

Math 3410 Course Outline

Sean Fitzpatrick
University of Lethbridge

Spring 2021

Abstract

As you continue your study of linear algebra in this course (Math 3410), you likely have many questions, such as: “What is a vector, anyway?” and “Is this on the test?”

The transition to online teaching prompts even more questions. This outline is intended to serve as a roadmap, to guide you through the various components of the course.

1 Introduction to Math 3410

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. If the “default settings” for the class don’t work for you, please don’t hesitate to ask for accommodation. Not everyone has reliable high speed internet. Not everyone is able to attend scheduled classes without work/family/life getting in the way. But everyone deserves a fulfilling, enjoyable learning experience in each class.

We begin with some introductions: to the university, to the staff, and to the course.

1.1 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 Aboriginal peoples who attend the University of Lethbridge and the contributions these Aboriginal peoples have made in shaping and strengthening the University community in the past, present, and in the future.

Unless you took a pass on the last semester, this is not your first crack at learning online. Making connections as we learn remotely will be a challenge, but somehow we’ll do our best to make this happen. One of the ways we’ll try to encourage community is by having regular group work, where you’ll be able to interact with other students in the class. Another is by having an active discussion platform. This year we’re trying out a new system, called **Campuswire**.

As usual, everything you need to know for the course will flow through our [Moodle](#) learning management system. Make sure you check in regularly to keep on top of what's happening in the course. (Possibly the hardest part of learning online is keeping track of deadlines.)

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. (See [Section 3](#) for details on how to get in touch.) 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](#).

1.2 Course staff and contact information

Math 3410 is running for Spring 2021 with a single section of 40-50 students. My name is [Sean Fitzpatrick](#). I can be reached via email at sean.fitzpatrick@uleth.ca.

Office hours: I'll do my best to arrive a few minutes early for class. If you do too, that's a great time to get in some questions (or attempt to influence the content of that day's lesson). Check Moodle for the most up to date information on office hours. I will also use Moodle's **Scheduler** booking system to let you book individual appointments.

1.3 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.

1.4 And what about the whole online thing?

Ah, right! More details on that throughout the outline. But to get us started: what changes?

- More emphasis on:
 - Conceptual understanding

- Discussion
- Context (the whole “what is this good for?” routine)
- Being generally swell human beings
- Less emphasis on:
 - Memorization (because how am I gonna stop you from looking stuff up, anyway?)
 - Routine computational proficiency (let’s be honest: the computer can do this better than us most of the time)
 - Tests and exams (so I can spend more time teaching and less time as the Math Police)

The course is set up with synchronous meetings (via Zoom) that follow the original timetable. I do not have the same volume of asynchronous content for Math 3410 that I do for Calculus. As a result, this will be more of a synchronous courses than my calculus offerings, making it more important that you attend class.

It’s also understandable if you can’t. Bad internet. Bosses who don’t understand that online classes still have, well, classes. Maybe you have to share your computer with your little brother. Maybe travel restrictions mean that when class meets, it’s 2 am where you are.

I’ll do my best to also support asynchronous learning when needed. Lots can be done on your own time, even if you do make it to class. You have free access to an online textbook (two of them, in fact), and while I don’t have pre-recorded videos, I will record most of what I present in class.

In [Subsection 2.4](#) you’re going to see that there are lots of pieces to your grade. And yes, most of them have deadlines. But don’t worry! Most of those pieces are small: designed to be done in class, or to take up no more than an hour or so of your time. Learning any kind of math is a marathon, not a sprint. So I’m giving you a little bit to do every day. Keep at it, and you’ll do well. (Also, many deadlines are flexible, so don’t hesitate to ask if you need more time.)

2 Essential course information

This section covers essential course information, including the meeting times, textbook, and grading scheme.

2.1 Course website

The primary course website is [Moodle](#). On Moodle, you can expect to find:

1. Links to important resources, like this syllabus, and the textbook.
2. Links to key course activities, including the online homework, and the discussion forum. (The links will log you into those services automatically.)
3. Details about your grades and assessments.
4. A weekly topics schedule.

As you learn to navigate online learning (and as I learn how to guide you), the weekly topics schedules will be key to staying on top of your course material. Every week you can expect to receive details on readings, videos, homework, and assessments, as well as information on what will be taking place in class, and how to access those classes.

