

# MATH 290, Linear Algebra

## Spring 2014

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January 09, 2013

### Contents

<b>1</b>	<b>Introduction</b>	<b>1</b>
1.1	Goals . . . . .	1
<b>2</b>	<b>Attendance</b>	<b>1</b>
<b>3</b>	<b>Academic Honesty</b>	<b>1</b>
<b>4</b>	<b>Course Information</b>	<b>1</b>
4.1	Textbook . . . . .	1
4.2	Calculator . . . . .	2
4.3	Basic Information . . . . .	2
4.3.1	Logistics . . . . .	2
4.4	Examinations . . . . .	2
4.5	Final Examination . . . . .	2
4.6	Writing Projects . . . . .	2
4.7	Homework . . . . .	3
4.8	Reading Questions . . . . .	3
4.9	Course Information Updates . . . . .	3
4.10	Total Points . . . . .	3
4.11	Additional Information . . . . .	4
<b>5</b>	<b>References</b>	<b>4</b>
<b>6</b>	<b>Math 290 Writing Projects</b>	<b>5</b>
	<b>Grading Rubric</b>	<b>5</b>
6.1	Writing Guidelines . . . . .	5

## 1 Introduction

The department's description of this course is at Linear Algebra[6].

The prerequisite for this course is MATH 181 (second semester calculus) but do not expect it to be like calculus – it is an algebra course through and through. However, linear algebra is used extensively in multivariate calculus, physics, chemistry, economics, and computer science so, during the semester, we will take a little time away from the algebra to introduce appropriate examples.

Linear algebra is the first “proof-based” course offered in Puget Sound's mathematics curriculum and serves as the gateway course to upper-division mathematics. Since proofs are written mathematics and linear algebra also meets the university's “Writing in the Major” requirement, there will be at least as much focus on developing mathematical writing skills as on linear algebra itself. More details are provided in the Writing Projects section below.

You should expect to spend at least as much time writing correct proofs of your results as you spend figuring out those proofs. In fact, one of the most important goals of this course is for you to deeply appreciate that you don't really understand a concept unless you can clearly explain its connections to other relevant concepts to someone else.

### 1.1 Goals

By the end of the semester, you should understand linear equations and their solutions, see how vector spaces arise naturally from generalizing the methods for solving systems of linear equations, and see these tools' utility in a range of applications. You should also be able to read a mathematical text for content and deep understanding (see “How to Study” [7] for an excellent description of how to read mathematics and other efficient ways to study), analyze a given problem to determine which linear algebra tools should be used in its solution, use a variety of strategies to determine and prove a solution of the given problem, and follow accepted mathematical style to present an accurate and carefully written formal proof of that solution.

During a normal class day we will work to achieve these goals by discussing new material and addressing questions that arise from reading the text or working on homework problems.

## 2 Attendance

Daily attendance is both required and expected. You are also expected to participate fully in class by pre-reading the material to be covered, seeking clarification for unclear points, and engaging in mannerly discussions of the topics.

## 3 Academic Honesty

Unless specifically told otherwise, all graded materials are to be your own work. This includes the reading and writing assignments. You are expected to be familiar with the university's Student Integrity Code [3] and will be asked to affirm you abide by the university's Academic Integrity provisions[4] on every assignment and exam.

## 4 Course Information

### 4.1 Textbook

The textbook is *A First Course in Linear Algebra, (Version 3.20)*, by Robert A, Beezer, ©2004-2012, and is published by Professor Beezer under the GNU Free Documentation License rather than by a commercial publishing house.

I will be teaching from the free electronic copy of Version 3.20, which is at <http://linear.ups.edu/html/fcla.html>, but you can buy a hard copy of Version 3.0 for around \$33. See <http://linear.ups.edu/> for details. You can also find the differences between versions at <https://github.com/rbeezer/fcla/blob/master/changes.txt>.

Since this is likely to be your first exposure to proof-based mathematics, you should also consider buying one of the many books on how to do proofs. I recommend “The Nuts and Bolts of Proofs” and can give you names of several others on request.

