University of Victoria
Faculty of Science | Department of Mathematics and Statistics
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Course Outline
MATH 110: Matrix Algebra for Engineers
Fall 2021

Territory Acknowledgement

We acknowledge and respect the lək̓ʷəŋən peoples on whose traditional territory the university stands and the Songhees, Esquimalt and W̱SÁNEĆ peoples whose historical relationships with the land continue to this day.

The First Peoples House is a social, cultural and academic centre for Indigneous students at UVic and serves as a safe and welcoming place that encourages the building of community. More information can be found at: `https://www.uvic.ca/services/indigenous/house/index.php`.

Course information

Instructors

Section	A01	A02	A03
CRN	12116	12117	12118
Times	TWF 8:30-9:20am	TWF 10:30-11:20am	TWF 12:30-1:20pm
Location	ELL 168	ECS 125	DSB C103
Instructor	Joseph Horan	Christopher Eagle	Christopher Eagle
Email	jahoran@uvic.ca	math110eagle@uvic.ca	math110eagle@uvic.ca
Office	DTB A451	DTB A441	DTB A441

Calendar Information

Number of Units: 1.5

Pre-requisites: Admission to BEng or BSENG program.

Course Materials

Textbook: C. Eagle, *Lecture Notes for Math 110.*
Available free at `https://www.math.uvic.ca/~eaglec/Math110/`.

Course webpage: The course webpage will be on Brightspace.

Calculator: You are permitted to use a Sharp brand calculators with a model number starting with "EL-510R". The latest such model may be purchased at the UVic Bookstore. No other brands or models of calculator are permitted in tests and exams of this course.

MATLAB: We will make use of the MATLAB computer algebra system, which is available at no extra cost to students. Detailed information about obtaining MATLAB will be provided on Brightspace.

Resources

Office Hours

The regularly scheduled office hours in this course will be held online via Zoom. Links to the Zoom meetings will be provided on Brightspace.

Day	J. Horan	C. Eagle
Monday		3:30-5:00pm
Tuesday	4:30-5:30pm	
Wednesday		
Thursday	10:30-11:30am	3:30-4:30pm
Friday		

Student groups

SUMS: Students in Undergraduate Mathematics and Statistics (SUMS) is an active group with many events during the term. Please see `http://www.uvic.ca/science/math-statistics/current-students/undergraduate/sums/index.php` for more information.

AWM: The UVic student chapter of the Association for Women in Mathematics aims to foster a community amongst all UVic students in which women interested in math and stats can grow in confidence and envision their success. Please see `https://onlineacademiccommunity.uvic.ca/awm/` for more information.

Student supports

It is important to take care of yourself, both for your own well-being and for your academic performance. If issues arise that affect your performance in this course, please feel free to contact your instructor. Additionally, the University provides a number of supports to help you in managing your physical and mental health.

Student Wellness Centre: The Student Wellness Centre (SWC) is made up of Counselling, Health and Multifaith. The SWC aims to provide holistic care to support UVic students' wellbeing emotionally, physically and spiritually. The SWC team includes counsellors, doctors, nurses, administrative staff, chaplains and other practitioners. `https://www.uvic.ca/current-students/home/wellness-centre/`

UVic Counselling Services: The UVic Counselling Services provides cost-free and confidential mental health services to help you manage personal challenges that impact your emotional or academic well-being.

Centre for Accessible Learning: Students with diverse learning styles and needs are welcome in this course. In particular, if you have a disability/health consideration that may require accommodations, please make contact with the Centre for Accessible Learning (CAL) as soon as possible. The CAL staff are available by appointment to assess specific needs, provide referrals and arrange appropriate accommodations `http://uvic.ca/cal`. The sooner you let us know your needs the quicker we can assist you in achieving your learning goals in this course.

