

MATH 110 Linear Algebra. Course Syllabus

with Professor Zvezdelina Stankova

Lec 1: MWF 12:10pm - 1:00pm, Latimer 120

Lec 2: MWF 2:10pm - 3:00pm, Stanley 105

Updated 8/12/2021

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1. INSTRUCTOR AND GENERAL INFORMATION

- **Instructor:** Professor Zvezdelina Stankova (Zvezda)
- **Office:** Evans 713; **Phone:** (510) 642-3768
- **Tentative office hours** (to be finalized by the end of the first two weeks of classes):
 - MWF 1:10pm-2:00pm (Stanley Cafe), MW 3:10pm-4:00pm (online).
 - There are no individual appointments.
 - Questions will be answered on a first-come-first-serve basis.
 - Administrative questions will take priority during the last 10 minutes of each office hours.
 - If you have an urgent question, you must make time to come in office hours. The common excuse: “I couldn’t make it to your office hours because of reason X, and hence I am writing to you an email.” will **not** be accepted. If your issue is important, you will make time to come to office hours. Anything that can be resolved in office hours must be resolved in office hours; **not** on email!
- **Email:** stankova@math.berkeley.edu; **ONLY FOR EMERGENCIES**, not for routine questions or questions that can be addressed in OHs.
- **All course information:** bCourses at <https://bcourses.berkeley.edu/>

2. ENROLLMENT, SECTION SWITCHING, bCOURSE ACCESS

2.1. For enrollment questions, contact:

- **Marsha Snow:** at enrollment@math.berkeley.edu, snow@math.berkeley.edu,
 - <https://math.berkeley.edu/courses/enrollment/enrollment-updates>
 - <https://math.berkeley.edu/programs/undergraduate/advising>

(1) Use e-mail only for *quick* advising questions.

- **Thomas Brown:** Last Name “A-L” students, thomasbrown@berkeley.edu.
- **Marsha Snow:** Last Name “M-Z” students, snow@math.berkeley.edu.

(2) For in-depth advising, make an appt M-F 10AM–12Noon & 1–4PM.

2.2. To switch discussion sections, students must go to CalCentral at

(1) <https://calcentral.berkeley.edu>

- The switch will be possible only if there is room in the section.

(2) **No access to enrollment:** Do **not** ask the instructor or GSIs to switch you to another section or to enroll you in the class. We have no control over enrollment in the class/sections.

2.3. bCourse Access: is granted only to officially registered students in the class.

Students **on the wait list** will **not** be added to the bCourse site. Until registered, you need to:

- Ask a classmate to share with you any other materials on bCourses.
- The instructor and the GSIs will NOT share course materials with individual students who are not officially registered for the class, join late, miss part of the class, lose materials, etc.

Follow these instructions precisely, and keep emails to me and the GSIs only for real emergencies.

3. PREREQUISITES

3.1. **Required:** MATH 53 Multivariable Calculus, and MATH 54 Linear Algebra and DEs

3.2. **Recommended:** MATH 74 Transition to Upper-Division Math (Introduction to Proofs)

4. ATTENDANCE AND PARTICIPATION: LECTURES AND DISCUSSION SECTIONS

4.1. **Enrollment in sections:** Each student must sign up for a discussion section on Fridays.

4.2. **Attendance Checks:** Lectures and discussion sections are mandatory and must be attended in-person by all students signed up for in-person section. Students in remote section 208-209 must watch the Lecture Recordings right after lecture and synchronously attend their sections on zoom.

- (1) Lecture participation will be taken in class, synchronously, via polls.
- (2) Students in remote sections 208-209 will take a lecture participation quiz on WebWork MWF btw 10-10:15pm that day.
- (3) Sign up for a section that you can attend synchronously.

5. TEXTBOOKS

5.1. **Required:** “*Linear Algebra*,” by Friedberg, Insel, Spence, 5th edition, ISBN: 9780134860244.

5.2. **Recommended:** “*A Decade of the Berkeley Math Circle*,” vol. I-II, edited by Stankova and Rike, MSRI/AMS, for learning proofs and problem-solving techniques.