## 4.2 Calculator

I **require** a calculator for this course. It must be able to perform the following matrix operations: row operations, reduced row echelon form, transpose, determinant, and eigenvalues/eigenvectors. I will allow the calculator to be used on examinations but will not allow its use for some problems.

If you do not have a manual for your calculator, you should be able to find one on the internet – for example Texas Instruments has their guidebooks at

<http://education.ti.com/en/us/guidebook/search> [8]. Be advised that some students have had trouble getting a TI 83 to do all of the necessary computations.

Here is a link to the department's Calculator Policy [http://math\\_old.pugetsound.edu/info/calcpolicy200608.pdf](http://math_old.pugetsound.edu/info/calcpolicy200608.pdf) [5].

## 4.3 Basic Information

You can find information pertinent to all of my classes at the link below and, once there, information specific to this class by clicking on the Math 290 link.

<http://mathcs.pugetsound.edu/~bryans/> [1]

### 4.3.1 Logistics

Classes meet for 50 minutes except on Thursday when we can meet for 80 minutes.

<b>Prof. Bryan Smith</b>	TH 390D	879-3562	bryans[at]ups.edu
Math 290	TH 197	M, F	12:00 - 12:50 PM
		Tue	12:30 - 1:20 PM
		Thu	12:30 - 1:50 PM
<b>Office Hours</b>		Tue, Thu	8:00-8:25 am
			12:00-12:25 pm
			1:30-1:55 pm
		Wed	2:00-3:20 pm
		Other	By Appointment

## 4.4 Examinations

All examinations are scheduled for Thursday. Note that the exam period will run for 80 minutes (be sure to know when class starts and ends on an examination day).

There will be three (3) 50-minute, in-class examinations and the lowest score will only count half as much as the other exams. I do not give make-up examinations except for truly exceptional circumstances. You **should not** expect all examination questions to closely mimic textbook examples or assigned homework problems.

There are copies of old exams on my web site. They might contain typos or even errors. They are offered “as is” for those who wish to use them as a study aid. But they are **not** part of this semester's course.

Examination One	Thursday	Feb 13
Examination Two	Thursday	Mar 27
Examination Three	Thursday	May 01

## 4.5 Final Examination

The final examination is scheduled for

Math 290B Mon May 5, 2014 12:00 - 2:00 P.M.

The final examination will be comprehensive and **cannot be rescheduled** so do not plan plane flights (or anything else) that will conflict with it. I will allow you to work longer than the two hours scheduled for the final.

## 4.6 Writing Projects

In order to meet the Writing in the Major requirement, I will assign a writing exercise most weeks (about two per chapter). You are to determine a solution for each and then write up a careful proof. These papers will be graded pass/fail for both mathematical content and written presentation. I will only accept problems on Tuesday and Thursday at the beginning of class. You may resubmit each problem repeatedly provided: 1)

you make a serious effort on each retry and 2) it has not been more than two weeks since you last submitted the problem. Problems that are not submitted within the two week deadline receive an automatic fail. **All work on these proofs is to be your own** with two exceptions: you are allowed to discuss problems with me and you may use any ideas that you witness during a classroom exchange.

Note specifically that

1. You may not discuss any aspect of these problems with anyone except me.
2. You may not use any written resources other than your textbooks for this semester.

See the grading rubric on the last page of this document for further details.

## 4.7 Homework

It is wise to work most, if not all, of the homework problems in the textbook. Although they will not be collected, they will form the basis for much of our in-class discussions.

## 4.8 Reading Questions

It is very important that you read the material at least twice. Once before and once after it is discussed in class. It is also important that you read correctly. Mathematics requires that you read **slowly** and with a pencil and paper at hand. (See “How to Study” [7] on the course webpage for more details.)

There are reading questions at the end of each section of the book. You are to read these **before** we cover that material (see the tentative schedule) and email your answers to me by 8:00 AM the morning we discuss that section in class. Note that these will not be accepted late.

When submitting your answers to the questions use the following structure.

