MATH 309 Theory of Vector Spaces
SPRING 2026

Instructor: Eric Swartz
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Office: Jones 133
Office Hours: TR 12:30–1:50 PM, W 3–4 PM, and by appointment
Course Homepage: We will use **Blackboard** as our course homepage.
Important dates: January 30 (Add/drop deadline), March 23 (Withdrawal deadline)

Content: We will cover the theory of vector spaces from an abstract perspective, i.e., this is a proof-based linear algebra course. We will cover complex numbers, vector spaces, linear maps, eigenvalues and eigenvectors, inner product spaces. Additional topics such as Jordan Canonical Form, bilinear and quadratic forms may be included if time permits.

Textbook: *Linear Algebra Done Right* by Sheldon Axler.
This text is available online for free at: `https://linear.axler.net/LADR4e.pdf`
We will cover Chapters 1–6 and additional topics if time permits, covering approximately one subsection of a chapter (e.g., "3D") per lecture.

Grading:

Homework:	40%
In-Class Participation:	10%
Midterm:	20%
Final:	30%

Final letter grades are assigned using the scale: A 93–100, A- 90–92, B+ 87–89, B 83–86, B- 80–82, C+ 77–79, C 73–76, C- 70–72, D+ 67–69, D 63–66, D- 60–62, F <60
This scale is not rigid! Lower cutoffs are often used.

In-Class Participation: Participation grades are based on faithful attendance and participation during lecture as well as actively working and participating during any group activities. Attendance and discussion one-on-one with me during office hours will also be looked on favorably and are an alternative option for students who experience anxiety. The

participation grade will (necessarily) be somewhat subjective in the eyes of the instructor, but I *want* everyone to get a perfect (or near perfect) participation score!

Class Absences: If you are forced to miss class, please let me know! Excused absences will not affect your participation grade. **Lecture notes are always posted on Blackboard.** I will work with you as best I can to cover the material that you miss!

Homework Overview: Homework will be assigned during nearly every lecture. The definitive list of assigned homework will be posted on Blackboard. The final due date for each problem is two weeks after the problem is assigned, unless otherwise noted.

- Incorrect proofs will be returned to be corrected (I grade every non-holiday weekday). Sometimes there will be detailed feedback, sometimes only a mistake will be underlined. Your final grade for a problem will be based only on the last score you received for the problem, *regardless of how many incorrect versions you turned in previously.*
- Partial credit may be given in some circumstances, but most problems will be scored as either 0 or 1! A completely correct proof will be marked with a checkmark at the end of the proof and a score of 1 on Blackboard.
- In order to be counted correct, a proof must be written in clear, correct English. This course is about proofs and proof writing, so you should try to express your proofs as clearly as possible!
- **DO NOT WAIT UNTIL THE DAY BEFORE A PROBLEM IS DUE TO MAKE YOUR FIRST ATTEMPT!**
- Especially early in the semester, as you are getting used to writing proofs, problems may take multiple tries to get completely correct! **It is a very good idea to turn in an attempt at a problem within the first day or two after a problem is assigned!**
- Late homework will only be accepted under truly extraordinary circumstances.
- While you may discuss the problems with your classmates (and you are in fact encouraged to do so!), copying someone else's work is strictly prohibited and will result in scores of zero for *everyone* involved. In particular, you may not use another student's final work as a "model," and you may not allow other students to study your final work. Everyone must turn in final proofs separately. Needless to say, copying or adapting a proof from another source (e.g., book or internet) is strictly prohibited as well.
- **In particular, the use or incorporation of any AI-generated content (such as from ChatGPT) in assignments is generally not allowed, and *any* use of AI needs to be properly cited. Submitted work may be reviewed, as needed, for AI-generated content.**

LaTeX: Your homework assignments must be typeset using LaTeX. Being able to use this software is a useful skill to have, and the programs are available for free, if you so choose. You may also use the online editor available at `https://www.overleaf.com/`. Simply sign up for free, start a new project, and paste the text from "sample.tex" into the source side. It is easy to google commands/techniques that you don't know, but a list of common symbols is available at `http://cklixx.people.wm.edu/TeX-symbol.pdf`

Homework Policy: PDF files are to be emailed directly to me at easwartz@wm.edu.

- You should name the file you are turning in starting with "LastnameFirstname" in the filename; for example, `SwartzEric_HWJan22.pdf`. (Name the file whatever you want, but *always* start with "LastnameFirstname"!)
- **You should combine HW from different assignments into a single file that you turn in on a given day, and you should either omit or mark as graded/correct problems that you have already gotten correct.**
- HW that is turned in by 9 AM ET on a given (non-holiday) weekday will be graded that day (or very shortly thereafter). HW turned in at other times may not be graded until the next "batch" (but may be graded sooner, if possible). If HW is due on a given date, I will accept it if it is turned in by 11:59 PM ET that day (but I might not grade it until the next day's "batch"). **Try to turn in HW by 9 AM ET on weekdays if you can!**

Exam Dates:

- There will be a midterm on Thursday, March 5, before Fall Break. The midterm will be closed book, closed notes.
- The final exam will will take place Monday, May 4, from 2 – 5 PM. It will be closed book, closed notes, and will cover material from the entire semester.

Student Accessibility Services: William & Mary accommodates students with disabilities in accordance with federal laws and university policy. Any student who feels they may need an accommodation based on the impact of a learning, psychiatric, physical, or chronic health diagnosis should contact Student Accessibility Services staff at 757-221-2512 or at sas@wm.edu to determine if accommodations are warranted and to obtain an official letter of accommodation. For more information, please see `https://www.wm.edu/sas`

Religious Accommodations: Please visit `https://www.wm.edu/offices/ce/policies/audit-risk-and-compliance/religious-accommodations.php` for further information.

Honor Code: Students are expected to uphold the Honor Code in this class.

Student Success: Students may receive support from Student Success through the following offices:

- For academic support such as tutoring, time management, study skills, and academic coaching, please contact Academic Wellbeing at `https://www.wm.edu/offices/studentsuccess/academic-wellbeing/` (academicwellbeing@wm.edu)
- For concerns about the wellbeing of a member of the William & Mary community or to seek assistance for interpersonal, academic, and wellness challenges, please contact Care Support Services at `https://www.wm.edu/offices/studentsuccess/caresupportservices/` (care@wm.edu)
- For accommodation needs or questions, please contact Student Accessibility Services at `https://www.wm.edu/offices/studentsuccess/studentaccessibilityservices/` (sas@wm.edu)

Mental and Physical Well Being: William & Mary recognizes that students juggle different responsibilities and can face challenges that make learning difficult. There are many resources available at W&M to help students navigate emotional/psychological, physical/medical, material/accessibility concerns, including:

- For psychological/emotional stress, please consider reaching out to the W&M Counseling Center (757-221-3620), 240 Gooch Dr. 2nd floor, `https://www.wm.edu/offices/wellness/counselingcenter/`. Services are free and confidential.
- For physical/medical concerns please consider reaching out to the W&M Health Center at `https://www.wm.edu/offices/wellness/healthcenter/` or 757-221-4386, 240 Gooch Drive.
- To seek assistance for interpersonal, academic, and wellness challenges, please contact Care Support Services at `https://www.wm.edu/offices/studentsuccess/caresupportservices/` (care@wm.edu)
- For a list of other resources available to students, see here.

As your professor, I also ask you to reach out to me if you are facing challenges inside or outside the classroom; I will guide you as best I can to appropriate resources on campus.