Learning Objectives and Course Topics

Linear algebra is the branch of mathematics concerned with studying "flat" objects, such as lines, planes, and their higher-dimensional analogues. The modern approach to the subject has its roots in the study of determinants (which we will see midway through this course), in the late 17th century, but was primarily developed in the 19th century. Linear algebra forms part of the basic language of many other parts of mathematics, and as such it is ubiquitous in mathematics and the sciences, with applications in general relativity, quantum mechanics, population modelling, economics, and computer search engines, to name just a few. By the end of the term you will have learned the language and techniques of linear algebra, and will be prepared to apply it in your future courses.

You may find that this course has a different flavour than other math courses you have taken, and the material may seem more abstract. Gaining proficiency with these new ideas will help you develop your problem-solving skills and your ability to work with new abstract concepts. In this course the computations you are required to perform are often less complicated than understanding which computations need to be performed and why.

In fact, computers are extremely good at carrying out most of the calculations we will see in this course, so computer software is used in many practical applications. To give you an opportunity to see how such software is used, this course includes the use of the MATLAB system in homework assignments. There will also be a project near the end of the course that asks you to use your knowledge from the course, and the MATLAB system, to solve some problems that could arise in real-world applications.

The specific topics to be covered in this course are described in the table at the end of this outline.

Course structure

This course is being held in-person. Our usual routine will involve the following components:

Pre-class readings: During class your instructor will inform you of which topics are coming up next. We strongly recommend that you read the corresponding section in the course notes (`https://www.math.uvic.ca/~eaglec/Math110/`). You might find that there are topics you don't fully understand when you do this pre-reading. That's perfectly normal! The purpose of the pre-reading is to get you some familiarity with the ideas to be discussed in class, to help make the lectures a more productive experience.

Lecture: Lectures will be held on Tuesdays, Wednesdays, and Fridays, with the time and locations depending on your section (see the table on the first page of this outline). During class time we will discuss the material from the pre-reading. Sometimes we will cover the material in a different way than the course notes. Class time may also include in-class activities of various kinds. The first lecture will be Wednesday, September 8, 2021.

Practice problems: The best way to learn mathematics is to practice. The course notes include practice problems in each section, most of which have hints, answers, and full solutions.

Tutorials: Tutorials will be held on Wednesdays, with the time and location depending on your tutorial section. Tutorials are smaller group meetings where you can discuss the course material with the TA leading the tutorial. Sometimes the TA will have specific problems they want to work through with you, but you should always come prepared with questions. On weeks where we have a term test those tests will be held during tutorial.

Homework: Written homework will be due on Fridays of most weeks (see the schedule at the end of this outline). Homework will be submitted using Crowdmark, and more details about that system will be provided on Brightspace early in the term. You are permitted (and even encouraged!) to discuss ideas with other students in the class, with the course instructors, and with the TAs, but the final work you submit must be in your own words and reflective of your understanding.

Evaluation and Grading

Your final percentage grade will be computed according to the following scheme.

Item	Date(s)	Weight
Homework Assignments	Most weeks, due on Fridays	30%
Term test 1	Wednesday, October 6, in tutorial	15%
Term test 2	Wednesday, November 3, in tutorial	15%
Final project	Due Friday, December 3	10%
Final exam	TBA	30%

Multi-section Course Policy: This course is a multi-section course. In order to ensure fairness to students, all sections of the course will be using the same method of evaluation described above. In addition, consistent testing standards across sections will be maintained. All sections will write the same final examination and all sections will have the same assignments.

Grading: Percentage scores will be converted to letter grades according to the university-wide standard grading table.

Homework: Homework assignments will be distributed most Fridays and due by 6:00pm the following Friday. Submissions will be through Crowdmark, with details provided early in the term. There will be 11 homework assignments collected, and we will not count your lowest homework grade.

Tests: Tests will be held during the regularly scheduled tutorial. More details will be provided closer to the time of the tests.

Final Examination: Off-schedule final examinations (i.e., deferred examinations) are given only in accordance with the university policy as outlined in the Calendar. If you are unable to write a final examination due to illness, accident or family affliction, please refer to the University Calendar page on Academic Concessions.

Students are **strongly advised not to make plans for travel or employment during the final examination period** as special arrangements will not be made for examinations that conflict with such plans.

