Course Syllabus: Math 3410A
Linear Algebra
Department of Mathematics and Computer Science
University of Lethbridge, Spring 2015

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Office: UHall C530 **Course website:** via moodle.uleth.ca
Office hours: MWF 11:30 am - 12:30 pm, TR 1:00 - 2:00 pm, or by appointment.
Lectures: MWF 3:00-3:50 pm in PE264

Course Description

This is an advanced course in linear algebra. We will focus on the properties of abstract vector spaces and linear transformations. Most of the material will be theoretical, rather than computational, in nature. Unlike in Math 1410, matrices and determinants will play only a minor role. (We won't encounter determinants until the very end, if time permits.)

Course Objectives

The main objective of this course is to develop a basic level of comfort and proficiency with abstract algebra and generalization. The goal of abstract linear algebra is to be able to establish general truths that we can then apply to a variety of situations and applications (and be able to do so without necessarily relying on direct computation). The results in this course can be adapted equally well to other sciences, from biology to physics. Linear algebra tends to be viewed as a relatively "easy" subject, in that most theorems can be proved directly without any particularly deep insight. On the other hand, it should provide good preparation for those planning to take more challenging courses such as Math 3400 and 3500 in the future.

Required Textbook:

Linear Algebra Done Right, 2nd ed., by Sheldon Axler; Springer, New York, 1997.

I chose this book for two reasons: one, it's affordable. A hard copy should be less than $60, and you can get an electronic version for less. Two, the focus is on linear transformations and vector spaces, with determinants banished to the last chapter. (Let's be honest: unless you're a computer, determinants are really a pain to deal with.)

Evaluation

Your grade will be determined according to the following table (see below for explanations of each component):

Component	Quizzes	Assignments	Term Tests	Final
Weight	10	20	30	40

Quizzes:

I will give a short quiz each Friday (unless there's a test), intended as a progress check on that week's material. If you have trouble with a quiz problem, it's a good indication that you didn't understand something and should see me for help. If you cannot attend a quiz, please inform me in advance.

Assignments:

There will be a total of six problem sets. In general, assignment problems will be more challenging than test or quiz problems, since you'll have time to think about them. Your grade will be based on the best 5 out of 6 assignments. Late assignments are not accepted without prior permission.
Note: Difficult problems are assigned with the expectation that you will seek help when necessary. I am usually quite happy to give significant hints during office hours. Group work is also allowed, and generally a good idea. **However,** there is a difference between discussing a solution and copying a solution. If you are unsure what the difference is, you should see me before submitting your work.

Participation:

Class participation is encouraged, but not required. We will have a class discussion forum at piazza.com available through Moodle for online participation. Piazza is a Q & A forum that supports mathematical notation and allows you to post anonymously, in case you're worried about posting a bad question or wrong answer.

Tests:

There will two in-class term tests, written on **Friday, the 13$^{\text{th}}$ of February** and **Friday, the 20$^{\text{th}}$ of March**.

Letter grade conversions:

The percentage grades earned in this class will be converted to letter grades according to the following table:

Letter grade:	A^+	A	A^-	B^+	B	B^-	C^+	C	C^-	D^+	D	F
Minimum % required:	95	85	80	77	73	70	67	63	60	55	50	0

Course policies

Communication:

Communication between students and myself can take place in several ways:

- Announcements on Moodle. Any updates and reminders will be posted on Moodle. These announcements will be sent to your uleth.ca email address by default, so be sure to monitor that account. It is also highly recommended that you log into Moodle on a regular basis to keep up to date on the course.

