



Course Outline (Fall 2025)

MATH*1160 - Linear Algebra I

Prerequisite: 4U Calculus and Vectors or 4U Advanced Functions

Restrictions: ENGG*1500, MATH*2150, MATH*2160

Credit Weight: 0.50

Academic Department: Mathematics & Statistics

Campus: main

Semester Offering: Fall

Teaching Assistants: Announced via email

Course Notes:

- **Workbook for this course:** **Students must buy the 'fillable' lecture notes for this course at the University Bookstore (cost about \$26).** (No textbook required).
- **Math Preparedness Booklet:** you should work through this booklet during the first week of class. It is found under the Contents section in Courselink.
- **In-class Discoveries:** these are investigations that we do together in class, and can be found under the Contents section in Courselink.

What you will need during in-class lectures:

- The fillable lecture notes (aka Workbook) that you bought at the University Bookstore.
- Discoveries (see Contents section of Courselink)
- Blank paper, pens/pencils.
- Scientific calculator.

Class schedule:

See the end of this outline.

Content Description:

This course provides an introduction to linear algebra in Euclidean space. Topics covered include: N-dimensional vectors, dot product, matrices and matrix operations, systems of linear equations and Gaussian elimination, linear independence, subspaces, basis and

dimension, matrix inverse, matrix rank and determinant, eigenvalues, eigenvectors and diagonalization, orthogonalization and projections, linear transformations. Some fundamental proofs and applications of these topics will be included.

Learning Outcomes:

- Have a basic understanding of the algebra of matrices
- Understand how linear algebra is needed to work with systems of linear equations
- Be familiar with some applications of linear algebra
- Have a basic understanding of some theoretical linear algebra concepts, including proof.
- Have gained some experience in using computer software (MATLAB) to manipulate matrices

Homework:

- Both the homework problems and solutions are found in the Contents section of Courselink and will (along with class examples) be the basis for the tests and final exam questions. *For most examination question type there will be a similar question in the homework questions!* For this reason it is very important that you do the homework and follow up at the Math & Stats Learning Centre if you have problems.

Tests and final exam:

Exams are based mainly on examples done in class and homework. The tests and final exam are multiple-choice (MC) and the 3 tests are **in-class, during your regularly scheduled class**. The following table gives dates, test lengths and percentage weights:

Assessment	% Weight	Dates/duration
MC Test 1	20	October 3, in-class (50 mins)
MC Test 2	20	October 24, in-class (50 mins)
MC Test 3	20	November 17, in-class (50 mins)
MC Final	40	December 6, 7-9pm, Room TBD.

The format of questions is very similar to the practice tests linked from Courselink. The syllabus for the tests and the final are posted on Courselink.

The tests and final exam are given using Gradescope, so students fill in 'Bubble' sheets during class. Solutions to the Tests will be posted on Courselink in due course.

Procedure for dropping the lowest test grade and zero test grades

- (i) if there are 3 non-zero test grades then the lowest test grade is 'dropped', i.e. the grade on the dropped test is the average of the other two (equivalently, the two remaining tests are now worth 30% instead of 20%)
- (ii) if you score zero on a test (unlikely!) the weight of that test goes to the final exam. So the final can have weights 40, 60, 80, or 100 %. See 'Academic consideration' below for what happens if you miss a test.

Teaching Assistants and Office hours

I offer office hours by appointment only; please email me using your University of Guelph address to schedule a meeting (**Monday to Friday at 9am**). Teaching Assistants do not hold office hours, but they are available to answer your questions via email.

The Math & Stats Learning Center:

The Mathematics & Statistics Department operates a drop-in learning center where you'll find a team of tutors that can help you understand and solve problems in Math*1160. The learning center is located on the third floor of the McLaughlin Library in the Science Commons. The hours of operation are as follows:

Monday	Tuesday	Wednesday	Thursday	Friday
9:30-15:30	10:00-16:00	9:30-15:30	10:00-16:00	9:30-14:30

See <https://mathstat.uoguelph.ca/tutoring>

Test preparation checklist:

Found in the Contents section of Courselink.

