

**Text** We will be using *A First Course in Linear Algebra*, by Robert A. Beezer as our textbook. We will follow Version 3.10 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, since it only has 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** Start at <http://buzzard.ups.edu/courses.html> to find a link to the course web page. Many of your questions can be answered here.

**Office Hours** My office is in Thompson 303; the telephone number is 253-879-3564. Making appointments or simple, non-mathematical questions can be handled via email — my address is [beezer@ups.edu](mailto:beezer@ups.edu). Office Hours are Monday, 2:30–4:00 PM; Tuesday, Thursday 3:00–4:00 PM; Friday, 2:30–3:30 PM. Office Hours are first-come, first-served, so I do not make appointments 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 (5.11) and will remain constant all semester. 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, available at the website for your textbook. 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, December 18 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. 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.

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,  $\text{\LaTeX}$ , and you will be required to use this tool appropriately when writing your proofs. I might request your  $\text{\LaTeX}$  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). 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.

We will be testing some enhancements to WeBWorK, designed to make questions like these reading questions possible. I am sure there will be a couple bumps in the road, so hang on and please be patient and recognize that you will be helping to make this open source software better for future students around the world.

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 with a citation it is generally not going to get any credit.

WeBWorK can interpret simple L<sup>A</sup>T<sub>E</sub>X syntax and interpret that for me as I review your responses. So this is a good place to hone your L<sup>A</sup>T<sub>E</sub>X 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 <http://buzzard.ups.edu/courses.html>.

**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 Sage exercises. 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. 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
Sep 2 Labor Day	Sep 3 Section WILA	Sep 5 Section SSLE	Sep 6 Section RREF
Sep 9 Section TSS	Sep 10 Section HSE	Sep 12 Section NM	Sep 13 Problem Session Writing SLE Due
Sep 16 Exam SLE	Sep 17 Section VO	Sep 19 Section LC	Sep 20 Section SS
Sep 23 Section LI	Sep 24 Section LDS	Sep 26 Section O	Sep 27 Problem Session Writing V Due
Sep 30 Exam V	Oct 1 Section MO	Oct 3 Section MM	Oct 4 Section MISLE
Oct 7 Section MINM	Oct 8 Section CRS	Oct 10 Section FS	Oct 11 Problem Session Writing M Due
Oct 14 Exam M Last Day for "W"	Oct 15 Section VS	Oct 17 Section S	Oct 18 Section LISS

Mid-Term

## Tentative Daily Schedule

Monday	Tuesday	Thursday	Friday
Oct 21 Fall Break	Oct 22 Fall Break	Oct 24 Section B	Oct 25 Section D
Oct 28 Section PD	Oct 29 Problem Session Writing VS Due	Oct 31 Exam VS	Nov 1 Section DM
Nov 4 Section PDM	Nov 5 Section EE	Nov 7 Section PEE	Nov 8 Section SD
Nov 11 Problem Session Writing D Due	Nov 12 Exam D&E	Nov 14 Section LT	Nov 15 Section ILT
Nov 18 Problem Session	Nov 19 Section SLT	Nov 21 Section IVLT	Nov 22 Problem Session Writing LT Due
Nov 25 Exam LT	Nov 26 Section VR	Nov 28 Thanksgiving	Nov 29 Thanksgiving
Dec 2 Section MR	Dec 3 Problem Session	Dec 5 Section CB	Dec 6 Section OD
Dec 9 Problem Session (or Snow Day) Writing R Due	Dec 10 Exam R	Dec 12 Reading Period	Dec 13 Reading Period

Final Examination: Wednesday, December 18 at Noon