6. HOMEWORK

6.1. **Assigned/Due:** HW will be posted on bCourses every week, usually the previous Saturday, although they may be amended after each lecture. HWs must be submitted to Gradescope by 11:59PM the following Monday.

6.2. **If missed class:** If you miss lecture or discussion section: do NOT e-mail instructor or GSI to ask for missed handouts and announcements. Instead, check bCourses and ask your classmates.

6.3. **Homework solutions will be:**

- **Posted on bCourses** ordinarily by Wednesday. Do **not** ask for solutions to be posted earlier: you must attempt to do your homework without help from posted solutions.

- **Taken down** the web in a week or so after being posted; hence make sure that you download them and read them on time. No HW solution files will be sent to students at any time: please, do **not** request them; ask instead your classmates for any missed HW solution files.

7. READING ASSIGNMENTS

It is the students' responsibility to read carefully and thoroughly the assigned textbook section(s) and review their class notes after each class. If you missed a lecture or a discussion section do **not** ask the instructor or the GSI for their notes. Ask your classmates for their notes. Handwritten Lecture Notes will likely be provided in due time on bCourses, but do not depend on them for a timely learning of the material. Typed Lecture Notes will be provided sometime in the afternoon.

8. QUIZZES

8.1. **Total number of quizzes:** There will be about 14 quizzes in-person in sections, given once a week. Quizzes will last for 10 min. Remote sections will have a few more minutes for pdf creation and submission on Gradescope.

8.2. **Number of quiz scores in final grade:** Only the top 10 quiz scores will be taken into account when determining a student's final grade. No more quizzes will be dropped, for any reason.

8.3. **No make-up quizzes:** If you miss the time when your quiz is given, you cannot retake the quiz at another time, and your quiz score will be 0. Thus, when you miss to take your quiz (for whatever reasons, including being sick, having a family emergency, etc.), keep in mind that exactly **the top ten** quiz scores will be counted, regardless of your reasons. **No** exceptions will be made to this policy: please, do not send me or to your GSI notes to be excused from quizzes.

8.4. **Purpose of the "Top 10 quizzes":** Keep the few times when you might miss quizzes only for true emergencies. The quizzes to be dropped are not intended as a back-up for slacking off, lagging behind the material, or catching up due to unsatisfactory academic performance on previous quizzes. The quizzes that will be dropped are meant to help you in case of an emergency. No further quiz scores will be dropped.

8.5. **Joining the course late and quizzes:** Again, 10 quiz scores will be used towards the final grade, including some possible 0s if fewer than 10 quizzes have been taken.

8.6. **Content of Quizzes:** The quizzes will be based on the current or previous HW and material. Each quiz will be graded out of 14 points and will consist of one problem for 12 points and 2 True/False or Multiple Choice questions. Each T/F will be graded as follows: 1 point for correct answer, 0 for blank, and -1 for incorrect answer. Each M/C question will be graded as follows: 1 point for correct answer, 0 points for incorrect answer or blank. The T/F and M/C questions on the quizzes are intended to prepare you for a problem with many T/F and M/C questions on each exam. One of the T/F or M/C questions on each quiz may be on administrative matters reflected in the syllabus or discussed in lecture or in section. Thus, you must read the syllabus and be updated on any administrative announcements and discussions from lecture and class.

8.7. **Cheat Sheet on Quizzes:** One page (one side of a regular sheet of paper), hand-written by the students. No copying and pasting of typed text from anywhere, unless the student has a registered disability that allows for typed or other specially prepared texts.

9. EXAMS

9.1. Times of the three exams:

- (a) **Midterm 1:** Wed, September 29, in class (remote sections only: online, 2-3PM).
- (b) **Midterm 2:** Wed, November 3, in class (remote sections only: online, 2-3PM).
- (c) **Final exam:**
 - Lec 1: Friday, Dec 17, 11:30-2:30PM, in person.
 - Lec 2: Thursday, Dec 16, 3-6PM, in person (remote sections only: online, 3-6PM).

9.2. **No make-up midterms or final exams:** Every student must take the three exams on the dates and times above. There will be no switching between classes and modes of final exam.