In case there's a day when Moodle isn't working properly and you need access to course materials, you can find some of them (like this syllabus) on my [personal website](#). The textbook for this course (and many others) is available on our [Open Textbook Server](#).

2.2 Scheduled classes

Math 3410 will be a primarily synchronous course. A lot of our Zoom meeting time will be devoted to group work on assignments. If there are several students who cannot attend the live sessions, we can try to form an asynchronous group, and facilitate using Campuswire.

On Monday, I will present content for the week. This will consist of highlights of the important theorems and concepts, and some examples. I won't be able to cover everything in one class, so I will be expecting everyone to keep up with the readings.

Tuesday classes will be used for work on theory and proof. I will prepare a problem set to be done during class, in groups.

Thursday will be a "lab" class. You will work in groups on computational problems, often with the use of a computer. We will mostly use the **Python** programming language, together with the **SymPy** library. You do not need prior knowledge of programming to use this software. The book is filled with examples containing all the code you will need, and the HTML version of the book lets you run that code in your web browser.

2.3 Course textbook

Our course textbook is *Lecture Notes for Math 3410* (by me), supplemented by *Linear Algebra with Applications*, by Keith Nicholson.

Both books are **open education resources** (OER). That means that the books are fully free, both in terms of cost, and your freedom to use and share the books however you see fit.

Use the Math 3410 notes as your guide to how we'll proceed through the course material. The Nicholson book provides additional details, along with plenty of exercises and examples.

If getting the book for free somehow feels wrong, or you worry you're missing out by not buying anything, here is a great book you can buy (especially if you're in Education):

[Mathematics for Human Flourishing](#), by Francis Su.

2.4 Grading scheme

Our assessment principles this year:

- No big high stakes assessments: lots of little ones instead.
- More concepts, and less rote computation. (Less — not none. Your follow-on courses will still assume you know how to take a derivative.)
- Classes (the synchronous part) will be used for work, not lecture. (Nobody wants to sit through a 75 minute Zoom lecture, including your instructor.)

- Group work is good for you. (Even if you don't always like it!)

The various graded components of the course are explained below. At first it will seem like there's a lot to do! But most items are small, and many can be done during class time.

Online Homework (10%) Whenever we're covering a topic for which appropriate problems are available, I'll provide a problem set you can complete, to help develop proficiency with the computational procedures in the course. Homework will be delivered through the **WeBWorK** online homework system. See [Subsection 4.1](#) for details.

“Lab” assignments (20%) On Thursdays, we'll have an assignment in class that is applied or computational in nature. You will work in groups, and will be encouraged to use the computer to assist you in solving the problems.

Proof Assignments (15%) Assignments will be done in groups, and there will be time set aside in each Wednesday class to work on them. Each assignment have only one or two problems.

Typically a written assignment is expected, but interested students are encouraged to explore alternative formats. For example, if a group wants to submit a video presentation instead of written work, that sounds like fun, and I will totally be on board with that.

Here is a fictitious (but possibly informative) grading rubric for assignments:

- A: wow, they clearly discussed this as a group, and nailed down all the key points! I also appreciate how the work is legible and relatively free of frustrated scribbling.
- B: everyone had something to say, but I'm not sure they all agreed. There's an obvious mistake that someone should have caught, suggesting that nobody thought to read it over before submitting.
- C: most of the details are there but this was clearly done in the last hour before the deadline. Also, it looks suspiciously like one person did all the work.
- D: looks like parts (a), (b), (c), and (d) were each done by a different person, and then arranged randomly on the page.
- F: nothing submitted. Or work is a crude drawing of what appears to be an integral attacking a kitten.

Peer review activities (15%) There will also be individual assignments that cover theory and proof. This will be facilitated through Moodle, using the **Workshop** activity. In a Moodle Workshop, you submit work like you would for a Moodle assignment. But once the submission phase closes, the workshop moves on to a peer feedback phase.

Typically, any reasonable effort at completing these activities will receive full credit. Any peer score over 75% will be automatically rounded up to 100%. I will review anything below 75% to see if the lower score is deserved.