- In person, during office hours. (Recommended, especially if you are having trouble with a concept.)
- Online discussion forum, via Piazza.com. (This can also be used to earn participation credit; see below for details.)
- Email. You are welcome to email me with questions about the course, and I will do my best to answer as soon as I can. I do, however, have a few email etiquette rules:
  - Include the course number in your subject heading, and your full name in the message text. Since I teach several classes at once, this will help to ensure a prompt reply. (For example, if your email consists only of "Yo prof, when's the test?" I won't be able to give you an answer since my courses have tests at different times.)
  - Questions about how to solve a particular homework problem should be directed to the discussion forum rather than email: the discussion forum can properly display math symbols, and it's usually the case that several students will have the same question.
  - Questions that can be answered by reading this syllabus (e.g. "When's the test?") will usually not be answered in a timely fashion, and the replies will generally be grumpy/sarcastic in nature.

Homework:

In addition to the assignments, I'll post a list of suggested practice problems every week. As with any math class, the best way to learn the material is by solving problems. Some of these practice problems may appear on a quiz.

Lecture:

On Mondays and Wednesdays I'll follow a fairly standard lecture format. Friday classes will be set aside for discussion and quizzes. The discussion will consist mainly of examples and exercises, to make up for the lack of tutorial in this course. I will use Moodle to keep you informed regarding the topics to be covered in class, and will expect you to read the corresponding sections in the textbook in advance.

Special arrangements:

If you are a student who has registered for accommodations with the Accommodated Learning Centre, please ensure that I am informed of the necessary arrangements as soon as possible, and please feel free to meet with me if there are any adjustments I can make to improve your learning experience.

Academic honesty:

Students are expected to be familiar with, and abide by, the rules laid out in the Academic Calendar regarding academic honesty, cheating, etc. and the penalties assessed for disregarding those rules.

Course schedule

Ideally we would make our way through the entire textbook, but the semester is about three weeks too short. My (optimistic) goal will be to cover the first eight chapters, and even then we will probably have to drop some material. Covering chapters 1-8 means that we won't get to Chapter 10, which covers change of basis and determinants. If the majority of the class feels that this material is too important to miss, we may have to skip most of Chapter 7. The schedule below is highly subject to change.

- Week 1, Jan. 7-9: Introduction, begin Ch. 1.
- Week 2, Jan. 12-16: Finish Ch. 1 – Vector spaces. Quiz 1 on Friday.
- Week 3, Jan. 19-23: Ch. 2 – Basis and dimension. Quiz 2 on Friday.
- Week 4, Jan. 26-30: Begin Ch. 3 – Linear transformations. Assignment 1 due Monday. Quiz 3 on Friday.
- Week 5, Feb. 2-6: Finish Ch. 3 – Matrix of an operator, change of basis. Quiz 4 on Friday.
- Week 6, Feb. 9-13: Begin Ch. 5 – Invariant subspaces. Assignment 2 due Monday. Term test 1 on Friday.
- Reading week, Feb. 16-20: Reading, or skiing, or something. You should read Ch. 4 and make sure you're familiar with the results. (You can skim over the proofs.)
- Week 7, Feb. 23-27: Finish Ch. 5 – Eigenvalues and eigenvectors. Quiz 5 on Friday.
- Week 8, Mar. 2-6: Begin Ch. 6 – Inner products. Assignment 3 due Monday. Quiz 6 on Friday.
- Week 9, Mar. 9-13: Finish Ch. 6 – Orthonormal bases, adjoints. Quiz 7 on Friday.
- Week 10, Mar. 16-20: Begin Ch. 7 – The spectral theorem. Assignment 4 due Monday. Term test 2 on Friday.
- Week 11, Mar. 23-27: Finish Ch. 7 – Normal and positive operators. Quiz 8 on Friday.
- Week 12, Mar. 30 and Apr. 1: – Begin Ch. 8 – Characteristic polynomials. Assignment 5 due Monday. No class on Friday.
- Week 13, Apr. 8-10: Ch. 8 continued – Decomposition of operators. Quiz 9 on Friday.
- Week 14, Apr. 13-17: Finish Ch. 8 – Jordan canonical form. Assignment 6 due Monday. Quiz 10 on Friday.