9.3. Scheduling or avoiding conflicts with exams?

- Do **not** buy tickets to travel and do **not** schedule other events during the days of exams: you must take the exams at the announced times.
- Do **not** ask for different dates or times for the final exam due to flight reservations or other reasons: the final exams times are assigned campus-wide and there will be no personal exceptions.
- Do **not** take this class if you have a conflict with any of this exam schedule.

9.4. **Exam Content.** A substantial part of the exams will be based on versions of problems from:

- **Homework:** problems, both regular and bonus.
- **Class:** problems, theory, and ideas discussed in class.
- **Quizzes:** quiz problems from random sections.

9.5. Are the exams comprehensive?

- **Midterms:** The topics for each midterm exam will be based on the portion of the course between exams. Thus, formally, midterms are **not** comprehensive. Yet, you cannot forget previous material since parts of it may come up in the solutions to midterm problems.
- **The final exam is comprehensive:** Anything covered in the course is fair game.

10. FINAL GRADE COMPONENTS

10.1. **Grading scheme.** Grades will be computed by taking:

- (1) 5% homework. There will be ≈ 38 HWs, each out of 10 points, checked for completeness.
- (2) 15% quizzes (using only the top 10 quiz scores). At the instructor's discretion, quiz medians of all sections in the class will be uniformized at the end.
- (3) 10% lecture participation. There will be at least 2 polls in lecture or alternative evening quiz for remote sections and DSP students with lecture accommodations, for 2 pts total:
 - answer the two polls any way during the given time: 1 pt;
 - answer at least one poll correctly: 1 pt.

The top 30 (out of ≈ 38) lecture attendances will count towards the final grade. Overall, about 20% proficiency on the polls will yield a perfect participation score of 10%; i.e., an "A" participation grade (unlike how exams are graded). Thus, enjoy the polls and learn as much as possible from them (instead of panicking that you did not correctly answer all or any polls on any particular lecture).

- (4) 20% each midterm 1.
- (5) 20% each midterm 2.
- (6) 30% final exam.

10.2. **Resurrection final.** The final exam will resurrect one of the midterms if the midterm has a score lower than the final exam. This means that the final exam may count as 50% instead of 30%. It is up to the instructor to decide if some of three exams will be rescaled in the end to the same median, so as to give them comparable weights in the final grade.

10.3. **Class curve.** The final letter grades will be based on a curve, which will NOT be given (or known) until the course is over. Class statistics on exams will be posted on bCourses.

10.4. **Missing both midterms:** will result in automatic failure of the course. No option of an incomplete grade here, as missing both midterms will not qualify a student for an incomplete grade.

10.5. **Missing the final exam:** will result in automatic failure of the course, unless valid reasons are provided for requesting an incomplete grade (see below).

11. SPECIAL ACCOMMODATIONS

11.1. **Skipping a midterm.** You may skip a midterm (but not the final exam!) due to a conflict with **religious creed** or with an **extra-curricular/sports activity**, or a severe **medical or family emergency**. Skipping both midterms or skipping the final exam will automatically lead to a failing grade. There are no make-up midterms or final exams.

- The student must notify the GSI that he/she will be skipping a midterm and explain the reason, so that the GSI does not worry about what happened. No need for a formal documentation.

- The final exam may resurrect only one missed midterm (but not both midterms). However, this option must be taken only when really necessary. Frivolous skipping a midterm usually leads to a poor final exam outcome.

- It is the student's responsibility to learn the missed material due to the absence.

11.2. **Special Arrangements for Disabled Student Program (DSP) students.**

- If you are a student with **a disability registered by the DSP** on UCB campus and require special arrangements during exams and quizzes, the instructor and the GSI must receive the official DSP accommodation by the DSP office at least **14 days (2 weeks)** in advance. We will **not** be able to accommodate anyone in less than 14 days (as all exams and quizzes will be locked for certain times on Gradescope/Webwork) and the student will have to take the exam (or quiz) along with everyone else under the regular conditions provided for the class. The earlier we are informed about your DSP status, the easier it is to provide appropriate accommodations for you.

- Do NOT ask to be given special accommodations while promising that in the future you will provide a DSP letter. Observe this policy: no exceptions will be made.

