

Math 1410 Course Outline

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Spring 2020

Summary

Math 1410 is an introductory course in linear algebra. Much of the course is computational (solving systems of equations, working with matrices, etc.) but there is some theoretical content as well. Compared to Math 1560 (Calculus I) there is less background knowledge required, but there is also a lot more terminology and notation to learn. The Academic Calendar imposes the following topics:

Linear systems. Vectors and matrices. Determinants. Orthogonality and applications. Vector geometry. Eigenvalues, eigenvectors, and applications. Complex numbers.

1 Welcome

Welcome to Math 1410 Elementary Linear Algebra. This is a first course in university mathematics, and as such, assumes no prerequisites beyond your high school mathematics. In fact, compared to calculus, linear algebra is less reliant on your mastery of high school math, beyond basic facility with algebra and arithmetic.

Where linear algebra becomes perhaps more challenging than calculus, is that there is a much larger vocabulary to learn, and more frequent use of abstraction and symbolic notation. Success in Math 1410 depends partly on computational proficiency, but also on your ability to understand and apply definitions and theorems.

Over the summer, the University of Lethbridge adopted an official recognition of our location on traditional Blackfoot territory. This acknowledgement also serves as a welcome message, and I am pleased to be able to include it here:

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 Siksikaitapii 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.

1.1 Course staff

My name is [Sean Fitzpatrick](#). You'll see me twice each week in class (right?), and I also handle most of the day-to-day organization. For any questions that you don't find answered in this outline,¹ you can email me at sean.fitzpatrick@uleth.ca, or drop by my office: C540 in University Hall.

Tutorials are handled by Sean Legge. He can be found in C518, and emailed at sean.legge@uleth.ca.

¹Except questions about homework – there's a forum for that.

1.2 Basic course information

Course website via [Moodle](#)

Course textbook *Math 1410 Elementary Linear Algebra*, edited by Sean Fitzpatrick (that's me!).

This is an OER textbook that I've assembled from existing open textbooks. Most of the content comes from the book *Matrix Algebra*, by Greg Hartman. The link above provides a PDF in colour, if you want to use the book electronically. If you want to *print* the book, you can order a copy from the Bookstore, using their print on demand service. If you'd rather print the book yourself, you'll probably want to use the [black and white version](#).

Both versions of the textbook (colour and black and white) will be posted on Moodle. If for some reason you temporarily lose access to Moodle, all open textbooks that I edit are always available on my website, at www.cs.uleth.ca/~fitzpat/oer.html.

Additional resources In case one book isn't enough (or you don't like my book). Another good free book is *Linear Algebra with Applications*, by Keith Nicholson.

The downside to all the books provided so far is that they're in PDF format. PDF is good for printing, but lousy on a phone. Unfortunately, I haven't yet found (or made) a book in HTML that covers everything in Math 1410. However, a very good book that comes close is *Understanding Linear Algebra*, by David Austin.

Class schedule Section A meets Tuesday and Thursday, 10:50 am – 12:05 pm in C610.

Section B meets Tuesday and Thursday, 3:05 pm – 4:20 pm in SA6012.

Tutorials run throughout the day on Wednesday. Check your timetable for the right time and place.

Office hours Monday and Wednesday, 10:00 – 11:15 am and 1:15 – 2:45 pm.

If none of those times work you can email me for an appointment. Note however that Tuesday and Thursday I'm in class most of the day, and Friday is often filled with meetings and prep work.

Grading Weighting of individual course components is given in [Table 2.1](#). Conversion to letter grades is given in [Table 2.2](#).

2 Frequently asked questions

2.1 Organizational questions

1. *How do I make sure I succeed in this course?*

Some of this will seem like fairly obvious advice, but...

- Do the homework as soon as you can. You'll be provided with weekly online homework sets. The online homework system automatically saves your progress. You can do one or two questions each night, rather than trying to get through them all the day of the deadline. Also, making at least one attempt early on lets you know which problems you don't understand, which lets you know what you should ask for help with during office hours and tutorial.
- Learn the art of reading a mathematics textbook effectively. It's trickier than you might think, and it's not unreasonable to ask for help on this.
- Follow along regularly on Moodle, so you know what will be covered in class, and prepare accordingly. It can be very useful to attempt a few problems *before* you've seen a demonstration in class.
- Learn the art of *productive failure*. It's fine/normal/expected that you won't get something on the first attempt, or maybe even the second or third. But as long as learn a little from each failed attempt, you're making progress.

- Never, ever, say “I don’t know where to begin!” on a problem. Make note of the terms used in the statement of the problem. Look up the definitions. Find similar examples. Get yourself stuck. Ask for help once you’ve figured out what it is that you don’t yet understand.

2. *What does a typical lecture look like?*

I will try to provide a mixture of examples and hands-on activities in each class. There will be some time spent on conceptual explanations, but don’t expect too much word-for-word transcription of the textbook onto the board. I’ll assume that you’re just as capable of reading definitions and theorems from the textbook as you are from a whiteboard.

3. *How do I find you if I need help with something?*

My office is C540, in University Hall.

