Kennesaw State University
College of Science and Mathematics
Department of Mathematics
Spring Semester 2023
MATH 3260 (Section 55): Linear Algebra I

1. Basic Information

Instructor: Dr. Timothy Faver
Email: `tfaver1_AT_kennesaw.edu` (this is the best way to contact me)
Website: `https://tefaver.com/teaching/math-3260`
Lecture time/location: MWF 1:25 pm–2:15 pm, Mathematics Room 120
Office: Mathematics Room 248
Office hours: (tentative) W 2:30 pm–3:30 pm, F 10:00 am–11:00 am

1.1. Learning outcomes. Upon successfully completing this course, you will be able to do the following:

1. Interpret and solve a system of linear equations in the language of matrices and vectors, in particular via Gauss–Jordan elimination;

2. Perform matrix operations, including the calculation of inverses of invertible matrices and determinants in general;

3. Describe and deploy the concepts of vector spaces, subspaces, linear independence, span, basis, inner products, and norms;

4. Compute the eigenvalues and eigenvectors of a matrix and understand how eigenproperties encode useful information about a matrix.

I won't claim that this course will *change* your life, but it's not too much of an exaggeration to say that linear algebra is your ticket to a *better* life. Many mathematical operations are **linear**, or almost linear: they satisfy, more or less, a rule like $\mathcal{A}(c_1x_1 + c_2x_2) = c_1\mathcal{A}x_1 + c_2\mathcal{A}x_2$. Linear algebra, then, is, at first glance, the mathematics of linear operations, and when paired with the power of calculus, the structure of linearity opens a world of possibilities.

Linear operations will mostly manifest themselves for us in the language of matrices and vectors; the learning outcomes above mostly reduce to posing problems in this language and using this language effectively. In particular, we will develop the helpful dual perspectives of matrices both as *static* and *dynamic* objects—sometimes they *encode* or *represent* data, and sometimes they *act* on and *change* other objects. Thus linear algebra is also essential for any solid understanding of data science, which appears to be everyone's favorite science these days. A good measurement of your grasp of the learning outcomes above will be understanding the front cover of Strang's textbook.

1.2. Course materials. We will closely follow the book *Introduction to Linear Algebra* (Fifth Edition) by Gilbert Strang. In particular, we will study much of Chapters 1–6, along

with some other topics; ideally, we'll cover about one section every two days. *I will not do nearly enough examples, for your taste, or mine, in class, so you must develop a close relationship with this book.*

• I will regularly provide readings from the book to complement our in-class discussions, and most of our problems will come from this book. You must have a copy of the fifth edition; a discount code from SIAM is available on D2L.

• Much useful auxiliary information (including a collection of complete, but succinct, solutions) is available from Dr. Strang's website:

$$\texttt{https://math.mit.edu/~gs/linearalgebra/ila5/indexila5.html}$$

• You may also find Dr. Strang's OpenCourseWare videos helpful:

$$\texttt{https://ocw.mit.edu/courses/18-06-linear-algebra-spring-2010}$$

These videos cover much of our course's content, although not necessarily in the exact order that we shall follow.

• I will keep a daily calendar of what we covered on the course website. This calendar will include references to corresponding material from the textbook; to review material from class, or to catch up from an absence, you should consult this calendar and then the textbook.

• Linear algebra (like much of math) is a powerful blend of abstract ideas and dirty calculations. You may want to use a calculator to help with the latter; I will permit the Texas Instruments TI-30XIIS scientific calculator on quizzes and exams, but no other devices (including, but not limited, to phone calculators and more powerful classical calculators). However, all answers must be exact, without decimals or rounding, so you should not rely too heavily on the calculator while studying.

• The materials above are *required* or *recommended*. Here are some *prohibited* materials. Please remove AirPods and other listening devices during class. Please keep phones off your desks, and please do not take pictures of the board without my explicit permission.

2. Grading

Your final numerical grade will be based on your daily attendance, written problem sets, in-class quizzes, two in-class exams, a final exam, and a glossary project. The following weights will determine your final numerical grade.

Component	**Weight**
Attendance	5%
Problem Sets	10%
Quizzes	25%
Glossary project	10%
Lowest exam score	15%
Middle exam score	15%
Highest exam score	20%

Your final letter grade will be determined by the interval to which your final numerical grade belongs.

