MATH 1B03 (Linear Algebra I)
MATH 1ZC3 (Engineering Mathematics II-B)
Section EVE C01
Course Outline for Spring Semester 2020

Avenue to Learn (course website). `https://avenue.mcmaster.ca/`
Online homework & labs (ChildsMath). `https://www.childsmath.ca/childsa/forms/main_login.php`.
Octave Online (free software). `https://octave-online.net/`

This course is an introduction to linear algebra. We are interested in both a computational approach (e.g., computing solutions to a linear system of equations) and a theoretical approach (e.g., an understanding of the underlying idea of a vector space). We will have lectures two times a week, plus weekly assignments and labs.

Prerequisites. One of Grade 12 Calculus and Vectors U, Grade 12 Geometry and Discrete U, or MATH 1F03.

Instructor Information.

Instructor:	Dr. Andres Zuniga
Email:	andres.zuniga@math.mcmaster.ca
Office hours:	Tuesday and Thursday 4:00pm - 5:00 pm (online).

Lecture Information.

- Course schedule: Tuesday and Thursday 7:00pm - 10:00 pm.
- Lecture and drop-in lab classroom: *Virtual Classroom (online).*
- Course Website: Course information will be posted on Avenue to Learn (Avenue).

Note: Both sections (1B03 and 1ZC3) will be following the same schedule. The tests, assignments and labs will also be the same.

Textbook Information.

- **(Required)** *Elementary Linear Algebra - Applications Version (11th Edition)*, by Anton and Rorres, Wiley. Note that we will use Chapter 10 of the 9th Edition to review complex numbers. A PDF version of this chapter will be available on Avenue to Learn.
- **(Optional)** Student Solutions Manual for Elementary Linear Algebra - Applications Version.

Visit the links below for instructions on how to purchase digital copies of the books from the McMaster Campus Store, or to purchase the course material from another supplier:

Math 1B03 listing and Math 1ZC3 listing

Calculators. No calculators are required, or needed, for this course.

Course objectives. This class corresponds to the first course on linear algebra. By the end of this course, students should be able to:

- *do computations involving matrices.* For example, you should be able to solve systems of linear equations using Gauss-Jordan elimination and matrix methods and find eigenvalues/eigenvectors of a matrix. Labs and assignments will facilitate this objective.

- *explain some theoretical underpinnings of linear algebra.* For example, you should be able to understand the language of vector spaces to develop a theory that supports and describes what is observed in the computations above. As well, you will practice critical thinking skills by demonstrating understanding of the concepts encountered in both computational and theoretical contexts. Labs and assignments will facilitate this objective.

Topics. Our goal is to cover the following topics: vector spaces given by solutions to linear systems; linear independence; dimension; determinants; eigenvalues and eigenvectors; diagonalisation; and complex numbers.

Word of advice! To do well in this class, it is *crucial to keep up with the lectures, homework and labs*! The pace of the spring version of this course is *much faster than* that of the fall/winter versions. If there is something you do not understand, please ask around with your classmates, the professor or the TA as soon as possible. You can check your grades in ChildsMath (or Avenue).

Assignment Information. There will be *six assignments* made available through online submission (ChildsMath website). They will be automatically graded if submitted before the deadline expires. For homework due dates, refer to the class schedule posted on Avenue, on a regular basis. A tentative calendar can also be found at the end of this document.

Lab Information. There will be *five labs* which will require the use of Matlab (version 7 or later), or the free-software called Octave. The labs will be submitted using the same website ChildsMath, listed above. For each lab, *a short guide with practical information and examples will be given*, concerning the syntax and structure of Matlab that will be needed for the labs. These guides will be found at the top of the page designed for each lab.
Our TA, Jeremy Colangelo, will run two drop-in lab sessions during the weeks when labs are due (on Tuesday & Thursday 6:00pm - 7:00pm) to help you develop the skills necessary to complete the labs. You will not be required to participate in the sessions, albeit it is highly encouraged to do so. Although Matlab is not available online, you can also use Octave Online (`https://octave-online.net/`), *available for you at no cost.* The syntax of Octave is very similar to that of Matlab. The official software, Matlab, can be purchased at the campus bookstore or online directly from Mathworks (`https://www.mathworks.com/store/`).

Test Information. There will be two online tests (duration 75 mins), tentatively set for

Midterm 1: Tuesday evening, May 19th, 2020 (7:00pm-8:15pm).
Midterm 2: Tuesday evening, June 2nd, 2020 (7:00pm-8:15pm).

These tests will be taken in the ChildsMath website. The topics covered on the test will be announced on the course webpage. Calculators are NOT ALLOWED on any of the tests or the exam.
Note: It is your responsibility to make sure you are able to take the online-evaluations during these times, and no permission will be given for make up tests (except extenuating circumstances).

Marking Scheme Information. Your final mark for this course will be calculated as *the highest* of the following two marks, which are to be computed as

Weight 1		**Weight 2**	
Final examination	30%	Final examination	50%
Midterms tests	2 at 20% each = 40%	Max. of Midterms 1 & 2	20%
Labs and Assignments	11 at $2.\overline{72}$ each = 30%	Labs and Assignments	11 at $2.\overline{72}$ each = 30%

Final Examination Information. This is a comprehensive examination (covering all the material from the course) with a duration of 2.5 hours; details on the topics covered will be announced later on Avenue. The final exam will be taken online in the ChildsMath website, and it will take place during our last day of lectures, Thursday June 18th, 2020 (7:00pm - 9:30pm).

Course Support. In order to help you succeed in this course, the following services are available to you.