4. *Do I need to make an appointment for office hours? What if I have class at that time?*

You don’t need an appointment -- just drop in. **Office hours** are the times that I promise to be available for consultation. If the times I choose don’t work, you can email me for an appointment.

5. *What if my question is not related to the course?*

Come see me anyway, or send an email. If I can’t help you myself, I’ll try to direct you to someone who can. There’s also some [great general advice for first year students](#) on the U of L website. You might be able to find an answer there.

6. *OK, but what if it’s kind of personal?*

If it affects your ability to participate in the course (or even if it doesn’t), you can come talk to me. In many cases, you might be best off seeing Academic Advising or Counselling Services. Links to these services, and general advice, can be found on the [U of L website](#).

You may also want to visit the University’s [Health and Safety website](#) for information on other resources on campus.

2.2 Coursework and evaluation

1. *What are your expectations of students?*

- I expect you to make your best effort to arrive prepared for each class. I’m also aware that this is not always possible.
- I expect quality writing: complete sentences, proper use of notation, and clear exposition. I don’t expect this right away, but I do expect you to work at improving.
- I expect you to treat your classmates with respect, and to contribute to group activities to the best of your ability.
- I expect you to ask for help when you need it. (Everyone does at some point.)

2. *Thanks, but what I really meant is, how do I earn my grade?*

Oh, right. The most frequently asked question of all. There are several different evaluation components that contribute to your grade:

Table 2.1 Relative weights of graded activities for Math 1410

Component	Number	Total Weight
Online homework	11	12
Assignments	4	12
Tutorials	12	16
Term tests	3	30
Final exam	1	30

3. *What is involved with each of the graded components?*

Here are brief descriptions of each one:

- *Online homework.*

Online homework is delivered via our **WeBWorK** online homework system. Access to WeBWorK is via Moodle. You can expect weekly homework assignments. Problems will be mostly routine practice, intended to prepare you for the tests. But there will also be the occasional challenging problem. It's all right if you miss one or two of these — the individual weight of any problem is quite small. The best way to ensure you can solve even the hardest problems is to start soon enough that you have time to ask for help.

If you have limited access to internet at home, I can usually generate a hard copy of the assignment for you. Get in touch if this is a concern for you.

- *Assignments.*

There will be four take-home written assignments. These will be project-like and can be done in groups. Assignments will explore aspects of the course that are more challenging, or otherwise impractical for a term test, either because of time constraints, or resource limitations. (For example, an assignment might have a problem best solved with the aid of a computer.)

- *Tutorials.*

There is a weekly tutorial. Tutorials meet on Wednesdays, at various times, depending on your section. Each week you will have an worksheet to complete during your tutorial. The worksheet will typically consist of routine problems similar to what you might encounter on a test. Each worksheet will be graded on a two point scale. Two points are awarded if everything is correct (except for possibly minor arithmetic errors). You will only get one point if you make mistakes, but you'll have a chance to make revisions the following week, and recover the lost point. If you do not attend tutorial, or hand in a mostly blank worksheet, you get zero points. You're encouraged to work in groups, and consult with Sean Legge if you're stuck.

- *Tests.*

There will be three term tests, on the following dates:

Test 1 January 30th, on Chapter 3.

Test 2 February 27th, on Chapters 4 and 5.

Test 3 March 26th, on Chapters 6 and 7.

Each test will be a **two-stage** test. You will have 45 minutes to write an individual test. Once time has expired on the individual test, you'll have 5-10 minutes to get organized into groups of 3 or 4. Each group will be given a new test (which will be based on some portion of the individual test) to complete in the remaining 20 minutes. Your overall test grade will be 80% individual plus 20% group, or 100% individual, whichever is higher.

- *Final Exam.*

A traditional, cumulative, three-hour exam. Note that final exams are no longer scheduled according to the timetable, so the date of the final exam will not be known until sometime in February. You should plan to remain on campus for the entire exam period. The Registrar's Office *will not* allow you to reschedule due to travel conflicts.

4. *How are letter grades calculated?*

Each of the grade components above will be assigned a numerical score. These will be added to get a score out of 100 using [Table 2.1](#). Your score out of 100 is converted into a letter grade according to the following table.

Table 2.2 Conversion of percentage scores to letter grades in Math 1410

A+	A	A-	B+	B	B-	C+	C	C-	D+	D	F
95-100	90-94	86-89	82-85	77-81	73-76	69-72	64-68	60-63	56-59	50-55	0-49

2.3 Course policies

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

1. *One of the tests conflicts with something else in my schedule. What are my options?*

If you know in advance that you will not be able to attend a test due to an “approved absence”, like varsity athletics, a conference, tea with the Queen, etc., send me an email. We will try to arrange an alternate sitting of the test. (Individual stage only.)

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

Contact me ASAP to make alternate arrangements. Make-up tests are possible, but only if you contact me in time. (Advance notice is preferred when possible.) If no arrangements can be made, we will meet to discuss adjustments to your grading scheme.

3. *Do I need a doctor’s note?*

No. This wastes health care resources and your time. 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.