Syllabus for the tests and final exam:

Found in the Contents section of Courselink.

Practice tests and solutions:

Found in the Contents section of Courselink.

Tests and solutions for this year (announced when ready)

Found in the Contents section of Courselink.

Texts recommended for background reading:

There are MANY books you can consult for background reading. For example:

- Bernard Kolman & David R. Hill: *Elementary Linear Algebra with Applications*, Pearson/Prentice Hall, 9th Edition, ISBN-13: 978-0-13-229654-0.
- **See the links in the Workbook to four open-access textbooks in Linear Algebra.**

Email Etiquette:

Although I try to respond to all email messages, please don't ask for class notes; tell me that you are going to miss a lecture; or generally ask me a question that you can find out for yourself. Keep your messages to the point, polite, and clearly state your question, with name, student ID, and course details.

Email Communication:

As per university regulations, all students are required to check their <uoguelph.ca> e-mail account regularly: e-mail is the official route of communication between the University and its students.

Academic consideration:

- There will be NO MAKE-UP TESTS. If you miss a test due to serious illness of yourself or a death in your immediate family, or due to personal grounds, please contact us by email ASAP explaining the reason for missing the test. You do NOT need to get a doctor's note. If consideration is granted I will readjust the weight of assessed material. HOWEVER, ONCE YOU HAVE TAKEN AN EXAM NO ACCOMMODATIONS CAN BE GRANTED (it is general University of Guelph procedure to NOT grant accommodations retrospectively). For further details concerning Academic Consideration see
- <https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-consideration-appeals-petitions/>
- UNDER NO CIRCUMSTANCES WILL ANY EXAM BE RE-SCHEDULED AT A DIFFERENT TIME AND/OR DATE.
- If you miss the final exam due to catastrophic events such as serious illness of yourself or death of your immediate family, you will receive an "Incomplete" grade, then (depending on circumstance determined by an independent committee) you may be allowed to take a deferred exam to receive a letter grade. If you miss the final exam you should (a) inform me by email, and (b) contact your program counsellor for advice.

Illness:

Medical notes will not normally be required for singular instances of academic consideration, although students may be required to provide supporting documentation for multiple missed assessments or when involving a large part of a course (e.g., final exam or major assignment).

Procedure used to re-adjust the weight of assessed material:

If consideration is given for missing a test (see above) the percentage of missed material is moved to the final. Please DO NOT ASK FOR ALTERNATE ARRANGEMENTS AS FOR REASONS OF FAIRNESS TO OTHER STUDENTS IT WILL NOT BE GRANTED:

- **Scenario 1:** Consideration is granted to miss **one** test
Assessment procedure: the final will contribute **60%** to your final grade.

- **Scenario 2:** Consideration is granted to miss **two** tests (UNLIKELY)
Assessment procedure: the final will contribute **80%** to your final grade.
- **Scenario 3:** Consideration is granted to miss **three** tests (VERY UNLIKELY)
Assessment procedure: the final will contribute **100%** to your final grade.

When You Cannot Meet a Course Requirement:

When you find yourself unable to meet an in-course requirement because of illness or compassionate reasons, please advise the course instructor (or designated person, such as a teaching assistant) in writing, with your name, id#, and e-mail contact. See the Undergraduate Calendar for information on regulations and procedures for Academic Consideration.

Regulations regarding seeing your final exam:

If you wish to see your final exam you must submit your **written** request to the chair of the department by the 5th class day of the new semester, see

<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/examinations/>

If you are granted permission to see your final exam you will be provided with: (a) your electronic answers, (b) a copy of the exam paper, and (c) written solutions.