Tests (30%) There will be five tests in total. Each test will be a take-home test, with a 48 hour completion window. There will be no time limit, but a reasonably well-prepared student should be able to complete each test

in about an hour. Tests will open on January 28, February 10,¹ March 4, March 18, and April 7.

You will write the test *individually*, and submit via **Crowdmark**. The test will be a take-home test: open book, and open notes. The primary restriction is that you are not allowed to hire someone else to write your test for you. (This includes using certain subscription-based websites that offer “homework help”.)

I will automatically drop your lowest test score. If you miss one test (for any reason), it will be dropped. You do not need to explain why you missed the test.

Exam wrappers (10%) After your test has been graded, you will be asked to submit a short reflection piece, where you comment on your performance and the feedback you receive.

Typically, you will be asked to comment on the following:

1. What did you do to prepare for the test?
2. What types of mistakes did you make on the test?
3. What (if anything) could you do differently next time?

Participation Participation is an optional grade, worth up to 10%. If you feel that your participation in the course was worthy of credit, you may submit a request for participation to be counted toward your grade at the end of the semester. Your request should detail the extent to which you participated in class, and you should also indicate where you would like your participation grade to be applied. You may use your participation grade to replace up to 5% of the weighting for any grade category, for a maximum of two grade categories. For example, you may ask to have participation replace 5% of tests, and 5% of group assignments.

The two best ways to accumulate participation credit are by asking (and answering) questions on our discussion forum, and by adding annotations to the textbook.

Regrading policy: for both individual tests and group assignments, once your work has been evaluated, you will have an opportunity to address the feedback you received. You can get back up to 50% of the points you lost by explaining what you did wrong, and how to correct it. Your explanation should reflect the fact that you have read and considered your feedback, and thought about steps you can take to avoid similar mistakes on the next test.

You may submit corrections in writing, or in person during office hours.

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 2.1 Conversion of percentage scores to letter grades in Math 3410

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
98-100	93-97	90-92	86-89	80-85	77-79	73-76	68-72	64-67	60-63	50-59	0-49

¹February 10 is a Wednesday. This test will run one day earlier than the others, to ensure that it does not extend into Reading Week.

3 Communication

The following communication channels are available in this course:

1. *Forums.*

There will be a primary course Q&A forum using [Campuswire](#). We are switching to Campuswire for the first time this semester, because the forum we used to use (Piazza) has switched to a paid/ad-supported model. Use of Campuswire is not mandatory (some of you may have privacy concerns) but it is strongly encouraged.

As far as I can tell, Campuswire provides a better product in any case. We still get a Q&A forum, and the forum still has useful features, like support for mathematical notation, and the ability for students to remain anonymous to their peers.

What's better is that the forum uses individual replies, rather than a single wiki-style reply, where one student ends up overwriting the reply of another. You can also upvote questions and answers that you like.

Another useful feature is the availability of chat rooms. Students have the ability to set up chat rooms, and you can make these private. (Yes, a private chat room can even exclude your instructor.)

Campuswire should be your primary communication channel. In particular, any questions about homework and course content should be asked there, since I can reply there with mathematical notation. You will also get a much faster reply on the forum than you will from email. If you have a question you don't want to ask publicly, you can send a direct message instead.

To access Campuswire, use the signup link and PIN code provided on Moodle. But note that to sign up this way, you will need to use your U of L email address. If you prefer not to provide your school email address to a third party company, you can ask me to send you an invite to a different email address.

2. *WeBWorK.*

There is one exception to the “put all homework questions on Campuswire” rule: in our WeBWorK online homework system, there is an “Email Instructor” button you can click to send feedback. This is useful if you think there's an error in the question, or if you've tried it several times and can't figure out why you're wrong. That email comes with a link I can use to jump directly to your version of the question, and see what answers you've tried. See [Subsection 4.1](#) for details.

3. *Email.*

You can email me for questions that aren't related to course content. For example, if you have to miss class, or a test, you can email me to let me know.

4 Technology elements

To facilitate online teaching, our course will rely on several technological solutions. This section provides details on navigating the technology.