A minimum grade of 40% on the final examination is required in order to receive a passing grade in this course.

Supplemental Examinations: The Department of Mathematics and Statistics does not award 'E' grades or offer Supplemental Examinations in any of its courses.

Policies and Ethics

Academic Integrity

Students are required to abide by all academic regulations set as set out in the University calendar, including standards of academic integrity. Violations of academic integrity (e.g. cheating and plagiarism) are considered serious and may result in significant penalties.

Academic integrity is intellectual honesty and responsibility for academic work that you submit individual or group work. It involves commitment to the values of honesty, trust, and responsibility. It is expected that students will respect these ethical values in all activities related to learning, teaching, research, and service. Therefore, plagiarism and other acts against academic integrity are serious academic offenses.

The responsibility of the institution: Instructors and academic units have the responsibility to ensure that standards of academic honesty are met. By doing so, the institution recognizes students for their hard work and assures them that other students do not have an unfair advantage through cheating on essays, exams, and projects.

The responsibility of the student: Plagiarism sometimes occurs due to a misunderstanding regarding the rules of academic integrity, but it is the responsibility of the student to know them. If you are unsure about the standards for citations or for referencing your sources, ask your instructor. Depending on the severity of the case, penalties include a warning, a failing grade, a record on the students transcript, or a suspension.

It is your responsibility to understand the University's Policy on Academic Integrity.

Missing work

Students who miss assessed work for a valid reason should contact their instructor as soon as possible, and no later than one week after the missed work is due. The policies for missed work are as follows:

Missing homework: The overall homework grade will be based on the remaining homework.

Missing term test: If a student misses one term test then a grade for the term test will be estimated based on the student's rank on the final exam. A student who misses both tests for acceptable reasons will need to meet with the course coordinator to discuss the calculation of their final grade.

Missing project: No extensions will be given for the MATLAB project, and we strongly recommend starting early. If you are unable to complete the project due to a prolonged illness or other valid reason then you must contact your instructor before the due date. In this case the final exam score will be used to estimate an appropriate project score. Note that technical difficulties with installing or using the MATLAB system will not be accepted as a valid excuse for not submitting the project on time.

Missing final exam: The final exam is an essential course component. A student who does not write the final exam is eligible to apply for formal academic concession (`https://www.uvic.ca/registrar/assets/docs/record-forms/rac.pdf`), and will otherwise receive a grade of 'N' in the course.

Deferred status is applicable only to the final exam, and is only available to students who have attempted course work totalling at least 40% of the course grade.

Re-mark requests

If you believe that your work has been incorrectly marked, you must write a short explanation (just a few sentences is enough) and provide your instructor with both your explanation and the work you wish to have regraded. All regrade requests must be submitted no later than one week after the work is returned to the class. Late re-mark requests, or requests submitted without explanation, will not be considered except in the case of absence due to serious illness or religious observance.

Attendance

The university Calendar states 'Students are expected to attend all classes in which they are enrolled.' See the Policy on Attendance. Our courses are conducted on that basis. If you miss an announcement (information concerning midterms, corrections to assignment, etc.) because you did not attend class, you must accept the consequences of not having learned of the change.

If you are ill, please do not attend lecture or tutorial. In that situation, please consult the Brightspace page to see what material was covered during that class. We also recommend that in this case you obtain class notes from another student. We will attempt to make recordings of lectures available, but the extent to which this is possible will depend on technological limitations.

Guidelines on Religious Observances

Where classes or examinations are scheduled on the holy days of a religion, students may notify their instructors, at least two weeks in advance, of their intention to observe the holy day(s) by absenting themselves from classes or examinations. Instructors will provide reasonable opportunities for such students to make up work or missed examinations.

Copyright statement

How to Succeed in This Course

Practice regularly Linear algebra is very different from most of the mathematics you learned in highschool, and it comes with a new vocabulary and a large number of new ideas. The best way to master linear algebra is to practice regularly. The course notes include practice problems for each section, most of which come with hints and solutions. While we will not be collecting these problems, they are an excellent way to make sure you are fully understanding the course material. We strongly recommend that you work on these problems as the course progresses - cramming before the tests is very unlikely to be successful in this course.