Numerical grade	**[90,100]**	**[80,90)**	**[70,80)**	**[60,70)**	**[0,60)**
Letter grade	A	B	C	D	F

2.1. Attendance (5%). *Regular and engaged attendance is essential for your learning; failures in my classes are strongly correlated with low attendance or attendance with weak engagement.* I will take attendance on each of the days that we meet and do not have an exam. Each day that you are present will add a point to your final attendance score. I may determine attendance by checking the class roster, collecting some in-class work (which I will not grade for correctness, just engagement), or checking the submitted quizzes (see Section 2.3). At the end of the term, your attendance grade will be determined by

$$\min\left\{100 \times \frac{\text{Total number of attendance points}}{\text{Total number of meetings} - 6}, 100\right\}.$$

This allows you to miss several classes without penalty, including the first week if you join the course after the term begins.

An absence may or may not be "excused." Important family commitments, religious obligations, feeling ill, COVID exposure/infection, emergency car trouble, legal issues, an essential work commitment, and university-sponsored athletics, trips, or programs are all sufficient reasons for an excused absence. Making up work in another class, oversleeping, traffic, and vacations (. . .early spring break. . .) are not.

If you feel that your absence merits an excuse, please read the material covered in the textbook that day and then email me (1) the reason for your absence and (2) a question about something that you don't understand from that day's discussion or, if you feel that you understand everything, a comment about something that seems interesting, or frustrating, or weird, or anything that evokes an emotional reaction in you. To receive the attendance credit, you need to send the email before you next return to class. An excused absence will not receive attendance credit without the component (2).

2.2. Problem sets (10%). *Regular work on problem sets will strengthen your understanding of course concepts and techniques. Success in this class will be impossible without diligent, thorough completion of the problem sets.* There will be 11 problem sets assigned on Wednesdays and due throughout the term at 11:59 pm on the following Thursdays; see the calendar (Section 4) for the exact dates. You will submit your solutions to the appropriate slot on D2L, and it is your responsibility to ensure that your D2L submissions are correctly formatted and organized according to the submission instructions. In particular, your work must be clearly typed or scanned (not photographed), and I will not accept any late problem sets for any reason. However, I will drop your lowest 3 problem set scores, so that your the problem set component of your final grade will be the average of your 8 best problem set scores. I will grade your work for completeness only (and so I expect that everyone will do very well); note that while (somewhat brief) solutions are available to all problems, copying even one of those solutions in your submission will result in a score of 0 for that problem set. You are most welcome to consult with me throughout the week about the preparation of your problem sets; see Section 3.2 for advice on office hours and Section 3.3 for email policy.

2.3. Quizzes (25%). *Timed work on in-class quizzes will complement your efforts on problem sets and test your ability to recall information and work independently.* From each problem set I will select a small number (2 or 3) of problems for a 15-minute quiz at the start of class on Fridays; see the calendar (Section 4) for the exact dates. Quiz problems will come verbatim from the problem sets. My goal with this dual method of assessment is that (1) problem sets allow you to digest the material at your own pace and to the extent that you feel necessary while (2) quizzes check your internalization of that material without auxiliary resources at hand. I will not give make-up quizzes for any reason (including absence due to illness), outside of absences for university-sponsored events; in particular, you may not take the quiz if you arrive late to class. However, as with the problem sets, I will drop your lowest 3 quiz scores, so that the quiz component of your final grade will be the average of your 8 best quizzes from the course. If you have an accommodations letter that grants extra time, please speak with me immediately to determine the best arrangement for your quizzes.

2.4. Glossary project (10%). *If we don't know what the words mean, we won't be able to do anything worthwhile.* Linear algebra (like most of math!) is highly dependent on specialized, technical vocabulary. You will prepare a detailed glossary—definitions, examples, nonexamples, pictures, commentary—of what *you* think are the 10 most important words that we use throughout the term; one goal of this project is not merely your deep, precise understanding of these words but also an articulation of why they matter in *your* increasingly educated opinion. Further instructions are available in the separate glossary description on the course website; note that you will submit drafts along with your exam reflections.

2.5. Exams (50%). *Exam preparation will help you connect discrete course topics; completing an exam under time constraints is one way of evaluating your fluency with course material and your intellectual independence.* There will be two in-class exams (Exams 1 and 2) during the term and a cumulative final exam. The final exam will only be given at the university-specified time, which cannot be changed. See the calendar (Section 4) for the exam dates. I will provide a detailed study guide at least a week in advance of each exam. You will earn 5 points on each exam from a reflection activity that you will do based on the study guide; you can earn the other 95 points on the actual exam. I will ask for updates on your glossary project in each reflection, too. Your reflection responses will guide our in-class review; you are welcome to consult with me individually before exams, though I discourage waiting until the last minute.