Regulations regarding a grade-reassessment:

If you believe that an error has been made in the determination of your final grade then you must **write** to the chair of the department (by the 10th class day of the new semester) requesting a grade re-assessment. This can lead to the grade staying the same, a grade increase, or a grade decrease. Please note that this should not be used as a means of 'trying to get a few extra marks', but for situations where you have grounds for believing that mistakes have been made in the determination of your final grade. Remember also that your final exam is multiple choice and graded by a computer. For further information see

<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/grade-reassessment/>

Copies of Out-Of-Class Assignments

Keep paper and/or other reliable back-up copies of all out-of-class assignments: you may be asked to resubmit work at any time.

Academic Accommodation of Religious Obligations

If you are unable to complete a course requirement due to religious obligations, please let the instructor know within the first two weeks of class. See the academic calendar for more information:

<https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-accommodation-religious-obligations/>

Academic Integrity:

The University of Guelph is committed to upholding the highest standards of academic integrity and it is the responsibility of all members of the University community, faculty, staff, and students to be aware of what constitutes academic misconduct and to do as much as possible to prevent academic offences from occurring. University of Guelph students have the responsibility of abiding by the University's policy on academic misconduct regardless of their location of study; faculty, staff and students have the responsibility of supporting an environment that discourages misconduct. Students need to remain aware that instructors have access to and the right to use electronic and other means of detection. Please note: Whether or not a student intended to commit academic misconduct is not relevant for a finding of guilt. Hurried or careless submission of assignments does not excuse students from responsibility for verifying the academic integrity of their work before submitting it. Students who are in any doubt as to whether an action on their part could be construed as an academic offence should consult with a faculty member or faculty advisor. The Academic Misconduct Policy <https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/academic-misconduct/> is outlined in the Undergraduate Calendar.

Use of chatGPT and other AI software:

Artificial intelligence (AI) software such as chatGPT and Microsoft's Bing AI chatbot etc. are very useful tools for learning mathematics. However, please familiarize yourself with what constitutes academic misconduct when using AI tools. See the university policy:

<https://news.uoguelph.ca/2023/03/university-of-guelph-statement-on-artificial-intelligence-systems-chatgpt-academic-integrity/>

Be cautious: these tools are not calculators. Blind reliance on their output often yields incorrect answers: I checked this with many examples! Verify any information they provide independently, as they often produce erroneous or misleading output. The educational utility of AI in mathematics will be a topic of in-class discussion.

Accessibility:

The University promotes the full participation of students who experience disabilities in their academic programs. To that end, the provision of academic accommodation is a shared responsibility between the University and the student. When accommodations are needed, the student is required to first register with Student Accessibility Services (SAS). Documentation to substantiate the existence of a disability is required, however, interim accommodations may be possible while that process is underway.

Accommodations are available for both permanent and temporary disabilities. It should be noted that common illnesses such as a cold or the flu do not constitute a disability. Use of the SAS Exam Centre requires students to make a booking at least 10 business days in advance, and no later than the first business day in November, March or July as appropriate for the semester. Similarly, new or changed accommodations for online

quizzes, tests and exams must be approved at least a week ahead of time. More information <https://wellness.uoguelph.ca/accessibility>.

Drop date:

Courses that are one semester long must be dropped by the end of the last day of classes; two-semester courses must be dropped by the last day of classes in the second semester. The regulations and procedures for dropping courses are available in the Undergraduate Calendar, see <https://calendar.uoguelph.ca/undergraduate-calendar/undergraduate-degree-regulations-procedures/dropping-courses/>

Course Evaluation Information - evaluations done online. See the format at:

https://mathstat.uoguelph.ca/sites/uoguelph.ca.mathstat/files/public/TeachevaluationformW16_1.pdf.

Recording of Materials:

Presentations which are made in relation to course work -- including lectures -- cannot be recorded or copied without the permission of the presenter, whether the instructor, a classmate or guest lecturer. Material recorded with permission is restricted to use for that course unless further permission is granted. **No video recordings are permitted!**

Resources:

The [Academic Calendars](#) are the source of information about the University of Guelph's procedures, policies and regulations which apply to undergraduate, graduate and diploma programs.

