eigenspaces of matrices.
- Identify whether a matrix is diagonalizable or not.

## Exam Policy and Dates

Your grade exclusively depends on the below listed items. There will be no other extra-credit opportunities.

- **Midterm Exam ( % 35 )** : August 02, Monday 14.40 -16.30 (Week 5)
- **Final exam ( % 50 )** : 21-24 August. Exact date will be announced by student resources. Further details will be announced on SUCourse+ before the exams.

Both exams will be online proctored and recorded. For proctored exams, your webcam and microphone should be on during the exam. In the case of non-compliance with this and other declared exam procedures, your exam will be invalid. Make sure to check that your webcam and microphone function properly before the exam.

- **Homeworks and Quizzes** : There will be 2 homeworks and 2 quizzes. The best three out of these will be counted for the final course grade.
  - hw 1 ( % 5 ) : July 09, Friday 8 pm - July 11, Sunday 8 pm (Week 2)
  - hw 2 ( % 5 ) : August 06, Friday 8 pm - August 08, Sunday 8 pm (Week 5)

- quiz 1 ( % 5 ) : July 30, Friday (Week 4)
- quiz 2 ( % 5 ) : August 13, Friday (Week 6)

The quizzes will be held during the recitation classes and will be asked to upload the first draft of their solutions on on SUCourse+. There will be no make-up for the homeworks or quizzes. Students found having a behaviour in contrast with Academic Integrity multiple times, will receive 0 (zero) point.

**Warning 1:** Every document that requires a student submission,

- i. must be in pdf format, and hand-written,
- ii. must have name, surname, student ID, and signature on the top left corner of the document on each page submitted,
- iii. Sabancı Student ID card or a valid ID card with name and photo on it must be placed on the top right corner of the first page. Submissions must be uploaded as a single pdf file. Any submission that is not in the described format will NOT be taken into account. Moreover, any solution that contains notations that are not used in the lectures/recitations will be completely ignored.

**Warning 2:** After any submission (i.e. online assignments, midterm exam, final exam), some of the students may be called for an oral examination. In this case, some students will be selected randomly and some will be selected based on any irregularities in their performance and/or level of work they submit. Oral examinations will be done over Zoom and each oral examination will be recorded. During an oral examination, students must

- i. keep their camera on at all times,
- ii. share their entire screens (not specific tabs or windows).

Performance of the student in an oral examination will affect their grades of the grading item they have been called upon. If a student fails to show up at an oral exam, or does not obey the aforementioned rules, (s)he will automatically get 0 (zero) point from that grading item.

- Exams are closed book. This means that during the exams, the use of books, notes, electronic devices (including cell phones, smart watches, calculators, computers etc.), or any other kind of supporting learning material is **NOT** allowed. A student violating this rule will receive 0 points for that exam.
- The passing grade will be determined after the last exam. Be aware that this passing grade may not match the overall average of the students.
- Do not underestimate this course! It is advised that you study regularly and attend all lectures and recitation sessions. If you do not fully understand the material it is recommended to take an appointment with your TA or your instructor immediately after class.
- Students are expected to follow the announcements made during the lectures or in SUCourse.

## Make-up Policy

Make up excuses are accepted only for the midterm and the final exams. Only health or technical problem excuses will be considered. Those who have health problem excuses have to prove it with a doctor report and those who have technical problems have to prove their excuse with a video showing the current date and time, such as taking a screenshot of the computer screen.

The make-up exam will contain all topics covered throughout the semester. The make-up examination will be done as a combination of face-to-face online verbal exam and written exam at the end of the semester. One can have a make-up exam for **ONLY** one of the exams. If a student miss both (Final and

Midterm) exams even with a valid excuse, then (s)he will be allowed to take make-up for Final exam only, and receive 0 (zero) point for Midterm exam. If the student do not contact with the instructor and do not take neither the exams nor the make-up, then (s)he gets NA (even though homeworks/quizzes appear in the grading).

## Participation

Although it is not mandatory to attend the lectures or recitation sessions, attendance may be checked and recorded. Students are responsible for all missed work, regardless of the reason for absence.

## Weekly Exercises

There will be weekly problems assigned each week. They will not be graded. You are not expected to return the solutions but you are strongly advised to solve them and discuss during the next recitation.

## Recitations

Students must attend the recitation classes to which they are registered. Recitations are supposed to be an active learning environment. Your behavior will be monitored by the TA's. If you misbehave during recitations, this will be reported to the instructors and appropriate measures will be taken, which may effect your course grade.

## Academic Honesty

We expect all students to follow common-sense practices during the exams. Cheating will not be tolerated. The action against such violations could range from getting a zero on the particular exam to explaining the case in front of the Disciplinary Committee.

## Class Discipline

It is our responsibility to provide students with excellent teaching and learning environments. We are therefore asking you to respect both our responsibility to teach and the right of other students to learn. Any action that disturbs your classmates or disrupts the online activities is unacceptable. Repeated violations of the above common sense rules may cause a student to be counted as absent for a lecture or a recitation.

## Suggestions

- Study regularly and attend all lectures and recitation sessions. Make sure you attend your own (registered) recitation section.
- Feel free to ask me and your TA questions in and out of class, especially during office hours.
- Math 201 is a combination of computational mathematics and theoretical mathematics (that is abstract definitions and theorems). The computational aspects of the course will feel more familiar and easier to grasp, but we will also focus on the theoretical aspects of the subject. Whenever you encounter an abstract concept in the lecture, take a pause and give yourself some time to think about it.
- In linear algebra, definitions and theorems build on each other quickly. If you fall behind, it will be difficult to catch up. Work hard from the beginning, and come to office hours immediately if you do not understand something. Studying out of class for this course should become a routine. Key to success in mathematics is practice.

## Registration Overrides

Time conflict requests will be accepted. However, any and all negative outcomes that may result are solely the student's responsibility.