Basic Information

Instructor: Prof. Jen Paulhus paulhus@math.grinnell.edu
> I do not check email between 9 PM and 7 AM on weekdays, and only infrequently on the weekends. I will make every effort to respond to emails within 24 hours.

My Office Hours: Monday 10 AM-12 PM or by appointment.

TA: Jasper Egge eggejasp2@grinnell.edu
> Jasper don't check email between 10pm and 7am from Sunday to Friday, and almost never checks emails on Saturday

Jasper Office Hours: Sunday, Monday, and Wednesday 8-10 PM, Thursday 8-9 PM

Class Webpage: http://paulhus.math.grinnell.edu/teaching/ma215f20.html

Class Meetings: 8:30-9:50 AM Monday, Tuesday, Thursday, Friday
WebEx Links: See PioneerWeb (PWeb) page

Text: *Linear Algebra* by Joseph R. Mileti
> We will cover most of the textbook. The book is still in draft form so if you find any typos or errors, or have other suggestions for the book, please let me know.

Other Sources: See PWeb for links to other online sources.

Learning Goals

Linear algebra is the study of lines and planes in higher dimensional space, and special functions on these spaces. We will begin in two dimensional space to develop intuition and then generalize results to higher dimension.

Here is what is successful student will master in this class.
- The key concepts of linear algebra: vectors, vector spaces, linear transformations, eigenvalues, eigenvectors, determinants, dimension, and linear systems.
- The basic building blocks of mathematical logic and proofs such as *if... then...*, *there exists*, and *for all* statements, as well as negations.
- How to structure basic proofs, and how to construct correct mathematical proofs.

Growth towards these goals will be measured in class by the students ability to
- know definitions, basic computational techniques, and fundamental examples in the subject,
- apply this knowledge to solve relevant problems on homework and exams, and
- write increasingly sophisticated mathematical explanations and basic proofs.

Grading

Problem Sets
Problem sets are due to me by 3 PM every **Monday, Thursday and Friday**. Any part of the assignment which is LaTeX'd may be turned in by 7 PM, otherwise no late problem sets will be accepted. However, I will drop your lowest problem set score. Problem sets are 17% of your grade. Assignments will be posted on the class webpage. Each homework assignment is worth the same percent of your final grade, although point totals will vary from assignment to assignment.

Writing Assignments
Many **Tuesdays**, a writing assignment will be due to me by 3 PM on PWeb (or 7PM if you LaTeX the assignment). No late writing assignments will be accepted, and they may not be made up later. Writing assignments are 8% of your grade.

Exams
There will be two in-class exams scheduled for **Tuesday, November 17** and **Tuesday, December 8**. No make up exams will be given, unless agreed to beforehand so contact me immediately if you have any conflict with an exam. The higher of your two exam scores will be 18% of your final grade, and the lower of the two exams will count as 15% of your final grade.

Final
There will be a cumulative final which will count for 22% of your grade. The final exam is **Monday, December 21 from 9AM-12PM**.

Attendance
You are expected to attend every class and you are responsible for all material presented and changes announced during class. There is a strong correlation between attendance and grade performance in this course. As such, 8% of your grade will be based on attendance. However, I also understand that in the online model there are any number of reasons you may need to miss occasional classes. If you are on time and attend at least ¾ of the class times, you will receive full points for attendance. Attendance scores will drop quickly if you end up below that ¾ threshold.

Engagement
The only way to learn mathematics is to engage deeply with it. The remaining 12% of your grade will reflect how well you are engaging in the class. Class time should not be the first time you are thinking about the material. As such, you are expected to have done the assigned reading *before* each class. To demonstrate this, you will post questions you have before class to the "Class Discussion" tab on PWeb (or answer other student questions). The discussion board system is called Piazza (see the "Technology" section below for more information). In addition, your collaboration with group members during class, your contributions to discussions in class including the warmups, and your questions in Jasper or my office hours will also impact this part of your grade. If you are perennially late for class, your engagement grade will suffer.

Online Learning

Having the self motivation and discipline to work independently from home is very difficult for humans when conditions are good, let alone when the world around you is pretty much a dumpster fire. Most of us will likely be craving structure in our lives and clear goals we can work towards. I will, therefore, set explicit deadlines for each homework, and enforce homework and exam deadlines. I anticipate this will be beneficial for almost all of you.

That being said, these are very strange and difficult times. If anything comes up which makes it hard for you to keep up with the work in this class (e.g., illness, travel home, or family obligations), let me know and I can work with you to make another plan.