In order to be excused from an exam, you must (1) notify me before the start of the exam (or as soon after as the circumstances allow) and (2) provide official documentation (a doctor's note, a quarantine notice or proof of COVID test, a note from your employer, etc.) excusing your absence in a timely manner. If your absence from an exam is excused, then you will take a make-up exam during finals week; if your absence is not excused, you will score a 0 on that exam. Dates and times for the make-up exam are also on the calendar. Valid (and invalid) reasons for missing an exam are, in general, the same as for missing class. In general, I will not permit a make-up if you notify me of your absence *after* the class has taken exam, barring exceptional circumstances that make prior communication absolutely impossible.

In the (hopefully) unlikely event that you first have an excused absence from Exam 1 and later have an excused absence from Exam 2, then you will take a make-up for Exam 2

within one week of returning to class. Failure to do so will result in a score of 0 on Exam 2. This is to prevent you from having too much work at the end of the term.

2.6. Midterm grades. I will submit midterm grades by March 7 to help you assess your progress in the course. I am required to include the following remarks in this syllabus: *A midterm grade will be assigned by the midterm grade due date identified on the Spring 2023 academic calendar. This midterm grade is for assessing mid-semester performance prior to the last day to withdraw without academic penalty. You may view your midterm grade in Owl Express. Note that only your final grade will be officially recorded on your academic transcript.*

Your midterm numerical grade will be determined by the following breakdown:

$$10\% \text{ attendance} + 15\% \text{ problem sets} + 30\% \text{ quizzes} + 45\% \text{ Exam 1}.$$

I will not drop any absences, problem sets, or quizzes in this calculation. Note that the weights here are, overall, quite different from what will determine your final grade; a good midterm grade is not a promise of a good final grade, but a bad midterm grade should serve as a warning that something is amiss in your current approach to the course. Midterm letter grades will follow the numerical correspondence for your final grade.

2.7. Incomplete grades. The catalogue specifies that an "incomplete grade may be awarded only when the student was doing satisfactory work prior to the last two weeks of the semester but for nonacademic reasons beyond the student's control, was unable to meet the full requirements of the course." I define "satisfactory work" to mean that it is mathematically possible for you to obtain a score on your remaining work that will allow you to pass the class.

The catalog subsequently states that a "grade of 'I' must be removed by completing the course requirements within one calendar year from the end of the semester in which the 'I' was originally assigned. In addition, should the student enroll in classes at KSU during the calendar year, the grade of 'I' must be removed by the end of the first semester of enrollment during that calendar year."

If you are awarded an incomplete for this course, it will be to your advantage to complete all remaining work as soon as possible. Based on your circumstances, we will agree on a mutually convenient and appropriate timeline for completing your work. Failure to follow this timeline without a justifiable excuse may result in failing grades for the missed work and possibly the course. Ideally, you would complete all work by the end of May 2023.

3. Strategies for Success and/or Failure

3.1. Attendance, participation, and independent work. Failures in my classes are strongly correlated with low attendance *or* attendance with minimal engagement; students who both attend class regularly and engage with me in and/or outside class tend to succeed.

3.2. Office hours. During office hours, we can discuss specific examples, problems, or techniques from class, the lecture notes, or the textbook. More broadly, we can talk about your study habits, time management, and mathematical reading skills. Before coming to office hours, think carefully about what you want to discuss so that we use our time well.

If my office hours conflict with your other classes, we can make an appointment for a different time. If the currently scheduled office hours conflict with the availability of students

who most frequently want to see me, I may change the weekly hours to accommodate the preferences of the majority.

An online option via Teams will always be available for office hours. The Teams link will be on D2L. I will attempt to hold office hours in person (I encourage masking).

3.3. Email communication. You are welcome to email me questions about any aspect of the course at any time. Feel free to send a photo or scan of work and indicate where you're stuck. A short hint from me can make a big difference for you.

Please include the words "Math 3260" in the subject of your email. I filter emails and may not respond to your message promptly, or may miss it entirely, without these key words. Please use your "students" email, not D2L email.

Please begin your email with a salutation (e.g., "Hi, Dr. Faver") before the body of text; this is simply good manners (and will put me in a good mood, which will be helpful for you). Please also address me by my name ("Dr. Faver," not just "Professor").

I will (typically) respond to email within 24 hours, but I cannot guarantee a response to questions about problem sets or exams late on Thursday evenings. Those final hours before an exam or quiz need to be about perfecting what is already good in you, not about learning it for the first time.

3.4. Reading assignments and recommended problems. It is quite likely, and wholly natural, that you will not fully understand the material that we cover in class. Readings from the textbook(s) will offer different perspectives that may be more conducive to your personal engagement with Math 3260. Part of your mathematical education is developing your reading comprehension; be prepared to invest time, and struggle, with the course's *written* materials before seeking outside help or alternate media.

