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MAT 2240: Introduction to Linear Algebra
Dr. Sarah J. Greenwald

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1.1   Course Goals

- Catalog description: A study of vectors, matrices and linear transformations, principally in two and three dimensions, including treatments of systems of linear equations, determinants, and eigenvalues. Prerequisite: MAT 1120 or permission of the instructor.
- Develop algebraic skills, including solving systems of equations and matrix algebra
- Develop spatial visualization skills, including visualization of vectors and linear transformations
- Learn about some historical and modern applications of linear algebra
- An introduction to Maple, a computer algebra software system, as it applies to linear algebra
- Practice critical and creative thinking and effectively communicate the mathematics of the course verbally and with written words, to fellow peers and the instructor.

1.2   Course Communication

- **Office Hours and ASULearn**: My office hours are Mon/Wed 1-1:45 in 326. I am always around and happy to help you during office hours unless otherwise posted. You do not need to make an appointment to use office hours—just drop by! I am happy to answer your questions, go over material you are not feeling comfortable with, or help you work on homework or projects. If someone else is in my office hours, join us—we'll take turns for questions. If you can't make office hours, contact me on ASULearn, which I'll try to answer at least once a day, including the weekends. Except for extreme emergencies, all private written communication must be handled through your Private Forum on AsULearn rather than e-mail. I'll also add some extra Zoom videoconference hours at times, which will be posted in class and on the web. The access link is on the ASULearn forums.
- **Check the main calendar web page and ASULearn forums often** for homework, announcements and for access to the other class web pages.
- **Work for Excused or Other Absences**: If there is some reason you must miss a class, then keep me informed on the private ASULearn forum, with any appropriate documentation, and obtain the assignment and class activities from the web pages. For excused absence credit you will turn in both the homework and missed classwork early or on time, if at all possible (you can send it with another student to class, slide it under my office door sometime before I leave for class, or even turn it in on ASULearn if need be, but I prefer printed work), or in a timely manner otherwise. These include responses to *i-clicker* questions and other class activities.
- **Inclement weather**: If the university cancels classes, plan for scheduled homework or problem sets to still be due unless there is guidance from the university otherwise. For example assignments can be turned in onto the private ASULearn forum. If needed, people who do not have any access to internet or who lose power or have other unforeseen conflicts should contact me as soon as possible on the ASULearn Forum. Also check ASULearn and the class web pages for updated info, which will at some point include plans for the missed class such as additional readings, problems, Zoom video conference meetings, chat, and/or forum sessions in ASULearn. Always check the university for the latest updates as I may be driving in or possibly without power myself when an update comes in.

1.3 Required Resources

- *Linear Algebra and Its Applications* by David C. Lay. 4th Edition. ISBN: 0321-38517-9. Pearson.
- Technology: Access to the course webpages, including the calendar page, which is used to access the other pages. A computer algebra system (Maple) is available in labs on campus and for download from the forum link on ASULearn.
- Printed copies of your Maple work and problem sets and the final project

1.4 Prerequisites

I will assume you have facility with the following that you further developed in MAT 1120: Calculus II and Analytic Geometry: algebraic solutions of linear equations (partial fractions), visualizations and equations of curves and surfaces and linear intersections in 2D and 3D (rectangle and box slicing, both visually and algebraically), limits applied to diverse objects (like improper integrals and partial sums of series), sin and cos trigonometry (trig substitution), linear approximations (Taylor polynomial of degree 1, Euler's method, and slope field), and mathematical reasoning and justifications (algebraic, numerical, and geometric reasoning). If you did not complete MAT 1120 recently or do not feel comfortable with the material, you should work on those concepts.