We are all going to have to deal with unexpected interruptions, technology not working right, and just generally bad days. **It's imperative that you keep up good communication with me if you run into issues or have questions.**

Class TA

Jasper Egge is a brand new graduate of the department. He has been hired under the Grinnell Corps program to help with the class. He will be in class, assisting me in managing the breakout sessions, and questions you may have. He will also hold many office hours to help you with any of the material, LaTeX, or generally answer questions about life as a math major here. He should be your first point of contact with content questions.

Class Policies

Warm-up Exercises

I will be on WebEx by 8:30 AM each morning we meet. Classes will begin with a warm-up exercise posted on PWeb. The warm-up exercises help us reset our frame of mind to be ready to engage with mathematics. I will place you into random breakout groups each day to work together in the warmup, and the warm-up period will conclude at approximately 8:40 AM. You should be online by 8:35 AM at the latest to start working on the warmup. If you are regularly late to class, your Engagement grade will suffer.

Short Discussions

Up to a few times each class period (including at the beginning of class for the warmup) we will break for a short discussion of the material. This will be accompanied by a prompt from me. Discussion partners (random breakout groups) will work together to answer a question, complete a computational exercise, identify misunderstandings, solidify concepts, and/or develop questions about the material.
- All partners should contribute to the discussion; in fact all partners are required to say something!

- Identify any thoughts, ideas, confusions, or new questions generated by the discussion.
- The partnership will formulate a response to the prompt that all partners understand.
- Each partner should be prepared to share the response with the class.

After we return from the breakout group, I will randomly select a student, and that student should explain the partnership's answer to the class. It is not a tag team answer. Only the person I called should answer the question. It is ok to say that you and your partner were not sure of an answer, but I will ask a followup question regarding what you and your partner discussed while you were trying to answer the question, so if your group cannot figure out the answer to the question I pose, come up with other questions you would like to ask me, or an explanation of where you got stuck. Participation in these conversations contributes to your Engagement grade.

Partnerships

As described above, we will spend part of the class time working in small breakout groups. When working in a partnership it is important to remember that varied backgrounds and experiences naturally induce varied explicit and implicit assumptions and attitudes towards each other. Each student should work diligently to be a cooperative, contributing member of the partnership who is helping the group achieve a common goal. The bottom line is that successful partnerships are founded on mutual respect. This can be achieved by:

- using your partners' names;
- recognizing that all partners matter and actively listening to all other partners;
- graciously inviting all of your partners to offer insights, suggestions, opinions, questions, etc.;
- being courageous enough to offer your own insights, suggestions, opinions, questions, etc.;
- being cognizant of the process by which partnership functions and how you operate within the partnership;
- thanking your partners at the end of each session.

Homework Submission

I highly recommend you learn to LaTeX (if you haven't already). Otherwise you will need to scan your homework in **black and white into one .pdf file** and then submit it via Gradescope (for Problem Sets) or PWeb (for Writing Assignments). See the "Technology" section below for information. Do not take pictures of the homework and email those. Picture photos are very large and are hard to annotate.

Homework Returns

All writing assignments will be returned to you on OneDrive. Problem Sets will be returned through Gradescope.

Accommodations

Grinnell College makes reasonable accommodations for students with documented disabilities. Students need to provide documentation to the coordinator for student disability resources, Jae Hirshman. Student should then notify me within the first few days of classes so that we can discuss ways to ensure your full participation in the course and coordinate your accommodations.

Workload

The amount of time students spend on this course outside of class varies depending on many factors, but about 15 hours a week beyond the classroom time is quite typical.

Academic Honesty

Make sure you are familiar with the college's guidelines for academic honesty.

For this class, you are allowed (and even encouraged) to work together to solve homework problems but everyone must write their own solutions. Here are some more explicit instructions regarding this: if several students are sitting around discussing how to solve a problem and in the course of the conversation one of you figures out a key piece and discusses that piece with everyone else, then you may all go off on your own and write up your own answers. Additionally, you may discuss your written solutions with anyone you have worked with to solve a particular problem.

However, it is not ok if one of you solves the problem yourself first, and then tells other people the key pieces of the problem. If you already have figured out a solution to a problem, and someone asks you how to solve the problem, tell them you already figured the problem out and they should talk to me or Jasper. Giving good hints is sometimes very tough. Conversely, if you know your colleagues have figured out a problem, you should not ask them for help but instead should talk to me or Jasper.

Consulting any completed solution is academically dishonest.

I repeat: **consulting any completed solution is academically dishonest.** Never search the Internet for a solution to a problem. Reading a math solution is much easier than figuring it out yourself. It only hurts your learning to find solutions online or in another book. I intentionally write some difficult problems and do not assume students will ace the problem sets. Talk to me or to Jasper or other students who have not yet solve the problem if you're stuck.

As mentioned above, giving a hint that helps but doesn't give away too much information is very hard. As such you should not ask for homework help from students who have formerly taken the class.

