

# Math 2331-06 (20537): Linear Algebra

## Spring 2018, MWF 10:00 am–11:00 am

**Instructor** Andreas Mang

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🌐 <https://www.math.uh.edu/~andreas>

**Office** PGH 614

**Office Hours** MW 11:00 am–12:00 pm or by appointment ([andreas@math.uh.edu](mailto:andreas@math.uh.edu))

**Class Time and Place** MWF 10:00 am–11:00 am in CBB 118

**Course Website** <https://www.math.uh.edu/~andreas/teaching/math2331-SP18/>

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## 1 Prerequisites

Credit for or concurrent enrollment in MATH 1432.

## 2 Textbook

*Linear Algebra and Its Applications*, 4th Edition, by David C. Lay. ISBN10: 0321385179 ISBN13: 9780321385178

## 3 Course Content

Linear Algebra, rich in applications within mathematics and to many other disciplines, is potentially the most interesting and worthwhile undergraduate mathematics course you will complete. For many of you this is the first course to begin bridging the gap between concrete computations and abstract reasoning. Later in your career, computers will do the calculations, but you will have to choose the calculations, know how to interpret the results, and then explain the results to others. Understanding the notions of vector spaces, linear (in)dependence, dimension, and linear transformations will help you make sense of matrix manipulations at a deeper level, clarifying the underlying structure. A key aim of this course is that you will not only be equipped with a computational ability but with the ability to use these notions in their natural scientific contexts, and with an appreciation of their mathematical beauty and power.

## 4 Dates, Recommended References & Other Readings

Course material will be made available section by section on the course website: <https://www.math.uh.edu/~andreas/teaching/math2331-SP18/>. A detailed, tentative schedule can be found below.

Week	Date	Topic	
1	01/17	Systems of Linear Equations	§1.1
	01/19	Row Reduction and Echelon Forms	§1.2
2	01/22	Vector Equations	§1.3
	01/24	The Matrix Equation $\mathbf{Ax} = \mathbf{b}$	§1.4
	01/26	Solutions Sets of Linear Systems	§1.5
3	01/29	Linear Independence	§1.7
	01/31	Introduction to Linear Transformations	§1.8
	02/02	The Matrix of a Linear Transformation	§1.9
4	02/05	Matrix Operations	§2.1
	02/07	The Inverse of a Matrix	§2.2
	02/09	Characterization of Inverse Matrices	§2.3
5	02/12	Partitioned Matrices	§2.4
	12/14	Matrix Factorization	§2.5
	02/16	<i>Review/Catch up/Special Topics</i>	
6	02/19	<b>Midterm Exam #1</b>	
	02/21	Subspaces of $\mathbb{R}^n$	§2.8
	02/23	Dimension and Rank	§2.9
7	02/26	Introductions to Determinants	§3.1
	02/28	Properties of Determinants	§3.2
	03/02	Vector Spaces and Subspaces	§4.1
8	03/05	Null Spaces, Column Spaces, and Linear Transformations	§4.2
	03/07	The Dimension of a Vector Space	§4.5
	03/09	Rank	§4.6
9	03/12	<b>UH Holiday (no class)</b>	
	03/14	<b>UH Holiday (no class)</b>	
	03/16	<b>UH Holiday (no class)</b>	
10	03/19	Change of Basis	§4.7
	03/21	Eigenvectors and Eigenvalues	§5.1
	03/23	The Characteristic Equation	§5.2
11	03/26	Digitalization	§5.3
	03/28	Eigenvectors and Linear Transformations	§5.4
	03/30	<i>Review/Catch up/Special Topics</i>	
12	04/02	<b>Midterm Exam #2</b>	
	04/04	Iterative Estimates for Eigenvalues	§5.8
	04/06	Inner Product, Length, and Orthogonality	§6.1
13	04/09	Orthogonal Sets	§6.2
	04/11	Orthogonal Projections	§6.3
	04/13	The Gram-Schmidt Process	§6.4
14	04/16	Least-Squares Problems	§6.5
	04/18	Diagonalization of Symmetric Matrices	§7.1
	04/20	Quadratic Forms	§7.2
15	04/23	The Singular Value Decomposition	§7.4
	04/25	<i>Review/Catch up/Special Topics</i>	
	04/27	<i>Review/Catch up/Special Topics</i>	
16	04/30	<b>last day of class</b>	

## 5 Attendance Policy

Attendance is not required, but strongly encouraged. A student is considered present only if he/she has arrived on time and remains until the class is dismissed. Coming to class late or leaving early is disruptive and thus discouraged.

