Math 3410A Course Syllabus

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1 Essential Information

Course Instructor
Dr. Sean Fitzpatrick
Contact: via email[1]
Office: University Hall C540

Student Hours
Monday 1:00–3:00 pm, Tuesday and Thursday 2:00–3:30 pm, Friday 10:00 am – 12:00 pm, and Wednesday by appointment[2].

Course Website
via Moodle[3]

Course Textbook
Linear Algebra, a Second Course featuring Proofs and Python, by Sean Fitzpatrick
The book is available in HTML and PDF formats on the U of L Open Textbook Server[4].
We will be using an interactive version of the HTML format, hosted on a Runestone server[5]. You will be able to log into the book via Moodle to access readings and homework assignments.

Class Meetings
Tuesday, Thursday, and Friday at 12:00 pm in SA7212.

Course Description
As per the Academic Calendar:

> Vector spaces over the real and complex numbers. Basis and dimension. Linear transformations. Change of basis. Gram-Schmidt orthogonalization. Eigenvectors and diagonalization. Canonical forms. Cayley-Hamilton Theorem.
>
> Prerequisites: Math 1410 and Math 2000.

See Section 4 for a more useful description.

[1] mailto:sean.fitzpatrick@uleth.ca
[2] calendly.com/dr-sean-fitzpatrick
[3] moodle.uleth.ca
[4] opentext.uleth.ca/courses.html
[5] runestone.uleth.ca

2 Welcome!

Welcome to the University of Lethbridge. Oki, and welcome to the University of Lethbridge. Our University's Blackfoot name is Iniskim, meaning Sacred Buffalo Stone. The University of Lethbridge acknowledges and deeply appreciates the Siksikaitsitapii peoples' connection to their traditional territory. We, as people living and benefiting from Blackfoot Confederacy traditional territory, honour the traditions of people who have cared for this land since time immemorial. We recognize the diverse population of Indigenous Peoples who attend the University of Lethbridge and the contributions these Indigenous Peoples have made in shaping and strengthening the University community in the past, present, and in the future.

Welcome to the course! Welcome to Math 3410, Linear Algebra. Although it doesn't take up as much space in our list of course offerings as Calculus, Linear Algebra is arguably the more useful subject, in this era of computer graphics and big data.

There are many of us in this class, coming from many different backgrounds and situations. I want my classroom to be as inclusive as possible. If the "default settings" for the class don't work for you, please don't hesitate to ask for accommodation.

As usual, everything you need to know for the course will flow through our Moodle[1] learning management system. Make sure you check in regularly to keep on top of what's happening in the course.

Don't hesitate to reach out if you have questions. I'll do my best to answer all of your course-related questions as quickly as possible. If you have questions that are not related to the course, you can ask those too, and I'll try to answer, or to direct you to someone who can. Some resources can be found on the University's Health and Safety website[2].

3 Navigating the course

For most students, getting the hang of writing proofs is the biggest challenge in the course. To learn to *write* proofs, we must first learn to *read* proofs. Reading a proof is not like reading a novel, or even a paragraph in a science textbook. Reading a proof requires active engagement. To quote Paul Halmos, "Don't just read it; fight it!"

Each time you read a proof, question every single line. Why do we start here? Where are we trying to get to? Why is this conclusion justified? Where did we use the hypothesis?

Most proofs in linear algebra follow a fairly straightforward script: hypothesis, definition, calculation, definition, conclusion. An important part of being able to follow this script is learning the definitions. But it is not enough to just know what a definition says! When you encounter a definition, try to construct your own examples that fit (or don't fit) the definition. Ask yourself how you would use this definition if it occured in a hypthoesis. What if you needed it in a conclusion? Pay careful attention to how the definitions are used in each proof that you read.

A lot of your course work is built into the textbook, via Runestone. Each week there will be two types of assignment: a reading assignment, and a homework assignment. The reading assignment, as the name suggests, will consist of an assigned reading, and often the completion of some of the interactive problems that are built into the book. These will be graded for completion and feedback, and not for correctness.

The homework assignments will come from the problems at the end of each section. They use a WeBWorK-based interface, but you can do them in the textbook itself, rather than needing to log into a separate online homework service.

Doing the readings on time will go a long way toward doing well in the course. We will be working on problems in class, including proofs, and you will get much more out of class if you show up prepared.

[1] `moodle.uleth.ca`
[2] `uleth.ca/services-for-students/health-safety`

4 Course Description

Math 3410 is the continuation of the study of linear algebra you began with Math 1410. Some topics will be familiar, like vectors, matrices, and systems of equations. But Math 3410 has a much greater focus on theory and proof.

At many universities, linear algebra is offered as a first course with rigorous proof. (Many places do not have an equivalent of Math 2000.) One reason for this is that most proofs in linear algebra are straightforward (relatively speaking). Many theorems in linear algebra follow the classic "if … then" format of a conditional statement. The corresponding proofs tend to follow a familiar script:

1. Assume the hypothesis.
2. Translate the hypothesis using the definition of some term in the hypothesis.
3. Rearrange some terms (i.e. do some algebra).
4. Recognize that you've met the definition of some term in the conclusion.
5. Translate to the conclusion using that definition.