11.3. **Taking the final exam "on the road" for athletes.**

- If you have a scheduled athletic competition as a member of an official UCB sports activity during the final exam, you must inform the instructor **at least 14 days prior to the final exam.**

- Final exams "on the road" are not automatically granted: certain conditions must be satisfied and the instructor needs to speak with your coach who will be with you and proctoring the exam. Thus, if you do not inform the instructor at least 14 days prior to the final exam, you will not be granted the privilege of taking the final exams under such special conditions. Take this seriously and act fast and responsibly to ensure that communication has reached the instructor by the deadline.

12. DROP DEADLINE

The results of the first midterm will likely be known **after** the drop deadline. Do not ask the instructor or the GSIs if we think you are more likely to get, say, B⁻ instead of C⁺: we will not know. The decision to drop the course will be entirely yours and you will have to make it based on your first several quizzes and the first midterm (if its score is available at that point).

13. INCOMPLETE GRADES

13.1. **University policies:** Please, consult the university policies regarding incomplete grades.

13.2. **Reasons for Incomplete:** An Incomplete “I” grade is rarely given.

The only justifications for an I grade are:

- **documented serious medical problem, or**
- **a genuine personal/family emergency.**

13.3. **Conditions for giving an incomplete.** When requesting an incomplete, the student must:

- have a passing grade (C^- or above) up to that point in the class.
- have completed at least 2/3 of the course work up to that point.
- present a formal document regarding the nature of emergency or the medical problem.

13.4. **Invalid reasons for requesting an incomplete.**

- Falling behind in this course or a heavy work load in other courses are not acceptable reasons for requesting an incomplete.

- If you miss a midterm (for whatever reasons), you will **not** qualify for an incomplete, as your grade before the final exam will include a 0 on that midterm, which will not have been “resurrected” by the final at the time of requesting the incomplete grade.

14. ACADEMIC INTEGRITY

The Mathematics Department, and in particular, the instructor and the GSIs in this course, expect that students in mathematics courses will not engage in cheating or plagiarism. The following is adapted from the Math Department web page to our course.

- For remote sections only: **Specific Honor Code and Exam Instructions** will be provided in due time. Adapt all written below to the online circumstances and using electronic platforms.

14.1. **What does cheating mean?** Broadly speaking, cheating means violating the policies of a course or of the university in order to gain an unfair advantage over fellow students. A particular kind of cheating is plagiarism, which means taking credit for someone else’s work. Cheating and plagiarism hurt your fellow students in the short term, they hurt the cheater in the long term, and they will not be tolerated. On exams, the most basic type of cheating is copying off of someone else’s paper. Graders easily spot when two exam papers look unusually similar, or have similar (wrong or correct) answers, calculations, ideas, or thought structure, even if written in different words or order of words. Even glancing at someone else’s paper to check your answer is cheating. If you write the correct answer to a computational problem without any justification or with a bogus justification leading to that answer, this raises strong suspicions that you cheated, on top of not receiving any credit anyways due to the lack of correct justification.

14.2. **Electronic devices on exams/quizzes.** Electronic devices such as phones, calculators (electronic, mechanical, or any other type), and other devices* are also not allowed on exams/quizzes not even to tell the time. There are too many ways to cheat using software and the Internet. Exams are not intended to test your ability to find the answer by any means necessary. The questions might be too easy for that! Rather, exams/quizzes are supposed to test your understanding of the course material, which you will need in order to use math correctly in subsequent courses and in the real world.

*Tablets/ipads for writing will be allowed for the remote sections only, with certain restrictions.

14.3. Expectations on exams, quizzes, and HW. Exams and quiz papers are expected to be your own work. In this class we encourage collaboration on homework, as it will be graded for “completeness” only; but you are carrying your personal responsibility to learn how to do the HW problems independently so as to be able to solve similar problems on exams and quizzes by yourself. When allowed, if you use proofs or calculations from textbooks or class notes, you need to cite these sources, even if you have rewritten the material in your own words; otherwise it is plagiarism.

14.4. How to avoid cheating? It is your responsibility to take reasonable precautions to prevent cheating. In exams, you should sit as far away from other students as the room permits, and hold your exam papers in such a way that they are not easily visible to other students.