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## 6 Dropping Policy

**January 31, 2018** Official reporting day (ORD); drop a course without receiving a grade.

**April 3, 2018** Last day to drop a course or withdraw with a 'W'.

## 7 Homework Assignments

Homework assignments will be given on a weekly basis. There will be a total of approximately 10 homework assignments. Homework assignments will consist of exercises taken from the textbook (see §2; "paper and pencil") and programming exercises (Matlab; <https://www.mathworks.com/products/matlab.html>). In fairness to fellow students and graders, late homework will not be accepted. However, your lowest homework score throughout the term will be dropped to allow for missed assignments. The homework has to be handed in every Monday at the end of the class, i.e., 10:50 am, which will also be the *sharp* deadline for Matlab assignments to be sent to the specified email address (see the homework cover sheet for detailed instructions on how to hand in the homework); if your Matlab homework arrives at 10:51am you will get a score of zero. A list of problems will be posted by the previous Monday. If you cannot hand in your homework on the designated due date, stop by my office and hand it in *before the assigned due date*. Homework scores cannot be changed after one week after they have been returned.

It is expected that you express your ideas clearly, legibly, and completely, which often requires complete English sentences (i.e., a justification) rather than a long string of equations or unconnected mathematical expressions. Homework can and should be worked on and discussed with others. Collaboration is a big part of learning and of scholarship in general. I strongly encourage you to participate in study groups with fellow students attending this course. However, your write-up of the homework has to be independent, and in your own words. Your homework needs to be complete, neatly written, and stapled. It is also expected that you do not only send in (by email; see above) your Matlab solutions but also attach them to your handwritten homework (printout). I reserve the right to deduct points if these rules are not followed. There will be **no makeup homework** (see §10 and §11 for details).

## 8 Quizzes

There will be a total of approximately 10 quizzes (in class). These quizzes will cover the material of the homework you handed in on Monday that week. They will cover theoretical homework only (i.e., not the Matlab assignments). The date of the quizzes will **not** be announced in class ("pop quizzes"). There will be **no makeup quizzes** (see §10 and §11 for details).

## 9 Exams

During the semester there will be two midterm exams and one final exam. The exams will contain a mixture of computational and conceptual problems. Some of them will resemble problems you have seen in your homework and quizzes, while some may be brand new to you. Exams shall be worked on independently and without the use of your textbook, homework, and class notes. There will be **no makeup exams** (see §10 and §11 for details). Exam grades can be disputed until one week after they have been returned. After that your grade cannot be changed. The exam period for the final is May 2–10, 2018.

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*any additional course policies presented by the instructor during the course.*

## 10 Grading

The final grade for the class will be determined as follows:

category	percentages	points
test/midterm 1	20%	$y_1 = 100$
test/midterm 2	20%	$y_2 = 100$
homework and quizzes	30%	$y_3 = 150$
final exam	30%	$y_4 = 150$
total	100%	500

Final letter grades assigned for this course will be based on the percentage,  $x$ , of total points/semester score earned. That is,

$$x = 100\% \left( \frac{1}{500} \sum_{i=1}^4 y_i \right).$$

The letter grade will be assigned as follows.

letter grade	percentage
A	$90\% \leq x \leq 100\%$
B	$80\% \leq x < 90\%$
C	$70\% \leq x < 80\%$
D	$60\% \leq x < 70\%$
F	$x < 60\%$

The lowest homework and quiz scores obtained in this course will be dropped to allow for missed assignments. The lowest test/midterm exam score will be replaced by the grade of the final exam (with the appropriate 20% weighting for midterm exams), if the grade for the final exam is better. Grades for exams, quizzes, and homework assignments can be disputed until **one week** after they have been returned. After that the grade cannot be changed.

## 11 Makeup Policy

Not turning in homework by the assigned due date, missing a quiz, or not being present for an exam results in a **score of zero**. There will be **no makeup assignments**. Technology failures will not be accepted as reason for missed assignment due dates. Therefore, do not leave anything to the last minute. It is the student's responsibility to identify alternative ways to complete or submit an assignment.

Exceptions are possible in the case of extreme circumstances, such as a documented, serious illness. In the event that a student cannot be present to turn in homework or take an exam on the day it is held the student needs to speak to me in advance, and make every attempt to do the work before (and not after) the rest of the class.

## 12 Academic Honesty/Honor Code

Plagiarism and cheating are serious offenses. The University policies on scholastic dishonesty will be strictly enforced (see Catalog/Student Handbook for more details).

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## 13 Students Disability Services/Special Needs

If a student has a disability and would like to request classroom accommodations, please see me after class or during office hours to discuss arrangements as soon as possible (see contact information above).

## 14 Mental Health/CAPS Statement

Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless. You can reach CAPS (<http://www.uh.edu/caps>) by calling 713-743-5454 during and after business hours for routine appointments or if you or someone you know is in crisis. No appointment is necessary for the "Let's Talk" program, a drop-in consultation service at convenient locations and hours around campus. [http://www.uh.edu/caps/outreach/lets\\_talk.html](http://www.uh.edu/caps/outreach/lets_talk.html).

## 15 Help

The Department of Mathematics has a mathematics laboratory, also known as CASA, located in 222 Garrison. There you will find student tutors who, on a walk-in basis, offer help with individual problems. The instructor is available for help during office hours. *All the information about this course will be posted regularly on the course website. Please check the site often.*

## 16 Cell Phones and Electronic Devices

During class and exam periods, all cell phones and other electronic devices must be turned off and kept in a secure location away from the students immediate view. The use of laptop computers in class is only permitted if students are using the computers to take notes or for purposes related to the class.