1.5 Learning Activities and Grades

I care about your success and have designed 2240 to help you learn, incorporating feedback from prior students and principles from the literature like *Make It Stick: The Science of Successful Learning* by Peter Brown, which I highly recommend.
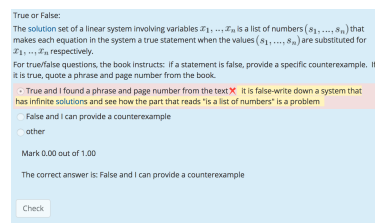

Try it Out	Review and Understand:	Apply:
low stakes *i-clickers*, low-stakes hw	access feedback and solutions. Also try the problems on your own from scratch (without the solutions in front of you) after a day or two, and again before an exam.	problem sets, exams, final project
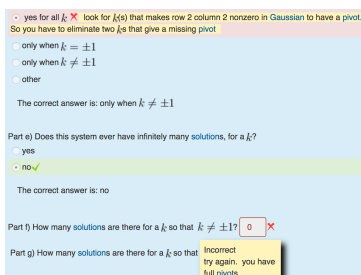
Check Instantaneous Feedback, Repeatable   General Feedback

- Effective Class Engagement 5%
  You are expected to contribute to discussions, activities, and *i-clicker* questions in a meaningful way and actively engage the material in class. You must be prepared for each class and check the main web page regularly for hw. These kinds of baseline activities will result in a participation grade of 3.5/5. Other activities can increase or decrease this grade. Utilizing office hours and ASULearn, asking and answering thought-provoking questions, coming up with creative ways of thinking about the material, and explaining the material to others are some examples of positive participation that will increase your grade. On the

other hand, performing activities that detract from the professional classroom environment or distract your neighbors or me will result in a lowered participation grade. Appalachian's General Education Program prepares students to employ various modes of communication. Successful communicators interact effectively with people of both similar and different experiences and values and in this class you will practice oral and written communication during class by interacting with your peers and me, being sensitive to an inclusive and respectful classroom environment. Many activities and class discussions are designed to be completed during class. Thus, attendance is required at ALL classes, and will form a portion of your grade. If you must be late to a class, or must leave early, then do still attend.

- Homework 5%
  I mark these via a checkmark for a good faith effort rather than for accuracy.
  Part 1 (online): shows instantaneous feedback—hover over a fill in the blank box for feedback after you *Check it*. You may try again if it will help your learning, or if you understand, you may continue without correcting it. After a hw is finished via *Submit all and finish*, general feedback opens and you can take another attempt until you receive the checkmark.
  Part 2 (paper): turn these in at the beginning of class. Designed to further develop your understanding and familiarity with the material, and independence in critical thinking.

- Problem Sets 30%
  There are 4 problem sets over the course of the semester. They are designed to apply knowledge in novel settings and approach problems from numerous points of view to draw connections and think out of the box. In the problem set annotations or explanations will demonstrate your work and understanding of by-hand and Maple printouts. Your work must be turned in on or before the due date at the beginning of class because solutions will be posted. To accommodate issues that may arise, the lowest problem set will automatically be dropped—save this for emergencies.

- Work Completion +1
  If you have earned a passing grade of at least a grade of 60% for every problem set (including the dropped one), and you have earned check marks on all except 3 of the other homework (including daily practice questions and test revisions), then you will receive +1 added on to your final average.

- Exams 50%
  There are 2 exams over the course of the semester. No late tests allowed*. You should view exams primarily as a learning experience. This means that exams are not only an opportunity for you to demonstrate your mastery of the material, but are also an opportunity for you to be challenged with new material in order for you to make new connections. To encourage exams as a learning experience a couple extra points will be granted for complete and correct test corrections.

- Final research presentations 10%
  You will research a topic related to the course that you are interested in and will communicate your expertise in written and oral format by reviewing and extending class concepts. The presentation component typically involves a group of 1 or 2 students at a time listening to and looking at your project so they can take notes for peer review. The presentations are modeled after what happens at research conferences, Appalachian's student research day, and science fairs. No make-ups allowed*. You must participate in the research project to pass the class.