4.1 Online homework

Online homework is delivered via WeBWorK. WeBWorK is an open source homework system that I maintain on a local server. This service is provided to you free of charge, and your data never leaves campus.¹

The value of WeBWorK is that questions are automatically graded, providing you with immediate feedback on your work. This is an excellent source of guided practice.

To access WeBWorK: simply click the relevant link in Moodle. You will be signed in automatically — there is no user name or password. But keep in mind that if your session times out due to inactivity, you have to return to Moodle to log in again.

Submitting answers: WeBWorK has an automatic preview feature. The mathematics in your answer will be rendered as you type. (You can turn this off in the user settings if you don't like it.) If everything looks good, click the Submit button. The system will immediately respond with “Correct” or “Incorrect”. If your answer is correct, there is nothing more to do: your answer has been recorded, and you have credit for that problem. If your answer is incorrect, you get to try again. (*Exception:* I typically do not give unlimited attempts for true/false and multiple choice questions.)

Other notes:

- Some questions are “scaffolded” — there are multiple parts, and you need to complete one part before being allowed to access the next. For these, you want to click the Preview Answers button, rather than Submit, to check your work and move on to the next step.
- If you need to include scientific units in an answer, the automatic equation rendering can cause trouble. There's a little tool bar on the right hand side that lets you switch to *text mode* to enter units.
- At the bottom of each page is an “Email Instructor” button. If you are stuck on a problem, or if you think there is an error in the programming (it happens!) you can use this to let me know. WeBWorK will send me an email with your message, along with a link to the exact version of the problem you were working on. Often I can figure out where you're going wrong by looking at your answer.

Please *do not* use the email button to ask me how to solve a problem. That's what the discussion forum is for. It should only be used after you've made several attempts at the problem, or if you see an error message of some sort.

Finally, some general advice: WeBWorK is not a new addition for the online environment. I've used it for awhile. The students who do well in this course are the ones who start their problem sets early. Please do not wait until the due date to begin: it leaves you no time to ask questions! The most effective way to use WeBWorK is to read the relevant portion of the textbook, try the problems, and then ask for help on the ones you're stuck on.

Oh, and please do not wait until you've made 50 unsuccessful attempts at a problem to ask for help. If you haven't figured out a question after 5 or 6 attempts, set it aside, and come back to it a bit later. If you still can't figure it out, go the discussion forum.

¹Okay, this is not entirely true. Since faculty are expected to teach from home, your data does travel from campus to my house via the university VPN.

4.2 Jupyter and Syzygy

The Python code that appears in the textbook can also be run in a Jupyter notebook. Jupyter notebooks are a great tool for completing a lab assignment with computation, since you can include both regular text (including images, links, mathematics, etc.) and code.

Unlike the Sage cells in the book, a Jupyter notebook lets you save your work, and you can also print it to PDF for submission.

The University of Lethbridge has access to an online Jupyter hub called **Syzygy**, which is available at <https://uleth.syzygy.ca/>. You can sign into Syzygy using your U of L credentials.

Note: for some reason, the first time you enter your credentials on the Syzygy site, the screen will just flash and leave you at the sign-in page. When this happens, click the Back button and try again.

4.3 Crowdmark

Tests and assignments will be submitted through Crowdmark. Like WeBWorK, Crowdmark is connected to Moodle, so you just have to click a link in Moodle to access your assessment and submit your work. Unlike WeBWorK, Crowdmark lets you do your work using pencil and paper. For ease of reference, I've placed [advice for using Crowdmark](#) on a separate page.

Basic advice:

- Start each question on a clean sheet of paper.
- Use a scanner, or a scanning app on your smartphone. PDF is best, but JPG and PNG files are also supported.
- When you submit, make sure your pages are in order, and rotated correctly.

4.4 Zoom and other video

Classes and tutorials will meet using Zoom. This is the officially supported meeting app for U of L classes, so you'll very quickly become familiar with (and tired of) Zoom.

We will *not* use Zoom for “content delivery”. This is the job of the textbook and the prerecorded videos. Those videos are embedded into the textbook, so you can watch them as you read. Alternatively, you can subscribe to [my channel on YouTube](#).