4. *What if my car breaks down?*

Same thing, for this, or other circumstances beyond your control. Send me an email, and we’ll sort something out. But if there’s a snowstorm forecast for the night before, maybe don’t plan a trip to Calgary.

5. *I’m on one of the Pronghorns teams.*

Good for you!

Oh, you probably have some scheduling issues. Your coach should be providing you with a letter. Plan to meet with me during office hours one day and we’ll sort something out.

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

First, make sure that you have registered with the University’s [Accommodated Learning Centre](#). If you have exam accommodations, you’ll need to schedule your exams with them. No need to let me know: they’ll contact me to request a copy of your exam.

If you require any in-class accommodations, or 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.

7. *Do we get to have calculators for the tests?*

Yes. Basic and scientific calculators are fine. Graphing calculators and computers are not.

8. *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 requested ahead of time. Online homework extensions need to be in place before solutions become available. See me if you’re having trouble, or take a look at the other resources mentioned in [Question 6](#) of the [Organizational questions](#).

9. *I missed class. What do I do?*

If it’s a one-time thing, don’t worry about it. Drop by during office hours if you need to catch up. If circumstances are conspiring to keep you from class on a regular basis, please meet with me to come up with a plan to get you through the course.

10. *Is there anything else I need to know?*

Students are expected to abide by the policies and regulations as laid out in the [Academic Calendar](#). This includes the University’s policies on plagiarism and academic misconduct. Obviously this means you can’t cheat on the tests, but it also means you need to figure out the distinction between getting help on homework, and getting someone else to do your work for you.

11. *I have a question that isn't answered here. How do I contact you?*

Short answer: you can [send me an email](#). There are a few caveats, however:

- First, check the course page (and the announcements forum) on Moodle. Any information I need to communicate to the class will be posted on Moodle, or emailed to the class as an announcement via Moodle.
- Is the question about homework? Email is not a good medium for discussing math. Your best option is to ask me in person. If that doesn't work, we have a class discussion forum, on [Piazza.com](#). You'll be able to access the forum via Moodle.

12. *I sent you an email. Why haven't you answered it yet?*

Here's a short troubleshooting guide:

- Your email was not sent from a ULeth account and had no subject line: It went to my spam folder.
- Your email sent between 10 pm and 6 am: I'm asleep. I'll answer when I get to work in the morning.
- Your email sent during office hours: I'm busy helping the students who are here in person. Consider dropping by yourself.
- Your email asked for help on a specific homework problem: Direct your question to the online forum.
- Your email was about something already addressed in this FAQ, and I need time to come up with a polite reply.

3 Course topics

The following table provides a list of the topics we'll attempt to cover in Math 1410, along with the dates I think we'll get to them, where they can be found in the textbook, and suggested¹ homework exercises.

¹In other words, problems that will increase your understanding of the material, and performance on the tests. You don't have to do them all.

Table 3.1 Math 1410 topics schedule for Spring 2020

January 7	Introduction and review	Chapter 1
Homework:	1.2 1–19 (odd); 1.3 1–17 (odd)	
January 9	Introduction to vectors	3.1, 3.2
Homework:	3.2 6–11, 16–24	
January 14	Dot and cross products	3.3, 3.4
Homework:	3.3 5–23 (odd), 27–32; 3.4 7–14, 21–29	
January 16	Lines in three dimensions	3.5
Homework:	3.5 5–28	
January 21	Planes in three dimensions	3.6
Homework:	3.6 3–30	
January 23	Systems of linear equations	4.1, 4.2
Homework:	4.1 1–13 (odd); 4.2 1–24	
January 28	Gaussian elimination	4.3, 4.4
Homework:	4.3 1–22; 4.4 1–18	
January 30	Test #1	Chapter 3
February 4	Vector solutions	4.5, 4.5
Homework:	4.6 1–28	
February 6	Matrix algebra	5.1, 5.2
Homework:	5.1 1–21; 5.2 1–43	
February 11	Matrix inverses	5.3, 5.4
Homework:	5.3 1–11; 5.4 9–35	
February 13	Properties of the inverse	5.5, 5.6
Homework:	5.5 1–9; 5.6 1–15	
February 25	Matrix transformations	6.1
Homework:	6.1 1–18	
February 27	Test 2	Chapters 4 and 5
March 3	Linear transformations	6.2
Homework:	6.2 1–11	
March 5	Null space and column space	6.4
Homework:	6.4 1–8	
March 10	Transpose and trace	7.1, 7.2
Homework:	7.1 1–23 (odd); 7.2 1–19 (odd)	
March 12	Determinants	7.3, 7.4
Homework:	7.3 1–23 (odd); 7.4 1–29 (odd)	
March 17	Applications of determinants	7.5
Homework:	7.5 1–17	
March 19	Eigenvalues and eigenvectors	8.1
Homework:	1.2 1–28	
March 24	Eigenvalues and eigenvectors	2.1, 8.2
Homework:	2.1 1–35 (odd); 8.1 1–6	
March 26	Test 3	Chapters 6 and 7
March 31	Diagonalization	8.3
Homework:	8.3 1–8	
April 2	Review	