* Accommodations in the determination of your final grade will be made for extenuating circumstances that are documented to prevent you from completing work early/on time. The grading scale is: $A \geq 93; 90 \leq A- < 93; 87 \leq B+ < 90...$

1.6   Academic Affairs Policies

We adhere to the University-wide syllabus and policy statements:
https://academicaffairs.appstate.edu/resources/syllabi-policy-and-statement-information

1.7 Tentative Calendar

Week 1: 1.1 and 1.2
Week 2: 1.2, 1.3 and problem set 1
Week 3: 1.4 and 1.5
Week 4: 1.7 and 2.1
Week 5: 2.2 and 2.3 and problem set 2
Week 6: 2.3 and applications Hill cipher and condition number
Week 7: problem set 3 and 1.8, 1.9, 2.7
Week 8: exam 1 and 6.1 and 2.7
Week 9: 3.1, 3.2, 3.3
Week 10: 2.8
Week 11: 5.1 and 5.2
Week 12: 5.6 and problem set 4
Week 13: 5.6 and exam 2
Week 14: applications of eigenvalues to spectral problems and final research
Final exam period: research presentations

1.8 Where to Get Help and Additional Policies

I encourage you to talk to me often in class, office hours, and on the ASULearn forums. Asking questions, and explaining things to others, in or out of class, is one of the best ways to improve your understanding of the material and I am always happy to help. This course is to be an environment in which everyone feels comfortable asking questions, making mistakes, offering good guesses and ideas, and is respectful to one another. As per the University-wide Statement on Student Engagement with Courses you can expect to spend (on average) 2–3 hours outside of class for each hour in class. In this course, this means spending between 2 hours and 30 minutes and 3 hours and 45 minutes between each class, on average. You are responsible for all material covered and all announcements and assignments made at each class, whether you are present or not. You are also responsible for announcements made on the web pages, so check them often. Your other time outside of class should be spent reviewing course material, completing homework assignments, reading solutions on ASULearn, and in office hours or the math lab. I prefer that you use office hours since it is easier to discuss material in person, but if you cannot make them, then ASULearn is a great alternative. I also want you to be informed about your choices regarding what you tell me about certain types of sensitive information. In situations where students disclose experiencing an act of interpersonal violence to their instructor, faculty are required to report what students tell us to the campus Title IX Coordinator, who then reaches out to the student by email offering support services. I care about you and want you to get the resources you need. I'm happy to talk with you if you decide you want that, but please be aware that if instead you'd like to explore options with someone who can keep your information totally confidential, I highly recommend the Counseling Center at 828-262-3180. They offer walk-in hours as well as after-hours coverage: `http://counseling.appstate.edu`.

- Appalachian Cares is a place to find updates about matters of student health and safety. It also functions as the most up-to-date clearinghouse of information, resources and support available. `http://appcares.appstate.edu/`.
- Any student who has difficulty affording groceries or accessing sufficient food to eat every day, or who lacks a safe and stable place to live, and believes this may affect their performance in the course, is urged to contact the Dean of Students, 324 Plemmons Student Union, for a list of resources and support. The ASU Food Pantry and Free Store is a free resource with pantry and personal care items, located in the Office of Sustainability on the bottom floor of East Hall.
- The library offers Research Advisory Program (RAP) sessions. `http://library.appstate.edu/gethelp/rap`
- The Learning Assistance Program provides five core services. Two services, University Tutorial Services and Academic Strategy Instruction, are offered to all undergraduate students, and three services, ACCESS, Student Support Services, and Academic Services for Student Athletes, serve specific groups of students identified as needing comprehensive support. `http://lap.appstate.edu/welcome-learning-assistance-program-1`

- AppSync is your one-stop connection to engagement and leadership opportunities at Appalachian State. `https://appsync.appstate.edu/`

You should explore the course material and write out your thinking in a way that can be shared with others. Academic integrity is a fundamental part of the course, which includes meeting deadlines, regular communication, and giving proper reference where it is due. These are essential to course integrity. Be sure to give acknowledgment where it is due. Submitting someone else's work as your own (PLAGIARISM) is a serious violation of the University's Academic Integrity Code, which defines: "Plagiarism includes, but is not limited to, borrowing, downloading, cutting and pasting, and paraphrasing without acknowledgement, including from online sources, or allowing an individual's academic work to be submitted as another's work."

