

Syllabus

Course	MA 322: Linear Algebra
Section	003
Classes	MWF 12:00 - 12:50 PM , CB 339
Text	Serge Lang, Introduction to Linear Algebra, Second Edition, Springer
Instructor	Serge Ochanine
Signup Office Hours	MF 1:00 - 2:00 PM and by appointment
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Course description. The subject of this course is *Linear Algebra*, which can be defined as the *general theory of systems of linear equations*. As such, it has applications in all other areas of mathematics, and also, directly or indirectly, in virtually any area of modern science or engineering. A quick glance on the provided schedule will give you a rough idea of the content of the course. Here I would only like to stress a couple of points that make this course different, say, from a calculus course.

To begin with, to be applicable in many different situations, a mathematical theory must formulate its results in a rather general form. For example, a theorem about vectors in the plane will be stated and proven for vectors in *any* vector space. This results in a somewhat *higher level of abstraction*, but has the welcome effect of making the theorem applicable not only to vectors in the plane, but also to matrices, to polynomials, to functions of one or several variables, and so on. More generality has also the effect of focussing our attention on the essential properties of the objects involved, thus disregarding the irrelevant peculiarities of specific examples. Students whose background in mathematics is limited to high school mathematics and calculus courses may find the increasing level of abstraction somewhat disconcerting. This is why the level of abstraction will increase *gradually* through the semester. Vector spaces and linear maps will be introduced only after vectors in \mathbf{R}^n , matrices, and linear systems have been thoroughly discussed. On the other hand, students should get ready, as soon as possible, for this increase in abstraction. Some of the exercises in the book, and in your homework assignments, have that specific purpose. When, for example, you are required to prove something about the dot-product in \mathbf{R}^n "using only the four properties of this product", or when you are asked to reformulate some result about linear systems as a result about vectors in \mathbf{R}^n , you are being prepared for this "leap into generality".

The other aspect of this course that I will mention, is the requirement that every statement, every theorem be given an *explicit, mathematically correct proof*. No matter what future use of mathematics you have in mind, and no matter what idea of mathematics you may have got from your previous mathematical experience, mathematics is about theorems and proofs. The idea that one can understand mathematics and be able to apply it without reading proofs or learning to give one's own proofs, is totally ludicrous. Proofs are the essence of mathematics. Trying to

avoid them is like trying to avoid water while trying to learn how to swim.

It wouldn't be very helpful to watch others swim either! In this course you will learn a lot of mathematics *by doing mathematics yourself*. Only by spending enough time on your homework, by actively participating in the problem sessions, and by being very active and vigilant during the lectures will you be able to master the material.

"Enough time" means *about 6 hours a week* for your homework for most of you. For some of you, it may mean more than 6 hours. It is very important that you be aware of this, and that you organize your work accordingly. The detailed schedule attached to this syllabus should help you with the organization. Also, do not hesitate to discuss with me any difficulty you may have.

Lectures. Two thirds of the classroom time will be devoted to lectures. Although I will follow S. Lang's book closely, I will not necessarily mention every single fact mentioned in the current section, and of course, I will discuss many results and examples which are not explicitly present in the book. These are part of the material that you have to understand and learn. Take careful notes and try to read your textbook in advance - your understanding will benefit greatly from this.

Homework. There will be six graded homework assignments. See assignment #1 for some indications on how you should work on these. There will also be a seventh, non-graded, assignment that should help you to prepare for the final. Late homework will not be accepted unless a special arrangement has been made prior to the due date. With some assignments, a questionnaire will be given. You are expected to answer the questions and return the questionnaire with your solutions. This will give me some very useful feed-back, and will give you an opportunity to evaluate your working patterns. The questionnaire is required even if you do not turn in your homework on the due date.

Problem Sessions. There will be seven problem sessions during which you will be working on problems in class in small groups. These are extremely important and I urge you to be very active in these sessions. Once you have solved the problems given in class, you will have till the next class to write down the detailed solutions. I will collect and check these solutions, and will assign a pass/fail grade for the write-ups.

Quizzes. Six graded quizzes (see the dates in the schedule).

Exams. One Midterm Exam (October 8, 12:00 PM) and a Final Exam (December 12, 10:30 AM). All exams will be in CB 339

Attendance and Make-ups. Attendance is required. If you miss a class, please give me a written note explaining the reasons for your absence. Be sure to include the current date and the exact dates of missed classes. A list of officially recognized excused absences is given in "Students' Rights and Responsibilities". It is very short. If an excused absence resulted in your missing some graded work, here is how you can make-up for this work:

- Missed Quiz or Exam: A make-up quiz or exam in a similar format will be given.
- Missed Homework: A one-hour test on the current chapter will be given to make up for a missing homework assignment.
- Missed Problem Session: The write-ups are due within one week of the end of the period of excused absence.

Grading Policy. Your grade for the course will be determined based on the following elements:

- Homework assignments: 5% each, for a total of 30%
- Quizzes: 3% each, for a total of 18%
- Problem Sessions: 1% each, for a total of 6%
- Midterm Exam: 21%
- Final Exam: 25%

The letter grade will be determined according to the rule:

- $> 87.5\%$ A
- $75 - 87.5\%$ B
- $60 - 75\%$ C
- $50 - 60\%$ D
- $< 50\%$ E

If you need help. If you need to talk to me outside the regular class hours, you have the following options:

1. Come to my office during the office hours (bring your homework notebook). If the hours are not convenient, use 2 or 3 to set up an appointment.
2. Send me your questions by e-mail (this is usually not suitable for mathematical questions). I am answering my e-mail once a day.
3. Give me a phone call.

It is usually easy to get in touch with me. Don't forget to bring your homework notebook when you come to my office.