Visit Brightspace The course Brightspace page will be kept updated with a variety of materials to help you succeed in this course. It is also where we will post important announcements. Visit regularly to keep up-to-date!

Check your progress Read the feedback your TA gives you on your homework assignments – that is a good indication of how your test solutions will be marked. Make a habit of providing a justification for each step of your work - we are much more interested in *how* you found your answer than the final answer itself. Keep an eye on the Brightspace grade book to see your current expected grade in the course.

Contact the instructors Your instructors are available to provide you with assistance, either in their office hours or by email. It is difficult to communicate the material of this course by email, so we strongly prefer that questions about course content be asked during office hours. Due to the number of students enrolled in each lecture, if you ask a question by email whose answer already appears in the Course Outline or in a post on Brightspace we will probably just send you a link. Our reply time will depend on many factors. Please be aware that we might keep very different hours than you do! If you will see your instructor in the next 48 hours, you might get a faster reply by asking your question in person.

Start preparing early If you are able to maintain a constant moderate level of work then you will not have intense weeks where it is hard to keep up with your workload. Begin reviewing for the tests a week or two ahead of time, by re-working homework worksheets and textbook problems.

Avoid falling behind The material in this course builds on itself, so it is very hard to understand later material if you have missed something from the earlier material. The next two pages have a description of which topics we intend to cover each week. Please note that the schedule is very much approximate. We may, at times, cover material at a different speed than is indicated in this table. The best way to know where we are in the course content is to attend class regularly.

Week of	**Lecture**	**Homework (Fridays)**	**Important Dates**
Sept. 6	Systems of linear equations Gauss-Jordan elimination	**Due**: Nothing **Handed out**: Worksheet 1	First day of classes Wednesday, Sept. 8 No tutorials this week
Sept. 13	Gauss-Jordan elimination Vectors and basic operations Geometry: The dot product	**Due**: Worksheet 1 **Handed out**: Worksheet 2	Tutorials begin this week
Sept. 20	Geometry: The dot product Lines and planes in $\mathbb{R}^2$ and $\mathbb{R}^3$	**Due**: Worksheet 2 **Handed out**: Worksheet 3	Last day for 100% tuition refund Sept. 21
Sept. 27	Span Linear independence Systems of linear equations revisited	**Due**: Worksheet 3 **Handed out**: Worksheet 4	National Day for Truth and Reconcilliation Thursday, Sept. 30 No classes or tutorials
Oct. 4	Subspaces of $\mathbb{R}^n$	**Due**: Worksheet 4 **Handed out**: Worksheet 5	**Test 1**: Oct. 6
Oct. 11	Linear transformations Operations on matrices	**Due**: Worksheet 5 **Handed out**: Worksheet 6	Last day for 50% tuition refund Oct. 12
Oct. 18	Operations on matrices Matrix multiplication	**Due**: Worksheet 6 **Handed out**: Worksheet 7	

Continued on next page.

Week of	**Lecture**	**Tutorial**	**Important Dates**
Oct. 25	Matrix inverses Determinants	**Due**: Worksheet 7 **Handed out**: Worksheet 8	Last day for withdrawing without penalty of failure Oct. 31
Nov. 1	Determinants Subspaces associated to matrices	**Due**: Worksheet 8 **Handed out**: Worksheet 9	**Test 2**: Nov. 3
Nov. 8	Subspaces associated to matrices	**Due**: Nothing **Handed out**: Nothing	Reading break No classes or tutorials Wed. to Fri.
Nov. 15	Eigenvalues and eigenvectors Diagonalization	**Due**: Worksheet 9 **Handed out**: Worksheet 10	
Nov. 22	Orthogonality Orthogonal projections	**Due**: Worksheet 10 **Handed out**: Worksheet 11	
Nov. 29	Orthogonal matrices The Spectral Theorem	**Due**: Worksheet 11 **Handed out**: Nothing	Last day of classes Monday, Dec. 6