We won't focus entirely on theory and proof, however. Linear Algebra has many interesting applications, and we'll try to fit in a few. We'll also include computational content. In particular, we'll spend some time learning how to use the computer to do some of our calculations for us.

There will be lab assignments will involve a bit of light coding in Python, in a Jupyter notebook environment. Jupyter notebooks will be hosted on the University of Lethbridge Syzygy[1] server. You'll need a computer, but will not need to install any software.

Most classes will involve some form of activity, with the type of activity varying depending on the day. On *Tuesday* we will usually have either a quiz or a lab assignment. On *Thursday* you will be working together to solve problems that I provide. We will work mostly on the whiteboards, and take time to compare each other's work. On *Friday* I will set aside some time to answer your questions, and we will work through one or two proofs together as a class.

5 Assessments and Grading

Your overall grade will be calculated from the following components, using the indicated weights.

Reading assignments (5%) There will be a weekly reading assignment due each Thursday at noon (before class). The reading assignments are entirely completion-based. You will need to read the assigned sections, and complete some of the exercises you encounter as you read.

Homework (20%) Homework will be assigned via Runestone[1], using links from Moodle. The homework problems will be chosen from the exercises at the end of each section. Homework assignments will be due each Tuesday.

Labs (20%) These will be done in class, in groups. Each lab assignment is computer-based, and will be done in a Jupyter notebook. Completed labs will be submitted on Crowdmark. Group submission is expected, but individual submissions will be accepted if a student misses class due to illness.
There are 5 lab assignments, one for each chapter. Labs will be done in class on Tuesdays, on the dates indicated in the Course schedule.

[1] `uleth.syzygy.ca`
[1] `runestone.uleth.ca`

Assignments (10%) There will be two assignments, consisting mostly of written work, although in some cases there may be some computational content as well. You are encouraged, but not required, to do these in groups.
Assignments will be graded on the validity of your proofs, as well as the quality of your presentation.
Assignments will come in three pairs: you will have three choices for Assignment 1, and this will also determine what you do for Assignment 2. Details about these assignments will be provided on Moodle.

Quizzes (25%) There will be 6 quizzes, to be written in class on Tuesdays, on the dates indicated in the Course schedule. (Any Tuesday that is not a lab day is a quiz day.)
Quiz questions will be reflective of (but not identical to) the problems worked on in class.

Final exam (20%) The final exam will take place during the exam period. It will be a cumulative exam, covering all content learned in the course.

Each of the grade components above will be assigned a numerical score. These will be added to get a score out of 100. Your score out of 100 is converted into a letter grade according to the following table.

Table 5.1 Conversion of percentage scores to letter grades in Math 3410

A+	97-100
A	92-95
A-	88-91
B+	84-87
B	80-83
B-	76-79
C+	72-75
C	68-71
C-	64-67
D+	60-63
D	50-59
F	0-49

A note on due dates Most due dates are flexible, and provided primarily for your benefit, to he with planning. (A course without deadlines can be a disaster for those w procrastinate.)
Runestone will allow late submissions of both reading assignments a homework. We will do our best to ensure your lab assignments are do during class time, provided, of course, that you come to class!

Other grading policies.

Revisions

For quizzes, labs, and assignments, you will be invited to submit revisions for any incorrect work. Revisions must be submitted within ***one week*** of receiving your feedback.
There will be resubmission forms available on Moodle. You may either:

1. Submit a revision for ***one*** problem, in which case your revised grade will replace the original score, or
2. Submit revisions for all problems, in which case each correct revision will earn you back 50% of the points originally lost.

You may not use revisions to submit work for a question you initially skipped. For a revision to be accepted, you must first attempt the problem. You are also not allowed to submit revisions to make up for a grade of zero assigned due to academic misconduct.

Dropping lowest grades

I will drop your lowest grade for reading assignments, homework, labs, and quizzes. Missing grades will be counted as zero, so (for example) if you miss a quiz, the grade for your missed quiz will be dropped.

6 Course policies (an FAQ)

This section deals with questions about accommodations, missed tests, and other exceptional (yet common) cases.

1. *This week is super busy and I don't think I can finish the homework on time. Can I have an extension?*

   Yes. There's a form for that, provided on Moodle. I don't need to know why you need the extension; just what you want extended, when you want it extended to, and whether you need anything from me to help complete the work.

2. *What happens if I get sick?*

   I'll do my best to be accommodating of any illness that interrupts your studies. There is no need to provide details of the illness. If you miss a week or more of work, please get in touch to make a plan for catching up. One of the biggest challenges in math is that once you fall behind, it's difficult to catch up on your own.

   If you're staying home to avoid spreading illness to others (thank you!), but well enough to attend class, I'll try to provide you with a video link via Teams or Zoom.

3. *What exactly does academic honesty mean?*

   In short, that any work you represent as your own, is your own. Much of your work can be done in groups, but not all of it. I will assume that you have access to a calculator, including online tools Symbolab, or Wolfram Alpha, or our Jupyter notebooks.