14.5. What to do in a case of cheating? If you suspect that other students are cheating, you should immediately inform the instructor and/or your GSIs. Students may be cheating in ways that the instructor/GSI has never even heard of (unlikely, but possible). Even if you don’t mention any names, the sooner you inform the instructor/GSI what is going on, the sooner they can take measures to put a stop to it. You can further report any cheating at:

<http://sa.berkeley.edu/conduct/reporting/academic>

14.6. Resolution to cheating. If you are suspected of cheating, the instructor may pursue a variety of actions depending on the particular nature of the incident. If you accept responsibility for academic misconduct, the matter can often be resolved between you and the instructor with possible academic sanctions ranging from losing points on an exam/quiz to failing the class, and a report will be sent to the Mathematics Department and/or Center for Student Conduct. It is not necessary for the instructor to determine whether the student(s) has a passing knowledge of the relevant factual material. It is understood that any student who knowingly aids in cheating is as guilty as the cheating student.

In serious incidents, or if you maintain that you are not responsible for academic misconduct, the instructor has the freedom and responsibility to impose any academic sanctions within the course that she deems appropriate, and the case will very likely be forwarded to the Center for Student Conduct. In such a case, more stringent actions (e.g., dismissing the student from the university) can be initiated by the Office of Student Conduct.

14.7. Conclusion. We hope that the above clarifications will help prevent cheating. If you have any questions about the rules or expectations, you should not hesitate to ask the instructor/GSI, or the vice chair for undergraduate affairs in the Mathematics Department.

15. DISRUPTED EXAMINATIONS

The following has been adapted from the Mathematics Department advising materials to faculty.

15.1. State law during fire alarms. Over the years, several final examinations have been disrupted by false fire alarms. State law requires that buildings must be evacuated during alarms, and the police department suggests that classes do so in an orderly, efficient fashion so that students can return to work as quickly as possible.

15.2. Penalties for false alarms. A false alarm is a misdemeanor, with a penalty of up to \$1,000 in fines and up to one year in county jail. If the alarm results in bodily injury (e.g., someone has a heart attack), a false alarm can be a felony with a penalty up to \$5,000 in fines and three years in state prison.

15.3. **When an alarm does sound during an exam**, we will use the following guidelines:

- If an alarm is pulled after the exam has been going on for more than 2/3 of the overall allotted time, the exam will be considered complete and the grading scale will be adjusted accordingly at the discretion of the instructor.

- If an alarm has been pulled after the exam has been going on for less than 15 minutes, we will evacuate and the students will leave the exams on their desks. After the alarm has been taken care of, the students will proceed back to the classroom and resume the exam. Anyone found carrying his/her exam outside the classroom will not be allowed to continue the exam, and the instructor will be given the freedom to decide how and whether to grade this student's exam.

- During an evacuation, the instructor and the GSIs will visibly monitor the students to cut down on casual exchanges of exam information.

- For exams that have been going on between 15 minutes and less than 2/3 of the total allotted time, the students will leave their papers in the classroom and evacuate. It will be up to the instructor to decide if there is enough time to resume the exam or to reschedule it.

16. CONDUCT SANCTIONS AND GRADE DEDUCTIONS FOR ILLEGAL POSTINGS

This section concerns what will happen when a student pirates course materials and posts them on-line, including but not limited to coursehero.com, or assists someone else in doing that. Apparently, the problem is pervasive, it encourages plagiarism, and in the long-run it hurts everyone by undermining and jeopardizing their learning process.

Here are the relevant sections from the **University-wide Code of Conduct** and this is what **UCB Student Conduct Committee** will use to apply sanctions to students who have posted course materials on-line or elsewhere without explicit permission from the corresponding instructors:

- **102.23 Course Materials - Selling, preparing, or distributing for any commercial purpose course lecture notes or video or audio recordings of any course unless authorized by the University in advance and explicitly permitted by the course instructor in writing. The unauthorized sale or commercial distribution of course notes or recordings by a student is a violation of this Code whether or not it was the student or someone else who prepared the notes or recordings.**

Copying for any commercial purpose handouts, readers or other course materials provided by an instructor as part of a University of California course unless authorized by the University in advance and explicitly permitted by the course instructor or the copyright holder in writing (if the instructor is not the copyright holder).