Use of interactive technology is allowed only when it is related to our class. Otherwise put cell phones away or place them face down and set them to vibrate. Photos or video or audio recordings may not be taken in class without prior permission. Food and beverages are allowed as long as they aren't distracting, but e-cigs, chewing tobacco/spit cups and other products are not allowed.

The purpose of homework is to learn and practice computational strategies, concepts, and develop critical thinking and problem-solving skills. In this course, you will be challenged with problems that you have never seen before. I do not expect you to be able to solve all the issues immediately. Instead, I want to see what you can do on your own. Out in the real world, this is important, since no matter what job you have, you will be expected to seek out information and answers to new topics you have not seen before. Many concepts require the critical and creative analysis of a variety of interpretations in order to fully consider the implications. I understand that this can feel frustrating and uncomfortable and I am here to help you through the process. It helps to remember that there are no mathematical dead-ends! Each time we get stuck, it teaches us something about the problem we are working on and leads us to a deeper understanding of the mathematics. In the real world though, you are not expected to face your work alone. You will be allowed to talk to other people and you may even be expected to work with other people. In this class, you are also not expected to face your work alone. I am always happy to help you and will try to give you hints and direction to help you understand the material. At times though, to encourage the exploration process, I may direct you to rethink a problem and to come back to discuss it with me again afterwards. This occurs when I believe that the struggle to understand is imperative for your deep understanding of the material.

1.9 Advice from Prior Students

- Come to class everyday
- Take homework and clicker questions seriously, they are a great no-risk way to gauge your knowledge
- If you start falling behind, put in the extra time/work to catch up because everything builds on each other. Definitely use resources available.
- Study the homework questions and study guide, they help a lot
- I would suggest that students taking this course in the future should strive to read course material ahead of time
- Do the assignments and problem sets. They help with everything. Do the practice tests fully.
- If you don't understand a topic, buckle down and review it and ask questions until it makes sense. Take advantage of all the resources available like office hours. Always review solutions online.
- Keep up with the definitions for the term sheets.
- Do all assignments. Ask question in class. Don't fall asleep. Laugh!
- Study using the resources other than the textbook. Class helps but can't go over everything, and the textbook is particularly vague about topics in this class.
- Take full advantage of office hours and ask questions about any and everything you're not 100% sure on.
- Homework problems are crucial, definitely help solidify material
- Do all the work assigned and you should do fine
- Do online hw first for help solving problems then do written work
- Pay attention, use office hours if you struggle
- Do all the assigned reading and use office hours of math lab if you need it

- Do all the exercise/participation problems!
- Take Dr. Sarah
- Go over what you learn in class at least a little bit each night
- Keep up and don't slack off
- Paying attention in class and asking questions is the difference between just solving problems and actually understanding them
- Learn the 1st chapter stuff real good including span/pivots/# of solutions as it will keep coming back
- Start problem sets earlier

1.10 Instructor Bio

My PhD is from the University of Pennsylvania in the Riemannian geometry of orbifolds. I am a full Professor of Mathematics, and I am also an affiliate of Gender, Women's and Sexuality Studies (GWS), investigating the connections between mathematics and society. I am married to the bassist Joel Landsberg. In our spare time, we like to travel, hike and conduct genealogy research. In addition to my own personal genealogy, I like to give back to the broader community, and in this context, I am affiliated with ASU's center for Judaic, Holocaust and Peace Studies. Some of what I like about mathematics is also what I enjoy about genealogy—the sense of exploration, discovery and aha moments that come with lots of patience and effort.