Doing the problem sets *alone* probably will not provide you with enough exposure to course material outside of class. Instead, you should attempt a variety of problems from the "Recommended Problems" lists that I provide each week; challenge yourself to do a certain number of these each week along with the problem sets. Recommended problems will also serve as additional, essential practice and review for exams. You should skim the textbook's problems that I don't assign, as well, and attempt some of them as you study.

3.5. How to fail. The following strategies have helped prior students fail my classes.

1. Don't come to class regularly; in particular, show up only for exams.

2. Be physically present but intellectually disengaged in class. Avoid talking with me.

3. Don't do the problem sets or any recommended practice problems.

4. Save all your Math 3260 work for only one day each week. Even better, do all problem sets and exam reviews on Thursday evenings only.

5. Ask for, but then completely ignore, my advice on improving your course performance.

6. Think about the course as an obstacle, not an opportunity. Definitely don't look for beauty, surprises, or things that might fill you with wonder and curiosity.

4. Calendar

You are responsible for knowing all of the due dates for assignments and scheduled dates for quizzes and exams listed below. All submissions to D2L are due at 11:59 pm on the stated day. If class is canceled on the day of a quiz or exam, we will take that quiz or exam during our next meeting, unless I specify otherwise.

R January 19:	Problem Set 1 due on D2L
F January 20:	Quiz 1 in class
R January 26:	Problem Set 2 due on D2L
F January 27:	Quiz 2 in class
R February 2:	Problem Set 3 due on D2L
F February 3:	Quiz 3 in class
R February 9:	Problem Set 4 due on D2L
F February 10:	Quiz 4 in class
M February 13:	Exam 1 reflection due on D2L
F February 17:	Exam 1 in class
R February 23:	Problem Set 5 due on D2L
F February 24:	Quiz 5 in class
R March 2:	Problem Set 6 due on D2L
F March 3:	Quiz 6 in class
M March 6:	No class—Spring Break
T March 7:	Midterm grades due
W March 8:	No class—Spring Break
F March 10:	No class—Spring Break
T March 14:	Last day to withdraw without academic penalty (11:45 pm)
R March 16:	Problem Set 7 due on D2L
F March 17:	Quiz 7 in class
R March 23:	Problem Set 8 due on D2L
F March 24:	Quiz 8 in class *and* Exam 2 reflection due on D2L
F March 31:	Exam 2 in class
R April 6:	Problem Set 9 due on D2L
F April 7:	Quiz 9 in class
R April 13:	Problem Set 10 due on D2L
F April 14:	Quiz 10 in class
R April 20:	Problem Set 11 due on D2L
F April 21:	Quiz 11 in class
T April 25:	Last day to withdraw with a WF
W April 26:	Final exam reflection due on D2L
F April 28:	Glossary project due on D2L
M May 1:	Last day of class
T May 2:	Exam make-ups, 3:30 pm–4:30 pm
W May 3:	Exam make-ups, 3:30 pm–4:30 pm
M May 8:	Final exam in class, 1:00 pm–3:00 pm

5. University Policies and Formal Matters

5.1. Federal, BOR and KSU Student Policies. You should be familiar with the policies detailed via the link below.

`https://cia.kennesaw.edu/instructional-resources/syllabus-policy.php`

5.2. KSU student resources. You should be familiar with the resources and rights available to you as detailed in the link below.

`https://cia.kennesaw.edu/instructional-resources/syllabus-resources.php`

5.3. Academic integrity statement. Every KSU student is responsible for upholding the provisions of the Student Code of Conduct, as published in the Undergraduate and Graduate Catalogs. Section 5c of the Student Code of Conduct addresses the university's policy on academic honesty, including provisions regarding plagiarism and cheating, unauthorized access to university materials, misrepresentation/falsification of university records or academic work, malicious removal, retention, or destruction of library materials, malicious/intentional misuse of computer facilities and/or services, and misuse of student identification cards. Incidents of alleged academic misconduct will be handled through the established procedures of the Department of Student Conduct and Academic Integrity (SCAI), which includes either an "informal" resolution by a faculty member, resulting in a grade adjustment, or a formal hearing procedure, which may subject a student to the Code of Conduct's minimum one semester suspension requirement.

5.4. Course catalogue description.
3 Class Hours 0 Laboratory Hours 3 Credit Hours
Prerequisite: A grade of "C" or better in MATH 1190
An introduction to linear algebra and some of its classical and modern applications. Among topics to be included will be systems of linear equations, matrices, determinants of matrices and applications, vector spaces, and inner product spaces. Significant use of technology will be employed in performing matrix computations.

5.5. COVID-19 statements. You should be familiar with the most recent university policies and resources regarding COVID-19 as detailed in the link below.

`https://www.kennesaw.edu/coronavirus`