As in other classes on campus, any unauthorized by me postings of any course materials, including but not limited to any handouts, syllabus, bCourse pages, quizzes, discussion worksheets, midterm reviews, exams, presentations, lecture notes, pictures, video, etc., will be:

- **Subject to a letter grade deduction of the final course grade, left entirely to the instructor's discretion, AND**

- **Formally reported to the University Student Conduct Committee.**

I had never felt the need to impose such strict rules until I was given the opportunity to see the damage that such mis-conduct causes to all students in classes on campus and elsewhere.

In case of doubt, before posting any materials related to the course, ask me or your GSIs. As a rule of thumb, anything that I or the GSIs have prepared for the course, anything on the bCourses site, etc., CANNOT be posted on-line. Be advised that there is a simple way to track down who has posted materials.

Finally, no one in the classes can take audio or video, or pictures of the boards or anyone in class, without my explicit permission and without the corresponding DSP accommodation presented to me in advance. Such audio, video, or picture materials are subject to the same rules of non-posting and usage strictly by the corresponding DSP student.

16.1. Piazza Site for MATH 110. The instructor will not moderate piazza. Some GSIs will be assigned to loosely monitor the piazza site.

- The piazza site is open only for students enrolled in the course, and the topics discussed are restricted only to the content or logistics of the course.
- While we will disable the ability for students to post anonymously to instructors, we do not wish that to dissuade you from feeling comfortable asking any honest and relevant question.
- Any posting of links or references on how to obtain unauthorized or pirated copies of the textbook or other copyrighted materials directly violates the course syllabus about plagiarism. Posting such content is illegal, and any student who does so faces academic and other sanctions.

17. QUESTIONS

17.1. Whom to Ask? Please, refer to the following list for who to contact when you have questions regarding the course. Contacting the wrong people will simply result in redirecting you to the appropriate contact person, and thus, will waste your and our time. GSIs are instructed **not** to answer any questions outside of their realm of expertise as listed below.

#	Type of Questions	Person to Ask	When and How
1	enrollment and section placement	Marsha Snow Thomas Brown	email or appointment M-F 10am-12pm, 1-4pm
2	quiz and exam scores	the student's GSI	office hours
3	missed handouts and announcements	bCourses, piazza, classmates	anytime
4	emergencies, administrative questions not addressed elsewhere	professor	office hours
5	math questions	GSIs, professor	sections, office hours
6	true emergencies that are not caused by you and cannot be resolved in office hours	professor	e-mail, phone

17.2. Email is only for emergencies! The professor will not answer any math or grading policy questions on e-mail: **professor's e-mail is only for emergencies!**

- "Emergencies" are urgent and important situations that are **not** caused by a student's procrastination, negligence, or disorganization.
- An "emergency" email is **no longer than 5 lines!** If you are in an emergency, you cannot write long emails!
- No attachments can be emailed to the professor, unless a prior agreement between professor and student has been reached after discussing the issue and the professor has requested more information in the form of an attachment.

17.3. For final exam room and time assignment: check the UCB final exam schedule on the web; do not send e-mail to professor or GSIs.

18. GSIs CONTACT INFORMATION

#	Name	Email	Office Hours
1	David Casey	caseydj@berkeley.edu	TBA on bCourses
2	Diego Bejarano	bejarano@berkeley.edu	TBA on bCourses
3	Ahmee Marshall-Christensen	ahmeemc@berkeley.edu	TBA on bCourses
4	Zirui Zhou	zirui_zhou@berkeley.edu	TBA on bCourses
5	Yifan Chen	yifan-chen@berkeley.edu	TBA on bCourses
6	Sean Murphy	sean.murphy@berkeley.edu	TBA on bCourses