Classes cancelled due to bad weather:

If bad weather (e.g. a snow day) causes classes to be cancelled on a test day, the test will be re-scheduled on the next regularly scheduled class.

Strike Action:

In the unlikely event of strike action by faculty, staff, or TAs that makes it difficult or impossible to teach the material on a test, the test will be cancelled and the weight re-distributed to the final.

Health and Wellbeing:

The University of Guelph provides a wide range of health and wellbeing services at the Vaccarino Centre for Student Wellness (<https://wellness.uoguelph.ca>). If you are concerned about your mental health and not sure where to start, connect with a Student Wellness Navigator (<https://wellness.uoguelph.ca/navigators>) who can help develop a plan to manage and support your mental health or check out our mental wellbeing resources (<https://wellness.uoguelph.ca/shine-this-year>). The Student Wellness team are here to help and welcome the opportunity to connect with you. You are not alone and you will not be judged for asking for help.

MATLAB:

The Workbook provides a gentle introduction to using computer software (MATLAB) to manipulate matrices. To use MATLAB there are a few options:

- MATLAB is available on the machines in the data resource center of the Library (1st Floor).
- Use your own account at your own department if your department has the MATLAB license.
- Buy a Student Version of MATLAB.
- **(Best Option):** Install *Octave*, which is free software and emulates MATLAB. Octave is compatible with Linux, MacOS and Windows. Caution: Most likely you can do all the (numerical) homework exercises, but we have not tested all the exercises yet. To download Octave go to <https://www.gnu.org/software/octave/download.html>

MATLAB Tutorials:

For a particularly simple introduction we recommend you work through the 1st tutorial linked from the Contents section of Courselink. There is also a more comprehensive tutorial at the same location. For additional details, the official MATLAB manual is available from

<http://www.mathworks.com/access/helpdesk/help/helpdesk.shtml>.

There are also numerous online MATLAB tutorials.

COVID-19 Disclaimer:

Please note that a resurgence of the COVID-19 pandemic may necessitate a revision of the format of course offerings, changes in classroom protocols, and academic schedules. Any such changes will be announced via Courselink and/or class email.

See the next page for the schedule.

Schedule for in-class lectures
Math*1160 Fall 2025
 (SECTION 01)

Description: Sections below align with the fillable Workbook (lecture notes). The schedule is a rough guide; I always finish topics in time for each test or quiz with time for revision.

Lecture	Date	Sections	Notes
# 1	Sept 5	Introduction	
# 2	Sept 8	1.1, 1.2	
# 3	Sept 10	1.2	
# 4	Sept 12	1.3	
# 5	Sept 15	1.4	
# 6	Sept 17	1.4	
# 7	Sept 19	1.5, 1.6	
# 8	Sept 22	1.6	
# 9	Sept 24	2.1	
# 10	Sept 26	2.2 (fast)	
# 11	Sept 29	2.3	
# 12	Oct 1	3.1, 3.2	
# 13	Oct 3	---	Test 1 (IN-CLASS)
# 14	Oct 6	3.2	
# 15	Oct 8	3.2	
# 16	Oct 10	3.3	
(Oct 13 - No classes)			
# 17	Oct 15	3.4	
# 18	Oct 17	4.1	
# 19	Oct 20	4.2	
# 20	Oct 22	4.2	
# 21	Oct 24	---	Test 2 (IN-CLASS)
# 22	Oct 27	4.3	
# 23	Oct 29	4.4	
# 24	Oct 31	4.4	
# 25	Nov 3	4.5	
# 26	Nov 5	4.6	
# 27	Nov 7	4.6	
# 28	Nov 10	4.7	
# 29	Nov 12	4.8	
# 30	Nov 14	5.1	
# 31	Nov 17	---	Test 3 (IN-CLASS)
# 32	Nov 19	5.2	
# 33	Nov 21	5.2	
# 34	Nov 24	6.1	
# 35	Nov 26	6.2	
# 36	Nov 28	6.2	