There are very serious consequences if you are found to be in violation of one of these policies. A typical first offense is a zero on the particular assignment, your final grade in the course is dropped a full or part of a letter grade, and you are ineligible to receive honors from any department.

Success in my Classes

Students come to this class was very different backgrounds, skills, and experiences. Usually the most successful students in my class have two things in common they work hard and back actively, and they are able to self reflect honestly and then make adjustments today here's accordingly.

Technology

I will be regularly checking email 7:00 AM -9:00 PM Grinnell time on weekdays and a bit on the weekend. Don't hesitate to email me with questions or issues you run into.

Otherwise, there are several basic types of technology you will need for the class.

WEBEX
I will use this program to hold class sessions and office hours. There is an app for desktops and phones/tablets which I recommend you download. The URL for our class meetings are posted on PWeb, and there is another link for WebEx sessions which you can use for office hours. You are not absolutely required to have audio or video on, there is a chat window you can type questions if you don't have audio. If you do have audio on your device, please wear headphones if at all possible to avoid nasty feedback.

A note on recordings. There are screen record options with WebEx. I don't generally plan to use it, but there could be occasions where I start talking about something and decide it is worth recording my explanation. I will do my best to let you know the session is being recorded if that happens.

PIAZZA ON BLACKBOARD
On the class PWeb page, there is a link for "Class Discussion". This leads to a page for Piazza a program for asking and answering questions. You will post your daily question(s) before class there. If someone has already posted one of your questions there, just click "good question", don't re-ask the same question. You should post your questions anonymously (although note that I will still see who you are). You should also tag your question with the appropriate folder for whichever topic(s) the question is from. You are welcome to answer other students' questions, but again, do so anonymously. Piazza allows you to embed LaTeX in your questions.

A WEB WHITEBOARD
If you would like a shared whiteboard to work with other students (or during our office hours) check out https://awwapp.com.

BLACKBOARD COLLABORATE
From PWeb, you will see a link for "Collaborate". This is software similar to WebEx which we may use occasionally until WebEx gets breakout sessions. Any of you can create Collaborate sessions too from our PWeb page, so you can meet up to work together on homework there if you would like.

GRADESCOPE
Gradescope will be where you submit your Problem Sets to be graded. It is a new system for me (and Grinnell) and so we may have a few small hiccups with setup at the very beginning. You will submit your problem sets, and the graders will be able to grade the assignments right on there. The ability to upload a rubric allows for consistency in grading, and the online system allows for quicker turnaround time. Here are a few of their help videos.

    Submitting Homework
    Viewing Feedback
    Scanning Instructions (note I give other methods to scan below)

SCANNING
If you really don't want to learn LaTeX, you will have to scan your homeworks as a pdf and submit them on Gradescope or PWeb.

If you have an iPhone or iPad you can scan using the "Notes" app. Click on "Notes", open a new note, click on the camera icon at the bottom. Then click "Scan Documents", make sure you are on "Black and White" option at the top, and hit the white button. You will then get a box you can move around to crop the picture to the right size. If you're happy with it, save it and then take the next page. When you're done, you can click on the "Share" button and email it to yourself, or Air Drop or however you want to share it.

If you have an android phone, there is an app called "CamScanner" which has been recommended by several students. You should be able to use the free version and not have to pay for a subscription: https://tinyurl.com/quwbfhr. **Don't forget, black and white, pdf format, and one document for the whole assignment.**

Unsolicited Advice
- Take ownership of your education.
- One major goal of the classes to teach you how to understand the basic language of mathematics and logic. Like any new subject, this requires much practice, practice, practice.
- Read ahead in the material. A list of pages to read before each class will be regularly updated on PWeb and the class webpage.
- Most of you will be challenged during the semester. Be prepared to not "get" everything right away.
- If you are struggling, make an appointment to talk with me.

Occasional Classroom Visitors

One of the upsides of teaching from home is more time with pets. Of course, this means the pets show up in class from time to time. In order of likelihood that you will see them, here are our cats (named after mathematicians, of course).

Sylvester is the newest member of the family, and the most likely to make appearances in class. He is an energetic 2 year old, and he views my desk as *his* property. Sylvester the mathematician (1814-1897) worked on many different areas in mathematics, including some related to linear algebra.

Tycho(noff) is our current "middle child" and he is 3 years old. Tycho is named after both the mathematician Tychonoff (1906-1993) who made major contributions to an area of math called topology, and the astronomer Tycho Brahe (1546-1601).

Maschke is our most senior cat at 12 years old. She is not thrilled to have two younger brothers, but she copes by pretending they don't exist. She is named for mathematician Maschke (1853-1908) whose most famous work is a result in a field of math called Representation Theory. This field of math is partially a generalization of the linear algebra you will learn this semester.