

Text We will be using *A First Course in Linear Algebra*, by Robert A. Beezer as our textbook. We will follow Version 3.20 throughout the semester as the official version for the course. This may be found in webpage and PDF versions from the book's site at <http://linear.pugetsound.edu>, where it is made freely available with an open license. If you prefer, you can use the hardcover version, which is Version 3.00, and has only minor differences. See the book's site for information on ordering a physical copy.

The Bookstore also has a **highly** recommended optional text: *The Nuts and Bolts of Proofs* by Antonella Cupillari (Third Edition). The course web page has some recommendations for similar books about proof techniques.

Course Web Page Course web page can be found from a link off of <http://buzzard.ups.edu/courses.html>. Many of your questions can be answered here.

Office Hours My office is in Thompson 303. Making appointments or simple, **non-mathematical** questions can be handled via email — my address is beezer@ups.edu. I read all of my email, usually very shortly after receiving it. Urgency of replying varies. Office Hours are Monday, Tuesday, Thursday, Friday, 3:00–3:50 PM. Office Hours are first-come, first-served, so I do not make appointments for these times, nor do you need to ask me if I will be present for these times. You **may** make an appointment for other times, or just drop by my office to see if I am in. Office Hours are your opportunity to receive extra help or clarification on material from class, or to discuss any other aspect of the course.

Computation Linear algebra is at the heart of many large computations in physics, chemistry, economics, statistics and other disciplines. So it is useful to become familiar with relevant software. Furthermore, freed from doing error-prone numerical computations you can concentrate on new ideas and concepts.

For both reasons, we will make extensive use of Sage. Since Sage is open source software, it is available freely in many places. Your default installation is the on-campus server at <http://sage.pugetsound.edu> which will be running the latest version (6.0) and will remain constant all semester. Or you might like using the (experimental) SageMath Cloud at <http://cloud.sagemath.com>. Availability, version incompatibility or convenience of other sites is not an excuse for not being able to use Sage. There are thorough discussions about Sage integrated into the web version your textbook. There is also a PDF version of the Sage material, which is less useful than the online version. We will discuss in class the use of Sage during examinations. In particular, if you do not own a laptop, investigate procedures **now** for borrowing one from the library.

Homework There is a nearly complete collection of exercises in the text. Any (or all) of the problems will be good practice as you learn this material. Many of these problems have complete solutions in the text to further aid your understanding. Of course, you are not limited to working **just** these problems.

None of these problems will be collected, but instead they will form the basis for our “Problem” sessions and for discussions in office hours. It is your responsibility to be certain that you are learning from these exercises. The best ways to do this are to work the problems diligently as we work through the sections (see attached schedule) and to participate in the classroom discussions. If you are unsure about a problem, then a visit to my office is in order. Making a consistent effort outside of the classroom is the easiest way to do well in this course.

Mathematics not only demands straight thinking, it grants the student the satisfaction of knowing when he [or she] is thinking straight.

— D. Jackson

Mathematics is not a spectator sport.

— Anonymous

I hear, I forget.

I see, I remember.

I do, I understand.

— Chinese Proverb

An education is not received. It is achieved.

— Anonymous

Exams There will be seven 50-minute timed exams — they are all listed on the **tentative** schedule. The lowest of your seven exam scores will be dropped. The comprehensive final exam will be given on Wednesday, May 14 at Noon. The final exam cannot be given at any other time and also be aware that I may allow you to work longer on the final exam than just the two-hour scheduled block of time. In other words, plan your travel arrangements accordingly.

As a study aid, I have posted copies of old exams on the course web site. These are offered with no guarantees, since techniques, approaches, emphases and even notation will change slightly or radically from semester to semester. Some of the solutions contain mistakes, and some of the problem statements have typos. In other words, they are not officially part of this semester’s course and I do not maintain them. In particular, I do not advocate working old exams as a primary, or exclusive, technique for learning the material in this course. **Use at your own risk:** they have not been reviewed for minor mistakes or inconsistencies with this semester’s course.