19. SUMMARY AND CONCLUSIONS

- (1) Any student is **welcome to visit** any GSI with math questions. The GSI's and instructor's office hours do not overlap, and hence there are lots of office hours during the week when one can get answers to questions. You do **not** have to come to the instructor's office hours with math questions: all GSIs are qualified to answer math questions related to the course.
- (2) Direct administrative questions (that are not answered in class) **in person** to your GSI or the instructor.
- (3) **Reserve email for emergencies only!** "Emergencies" are urgent and important situations that are **not** caused by a student's procrastination, negligence, or disorganization. Yes, this is repeated, as a number of students ignore this and send all sorts of routine or non-emergency emails that can be resolved in office hours.
- (4) **No repeats.** Administrative questions that are addressed in this handout or answered in lectures or sessions will not be answered on e-mail or otherwise.
- (5) **Missed information.** For any missed information: ask your classmates.
- (6) **Be organized, responsible, and hard-working:** these traits will take you half of the way to performing well and getting a lot out of this course.

TURN OVER FOR TOPICS OF THE COURSE

20. TENTATIVE TOPICS OF THE COURSE

Theme 1: Main Structures, Operations, and Objects

- (1) 1.1. Introduction. 1.2. Vector Spaces. Examples
- (2) 1.2. Properties of Vector Spaces. 1.3. Definition of Subspaces
- (3) 1.3. Examples of Subspaces
- (4) 1.4. Linear Combinations and Systems of Linear Equations.
- (5) 1.5. Linear Dependence and Linear Independence. 1.6. Bases
- (6) 1.6. Dimension and Replacement Theorem
- (7) 2.1. Definition of Linear Transformations. Kernel and Image
- (8) 2.2. Properties and Matrix of a Linear Transformation
- (9) 2.3. Matrices of Linear Combinations of Transformation. Matrix Multiplication
- (10) 2.2. Composition of Linear Transformations and Matrix Multiplication.
- (11) 2.3. Problem Solving with Compositions of Transformations. Introduction to Isomorphisms
- (12) 2.4. Properties of Isomorphisms and Invertibility
- (13) 2.5. Change of Bases
- (14) 2.6. Similar Matrices. Dual Bases

Midterm I

Theme 2: Applications to Systems and “Ideal” Matrix Forms

- (15) 3.1. Elementary Matrix Operations and Elementary Matrices
- 3.3. Systems of Linear Equations - Theoretical Aspects
- (16) 3.4. Systems of Linear Equations - Computational Aspects
- (17) 4.1. Determinants of Order 2. 4.2: Determinants of Order n
- (18) 4.3: Properties of Determinants. 4.4: Summary - Important Facts about Determinants
- (19) 5.1. Introduction to Eigenvalues and Eigenvectors
- (20) 5.2. Diagonalizability I: Introduction
- (21) 5.2. Diagonalizability II: Practical Aspects
- (22) 5.2. Diagonalizability III: Test for Diagonalizability
- (23) 5.2. Diagonalizability IV: Applications to Recurrence Sequences and Systems of DEs
- (24) 5.4: Invariant Subspaces and the Cayley-Hamilton Theorem
- (25) 7.1: Jordan Canonical Form I: Cyclic Spaces and Jordan Blocks
- (26) 7.1: Jordan Canonical Form II: Generalized Eigenvectors and Eigenspaces.
Intro to Modified Operators
- (27) 7.2. Jordan Canonical Form III: Properties of Modified Operators

Midterm II

- (28) 7.2. Constructing Jordan Canonical Bases
- (29) 7.2. Jordan Canonical Form and Cayley Hamilton Theorem
- (30) 7.2. Bullet-Proof Algorithm for Finding JCF

Theme 3: Extra Structure: Inner Products, Operators, and Quadratic Forms

- (31) 6.1. Inner Products. Properties and CBS Inequality
- (32) 6.1. Applications of Inner Products. Orthogonal Bases
- (33) 6.2. The Gram-Schmidt Orthogonalization Process. Orthogonal Complements
- (34) 6.3. The Adjoint of a Linear Operator
- (35) 6.3. Least Squares Approximations
- (36) 6.4. Symmetric and Hermitian Operators
- (37) 6.5. Unitary and Orthogonal Operators
- (38) 6.8. Quadratic Forms on \mathbb{R}^n

Reviews for Final Exam (RRR)

Final Exam