List 4.1 Zoom guidelines and etiquette

- Sign on using your U of L email and your proper name. I'm hoping to be able to put you into “breakout rooms” using pre-assigned groups. This will not work if your name doesn't match what's on the class list.
- Please **do** mute your microphone when everyone is together in the main room. You can unmute if you want to ask a question.
- Please **don't** mute your microphone while in a breakout room. (With reasonable exceptions: some of you might be in noisy environments, such as a construction site, or a house with kids.)
- About cameras. I will never require you to turn your camera on. Some of you may have very good reasons why you do not want

to turn your camera on, and some of you may not even have a camera to turn on. But if you are willing to turn your camera on, it does help me, since I can use the visual cues you provide to tell if you understand what we're discussing.

When you are working with your group, in a breakout room, please consider turning on your camera, even if you otherwise don't. It makes it much easier to work as a group if you can see each other.

List 4.2 Asking questions during class

1. Using the chat box in Zoom. This is probably most useful to quickly ask for clarification on something I just said.
2. Using your voice! There is a "raise hand" feature if you don't want to interrupt, but it's often perfectly reasonable to interrupt, especially if you notice me getting something wrong!

Group work in Zoom. During most Zoom sessions, you will be put into smaller breakout rooms to work on problems. Breakout rooms are not recorded, and I cannot actively monitor the breakout rooms — these are essentially private working sessions for your group. I *do* have the ability to join a breakout room temporarily, but will only do so when invited. If you need my help during a breakout session, there is an "Ask for help" button you can use to get my attention.

You will be encouraged to use Microsoft OneNote to collaborate with your group. OneNote lets you type notes, insert photos, and use handwriting, if you have a touch-enabled device. Unlike the Zoom chat and whiteboard features, your OneNote notebook will remain available after class for you to refer to. See [Subsection 4.5](#) for more details.

Recording. First of all: I do not intend to record entire Zoom meetings. I will record parts of class where I am presenting an example or exercise. However, I will not do this using Zoom's recording feature. Instead, I will record the same screen that I am sharing with you in Zoom using other software. This way, student images and voices will not be captured in the videos. Any videos I record will be uploaded to Moodle using the **YuJa** platform.

Please be aware that it is an *academic offence* to record a class, or anyone in it, without prior authorization. If all members of a breakout room agree to having someone record your discussion, this is fine. When are in the "main room" of Zoom, recording is not permitted.

4.5 Using OneNote

OneNote will be used both for class presentations, and for student collaboration. Details here will include how to access class notebooks, how to edit collaboratively, how to print, etc..

Students will have access to OneNote through their Office 365 accounts. There were early promises of Moodle integration that don't seem to have worked out. What we got instead are class "teams" on Microsoft Teams. There's one team per section, and each team has a class notebook attached to it.

5 Course policies (an FAQ)

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

1. *I don't think I can attend the classes regularly. Can I still take the course?*

Short answer: yes. I recognize that not all students have access to the same technology. If your home internet is unreliable, attending Zoom sessions could be a challenge. If you can't attend synchronous sessions, I will arrange alternatives for graded work done asynchronously. I will also try to connect you with other students in the same situation, so that you still have a group you can work with.

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.

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 (like [Symbolab](#)) that give you step-by-step solutions.

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 are paying money in exchange for answers to graded work, you are committing an academic offence.

Penalties for academic dishonesty are outlined in the [Academic Calendar](#). 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.

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. *I missed a test! What do I do? Do I get a zero?*

First, contact me as soon as possible for any missed test. There are *five* tests, and I only count *four* towards your grade. As long as you only miss one test, there is no penalty. This is true regardless of your reason for missing the test.

6. *What if I really wanted to write that test?*

Inform me of this when you contact me to explain your absence. There's no guarantee that I can schedule a makeup test, but I'll try. You're more likely to get a makeup test if you've contacted me in advance.

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

No. This wastes health care resources and your time. (That was my answer before the pandemic, and it's doubly so now.) Just email me to say you were sick. 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 [Accommodated Learning Centre](#). No need to let me know: they notify me of every student with accommodations.

Some accommodations will look a bit different this year, but exam accommodations such as extra time are still possible.

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. However, I regret that we have not had the time (or paid help) necessary to add elements such as alt-text descriptions for images. It's on the to-do list, but that list is long, and growing.

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.