Writing This course has been designated as part of the University’s Writing in the Major requirement. Thus, there will be two proofs assigned for each chapter. You will be expected to formulate a proof, and write it up clearly. These will be graded on a pass/fail basis. Each chapter’s questions will be returned to you with comments, and if you do not earn a pass, then you can resubmit them at the close of the next chapter. You may resubmit a problem for several consecutive chapters in a row, **so long as you make a serious effort on each outstanding problem at each opportunity.** Once you miss an opportunity to resubmit, or a retry does not contain any new work, or significant comments are ignored, then it will be scored as a fail. Failure to follow the directions for submitting these can result in a retry with no feedback from me.

These will be due the day of the problem session prior to the chapter exam, and submitted **prior to the start of class**. During the first two weeks, we will learn the mathematical typesetting software, L^AT_EX, and you will be required to use this tool appropriately when writing your proofs. I might request your L^AT_EX source as part of grading your exercises, so make sure you retain these.

These problems **are your own work** (i.e. no collaboration on formulating the proof, no collaboration on writing the proof, no copying content from the book's source, no discussion whatsoever with classmates). In particular, I do not provide consultation in advance of submission, but rather will provide careful comments on your written submitted work. Late submissions will not be accepted and forfeit your opportunity to submit retries.

Reading Questions Each section of the textbook contains three reading questions at the end. Once you have read the section **prior** to our in-class discussion, it will be time to consider these questions. We will use the WeBWorK system for submitting your responses. Note that some questions will be identical, but some will be random variants of those in the book. WeBWorK will grade the computational problems, and I will grade the free-form response questions.

Responses will be due by 6 AM of the day we discuss the section in class, and will not be accepted late. If a question asks for a computation, then it will likely be graded by WeBWorK. If the question requests a yes/no answer, or asks "Why?" then give a thorough explanation in the response box. Cutting and pasting from the textbook without a citation is plagiarism. And even providing a citation with a verbatim quote is generally not going to get you any credit.

WeBWorK can interpret simple L^AT_EX syntax and interpret that for me as I review your responses. So this is a good place to hone your L^AT_EX skills.

Grades Grades will be based on the following breakdown: Exams — 55%; Reading Questions — 10%; Writing — 15%; Final — 20%. Homework, attendance and improvement will be considered for borderline grades. Scores will be posted anonymously on the web at a link off the course page.

Reminders Here are three reminders about important university policies contained in the *Academic Handbook*. These are described thoroughly online at <http://www.pugetsound.edu/student-life/student-handbook/academic-handbook/>, or a printed copy may be requested from the Registrar's Office (basement of Jones Hall).

"Regular class attendance is expected of all students. Absence from class for any reason does not excuse the student from completing all course assignments and requirements." (Registration for Courses of Instruction, Non-Attendance)

Withdrawal grades are often misunderstood. A Withdrawal grade (W) can only be given during the third through sixth weeks of the semester, after that time (barring unusual circumstances), the appropriate grade is a Withdrawal Failing (WF), **even if your work has been of passing quality**. See the attached schedule for the last day to drop with an automatic 'W'. (Grade Information and Policy, Withdrawal Grades)

All of your graded work is expected to be entirely your own work, this means Reading Questions and writing exercises (see above specifically about writing). Anything to the contrary is a violation of the university's comprehensive policy on Academic Integrity (cheating

and plagiarism). Discovered incidents will be handled strictly, in accordance with this policy. Penalties can include failing the course and range up to being expelled from the university. (Academic Integrity)

Conduct Daily attendance is required, expected, and overall a pretty good idea. Class will begin on-time, so be here, settled-in and ready to go. In other words, walking in the door at the exact time class is to begin is not acceptable. Repeated tardiness and absences will result in grade penalties, in accordance with university policies. Do not leave class during the lecture unless there is a real emergency — fill your water bottles, use the toilet, and so on, **in advance**. Please keep phones in your pocket or bag, unless you are using them to read the text. In short, we are here to learn and discuss mathematics and it is your responsibility to not distract your peers who are serious about their education.