   Use of these tools is acceptable, but take care that you are not overly reliant on them. What is not acceptable is having someone else do your work for you. This includes tutors, classmates, friends, family members, and online "homework help" sites. If you submit work that somebody else did for you, you are committing an academic offence. ***This includes getting AI to write your assignments.***

   Penalties for academic dishonesty are outlined in the Academic Calendar[1]. Depending on the severity of the offence, penalties for a first offence can range from a grade of zero on an assessment, to an F in the courses. Academic offences are also reported to the Dean of Arts & Sciences. They keep a record of each offence, and students with multiple offences can be subject to supplementary discipline.

[1] `uleth.ca/policy/resources/student-discipline-policy-academic-offences-undergraduate-students`

4. *Does that mean I'm not allowed to get help with my homework?*

   Not at all! But keep in mind that your course instructors will be available for help, free of charge. (OK, maybe not free of charge, but you've already paid for it with your tuition.) We will be responding on the discussion forum regularly, There will be time to ask questions in every class, and there will be online office hours. The Student Success Centre will also be running free help sessions (details TBA).

   Some of you may still decide to pay for tutoring, and that's fine. But you have a duty to disclose sources of help on an assignment, and the individual tests are still tests, even if you won't have someone watching over your shoulder.

   You should probably avoid the various paid "homework help" websites. Most of these don't offer help. They offer worked solutions for a price. Getting those solutions won't help with your understanding. More importantly, the people working for these sites are paid (poorly) per solution, and they often provide incorrect and/or badly written work. (We saw plenty of examples of this last Spring, and yes, all those students now have discipline reports on file.)

5. *What do I do if I can't write a test during the scheduled time?*

   If you know in advance that you will not be able to write during the test window, let me know, and I'll arrange for an alternate time. If you miss a test due to illness, your test score will be replaced by your exam grade, or the average of your other three tests, whichever is higher.

6. *What if I miss the final exam?*

   If you are unable to write the final exam, you will need to contact Academic Advising. They are responsible for authorizing rescheduling of exams. Usually if you miss an exam due to illness, an incomplete grade is recorded. You will write a makeup exam at a later date, at which point your grade will be updated.

7. *Do I need a doctor's note?*

   No. This wastes health care resources and your time. Just email me to say you were sick, and spare me the details. However, if you miss more than one test due to illness, we'll need to meet to discuss how to adjust your grade.

8. *I receive learning accommodations. What arrangements can I make?*

   First, make sure that you have registered with the University's Accessible Learning Centre[2]. No need to let me know: they notify me of every student with accommodations.

   If there are any adjustments I can make to facilitate your learning, please do not hesitate to get in touch with me. All students deserve an equal opportunity to learn. Note that the HTML textbook is designed with accessibility in mind, and should work with screen readers.

9. *Life intervened and I can't keep up this week. What do I do?*

   Send me an email. Extensions are usually granted as long as they're granted ahead of time. Online homework extensions need to be in place before solutions become available. Book an appointment with me as soon as you feel like you're falling behind and I'll do my best to get you up to speed.

7 Course schedule

We will follow the schedule below as closely as possible. Expect homework (HW) due each Tuesday before class (except Jan. 7), a reading assignment (RA) due each Thursday before class, and quizzes and labs as indicated.

[2] `ulethbridge.ca/accessible-learning-centre`

The sections indicated each Thursday reflect both the reading assignment due that day, and the material that we will be working on in class.

Friday classes will always be a mix of Q&A and proof analysis based on that week's material, so we haven't included details for Friday in the schedule.

The content for each lab assignment and quiz will be provided on Moodle.

Table 7.1 Schedule for Winter 2025

Tuesday	Thursday	Friday
Jan. 7: Syllabus, overview.	Jan. 9: Sections 1.1, 1.2	
Jan. 14: HW 1, Quiz 1	Jan. 16: Sections 1.3, 1.4	
Jan. 21: HW 2, Lab 1	Jan. 23: Sections 1.6, 1.7	
Jan. 28: HW 3, Quiz 2	Jan. 30: Sections 2.1, 2.2	
Feb. 4: HW 4, Lab 2	Feb. 6: Section 2.3	
Feb. 11: HW 5, Quiz 3	Feb. 13: Sections 3.1, 3.2	
Feb. 25: HW 6, Lab 3	Feb. 27: Section 3.3	
Mar. 4: HW 7, Quiz 4	Mar. 6: Sections 4.1, 4.2	
Mar. 11: HW 8, Lab 4	Mar. 13: Section 4.5	
Mar. 18: HW 9, Quiz 5	Mar. 20: Sections 5.1, 5.2	
Mar. 25: HW 10, Quiz 6	Mar. 27: Sections 1.8, 5.4	
Apr. 1: HW 11, Lab 5	Apr. 3: Sections 5.6, 5.7	

The final exam will be scheduled by the Registrar after the extended add/drop deadline. Once the exam is scheduled, you will be able to find the time and place on the Bridge. Please do not plan any travel during the exam period until you know your schedule.