1. Sent to me at bryans@pugetsound.edu
2. The “Subject” line must contain “290” followed by the section acronym. For example, the first reading assignment should have “290” and “WILA” in it’s subject line.
3. Have your full name as the first line of your response.
4. Do not type the questions into your email – just answers.
5. Give very brief answers. Do not include computations for numerical questions but do give brief reasons.
6. Send only pure text. Do not send attachments, WORD files, or graphics. Do not send your answer in HTML.
7. Mathematical notation is cumbersome in text-only email but don’t worry too much about it. I should be able to decipher most reasonable attempts.

## 4.9 Course Information Updates

If you wish, I will periodically post a grade report of your current standing in the class on my university web page. You should keep track of your grades on the various assignments and check them against these reports. If there are any discrepancies they should be dealt with immediately.

To have your information posted you need to print your name, the class (MATH 290), and a code on a sheet of paper. Then sign the paper and physically hand it to me. The code is to be a sequence of up to 23 symbols I can type on a keyboard.

## 4.10 Total Points

Writing Projects	36%
Reading Questions	10%
Examinations	39%
Final Examination	15%

## 4.11 Additional Information

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. Stay low, away from doors and windows, and as close to the interior hallway walls as possible. Wait for further instructions.

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.

## 5 References

### References

- [1] Bryan Smith's Homepage  
<http://math.pugetsound.edu/~bryans/>
- [2] Math 290 Course Webpage  
[http://math.pugetsound.edu/~bryans/Current/Spring\\_2013/290Index\\_Spring2013.html](http://math.pugetsound.edu/~bryans/Current/Spring_2013/290Index_Spring2013.html)
- [3] General Student Integrity Code <http://www.pugetsound.edu/student-life/student-resources/student-handbook/student-integrity-code/>
- [4] Academic Integrity Provisions <http://alacarte.pugetsound.edu/subject-guide/6-Academic-Integrity-Puget-Sound:>
- [5] Department Calculator Policy  
[http://math\\_old.pugetsound.edu/info/calcpolicy200608.pdf](http://math_old.pugetsound.edu/info/calcpolicy200608.pdf)
- [6] Department Syllabus for MATH 290  
[http://www.math.ups.edu/~matthews/Syllabi/MATH290\\_May2006.pdf](http://www.math.ups.edu/~matthews/Syllabi/MATH290_May2006.pdf)
- [7] William Rapaport's "How to Study"  
<http://www.cse.buffalo.edu/~rapaport/howtostudy.html>
- [8] TI-83 Guidebook  
<http://education.ti.com/en/us/guidebook/search>

## 6 Math 290 Writing Projects

## Grading Rubric

Code	Logic and Mathematics
Accept	Arguments are correct, complete and without inappropriate material.
L	Logic or Mathematics are incorrect
T	Terminology or notation is incorrect
W	Writing does not adhere to the guidelines.

### 6.1 Writing Guidelines

It is best to think of these projects as weekly writing assignments in which you completely explain and justify your analyses of the problems. There is to be no collaboration at all when you work these problems and write them up. Your sole outside resources are direct discussions with me or discussions that occur during class.

In addition I expect your papers to be

1. Fully documented – specifically:
  - (a) Any idea obtained during in-class brainstorm sessions or in discussions with me is cited in-line.
  - (b) All textbook results (theorems, propositions, and lemmas) are cited in-line and include the acronym of the result.
  - (c) Any use of technology is cited in-line.
  - (d) You have signed the cover sheet affirming you have neither discussed any aspect of these problems with anyone (except me) nor have you used any written resources other than your textbooks for this semester.
2. Carefully handwritten in ink or written with a word processor. (I can show you how to use L<sup>A</sup>T<sub>E</sub>X and Sage for this. You can also use Scientific Notebook, Mathematica or Microsoft Word. Please check with me before using any other program.)
3. Written using complete, accurately punctuated sentences.
4. Presented in active voice, the first person plural and with a clear, easy-to-follow expository style.
5. Targeted at an audience consisting of students not in this class but with an equivalent mathematical background – say those currently in another section of this course.