Purpose This course is much different from most any mathematics course you have had recently, in particular it is much different than calculus courses. We will begin with a simple idea — a linear function — and build up an impressive, beautiful, abstract theory. We will begin computationally, but soon shift to concentrating on theorems and their proofs. By the end of the course you will be at ease reading and understanding complicated proofs. You will also be very good at writing routine proofs and will have begun the process of learning how to create complicated proofs yourself.

You will see this material applied in subsequent courses in mathematics, computer science, chemistry, physics, economics and other disciplines (though we will not have much time for applications this semester). You will gain a “mathematical maturity” that will be helpful as you pursue upper-division coursework and in any logical, rational, or argumentative activity you might engage in throughout your lifetime. It is not easy material, but your attention and hard work will be amply repaid with an in-depth knowledge of some very interesting and fundamental ideas, in addition to beginning to learn to think like a mathematician.

Student Accessibility and Accommodation If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Peggy Perno, Director of the Office of Accessibility and Accommodations, 105 Howarth, 253-879-3395. She will determine with you what accommodations are necessary and appropriate. All information and documentation is confidential.

I request that you give me at least two full working days to respond to any requests from this office.

Classroom Emergency Response Guidance Please review university emergency preparedness and response procedures posted at <http://www.pugetsound.edu/emergency/>. There is a link on the university home page. Familiarize yourself with hall exit doors and the designated gathering area for your class and laboratory buildings.

If building evacuation becomes necessary (e.g. earthquake), meet your instructor at the designated gathering area so she/he can account for your presence. Then wait for further instructions. Do not return to the building or classroom until advised by a university emergency response representative.

If confronted by an act of violence, be prepared to make quick decisions to protect your safety. Flee the area by running away from the source of danger if you can safely do so. If

this is not possible, shelter in place by securing classroom or lab doors and windows, closing blinds, and turning off room lights. Lie on the floor out of sight and away from windows and doors. Place cell phones or pagers on vibrate so that you can receive messages quietly. Wait for further instructions.

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Jan 20 MLK Day	Jan 21 Syllabus Section WILA	Jan 23 Sage Math Cloud	Jan 24 L ^A T _E X
Jan 27 Section SSLE	Jan 28 Section RREF	Jan 30 Section TSS	Jan 31 Section HSE
Feb 3 Section NM	Feb 4 Problem Session Writing SLE Due	Feb 6 Exam SLE	Feb 7 Section VO
Feb 10 Section LC	Feb 11 Section SS	Feb 13 Section LI	Feb 14 Section LDS
Feb 17 Section O	Feb 18 Problem Session Writing V Due	Feb 20 Exam V	Feb 21 Section MO
Feb 24 Section MM	Feb 25 Section MISLE	Feb 27 Section MINM	Feb 28 Problem Session
Mar 3 Section CRS Last Day for “W”	Mar 4 Section FS	Mar 6 Problem Session Writing M Due	Mar 7 Exam M
Mar 10 Section VS	Mar 11 Section S	Mar 13 Section LISS	Mar 14 Problem Session

Mid-Term

Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Mar 24 Section B	Mar 25 Section D	Mar 27 Section PD	Mar 28 Problem Session Writing VS Due
Mar 31 Exam VS	Apr 1 Section DM	Apr 3 Section PDM	Apr 4 Section EE
Apr 7 Problem Session	Apr 8 Section PEE	Apr 10 Section SD	Apr 11 Problem Session Writing D&E Due
Apr 14 Exam D&E	Apr 15 Section LT	Apr 17 Section ILT	Apr 18 Problem Session
Apr 21 Section SLT	Apr 22 Section IVLT	Apr 24 Problem Session Writing LT Due	Apr 25 Exam LT
Apr 28 Section VR	Apr 29 Section MR	May 1 Problem Session	May 2 Section CB
May 5 Problem Session (or Snow Day) Writing R Due	May 6 Exam R	May 8 Reading Period	May 9 Reading Period

Final Examination: Wednesday, May 14, Noon