- **Practice Problems.** Suggested problems and practice tests/exams will be made available on the class website.
- **Lab sessions.** There will be two one-hour drop-in sessions each week (Tuesday & Thursday 6pm-7pm, except for two weeks), for students to work on problems/concepts related to Matlab (Octave) programming skills, needed to complete the laboratories in ChildsMath. Although attendance in lab sessions is not mandatory, it is strongly encouraged.
- **Math Help Centre.** Due to the current unprecedented circumstances, the drop-in Help Centre in Hamilton Hall is currently closed. Instead, starting Monday, May 11 a TA will be available online to answer questions. Exact times, and the links to join them online will be provided and posted on the course website as soon as they are available. You can also visit the website:

  `https://ms.mcmaster.ca/~mcleac3/Site/HelpCentreSite.html`

  for more information.
- **Office hours.** This time is intended to help students learn the course material, and provide opportunities to ask further questions and seek help. Although attendance in office hours is not mandatory, it is strongly encouraged. The weekly times will be announced in the course website.

OFFICIAL McMASTER POLICIES

1. **Policy on Academic Ethics.** You are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. Academic credentials you earn are rooted in principles of honesty and academic integrity.

   The McMaster Academic Integrity Policy defines academic dishonesty as "to knowingly act or fail to act in a way that results or could result in unearned academic credit or advantage." This behavior can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: "Grade of F assigned for academic dishonesty"), and/or suspension or expulsion from the University.

   It is your responsibility to understand what constitutes academic dishonesty. The following illustrates only three forms of academic dishonesty: (1) plagiarism, e.g. the submission of work that is not one's own or for which other credit has been obtained. (2) improper collaboration in group work, and (3) copying or using unauthorized aids in tests and examinations. Appendix 3 of the McMaster Academic Integrity Policy gives full explanations of several different kinds of academic dishonesty.

   Further information on the topic of academic integrity can be found in

   `https://www.mcmaster.ca/academicintegrity/`
2. **Online Course Behaviour.** McMaster is committed to an inclusive and respectful community. These principles and expectations extend to online activities including electronic chat groups, video calls and other learning platforms. If you are concerned about your virtual classroom experiences, the Equity and Inclusion Office (EIO) is available to advise and assist students who may be experiencing any equity, accessibility, inclusion, harassment, discrimination or sexual violence concerns. You can reach the EIO at equity@mcmaster.ca. Thank you for joining us in ensuring that our McMaster online communities are spaces where no one feels excluded and everyone is able to enjoy learning together.

   `https://equity.mcmaster.ca/contact-us`
3. **Online testing tools.** This course may use proctoring software (TBD) for tests/exams. This software may require you to turn on your video camera, present identification, monitor and record your computer activities, and lockdown your browser during the exam. This software may be required to be installed before the exam begins. If you have questions about whether this software will be used, or concerns about the use of this software, please contact your instructor.

4. **Sharing and posting of course material.** Students who have access to authorized recorded lectures in a course may use these recordings only for personal or group study and should not reproduce, share or upload the recording to any publicly accessible web environment. Similarly, notes, slides, evaluations and tests are for personal use and should not be shared with others outside of a course.

5. **Academic Accommodation of Students with Disabilities.** Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail: sas@mcmaster.ca. For further information, consult the McMaster University's Academic Accommodation of Students with Disabilities policy.

6. **Requests for Relief for Missed Academic Term Work.** *If you have missed work, it is your responsibility to take action.* Once per term, you may use the McMaster Student Absence Form (MSAF) to request relief from missed academic work, resulting from medical or personal situations lasting up to 3 days. MSAF is an online self-reporting tool; no documentation is needed. Please visit

   `https://www.mcmaster.ca/msaf`

   `http://academiccalendars.romcmaster.ca/content.php?catoid=13&navoid=2208#Requests_for_Relief_for_Missed_Academic_Term_Work`

   for more information. It is your responsibility to email the professor as soon as possible (within three working days) about the absence. Please note that the MSAF may not be used for term work worth 25% or more, nor can it be used for the final examination.

   Absences for a longer duration or for other reasons must be reported to your Faculty/Program office, with documentation, and relief from term work may not necessarily be granted. **In Math 1B03 and 1ZC3, the percentages of the missed work will be transferred to the final examination**.

   There have been changes to the McMaster Student Absence Form (MSAF) policy beginning in the fall 2015 term, most notably:

   - The time frame within which the MSAF is valid has been reduced from 5 days to 3 days.
   - The upper limit for which an MSAF can be submitted has been reduced from "less than 30%" to "less than 25%" of the course weight. Nor can it be used for the final examination.

   In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar Requests for Relief for Missed Academic Term Work. Please note these regulations have changed beginning Fall 2015.

7. **Late Withdrawal Policy.** The University senate approved in Fall 2019, effective immediately, a proposal for late withdrawal option. Students who have become irretrievably behind in a course and are not prepared to complete a final exam or an equivalent evaluation should contact their Academic Advisor in their Faculty or Program Office. A form will be provided that will allow a student to make this request while seeking counsel with an Advisor.

   In consultation with their Academic Advisor students may request a Late Withdrawal, without the need for a petition, prior to the last day of classes in the relevant term with the conditions outlined in the policy. This request can be made after the scheduled "Last day for withdrawing from courses without failure by default" stated in the McMaster Sessional Dates.

   Requests for Late Withdrawal cannot be made in courses for which the final exam (or equivalent) has been attempted or completed. This also includes courses where a final grade has been assigned (e.g. clinical courses).

8. **Academic Accommodation for Religious, Indigenous or Spiritual Observances (RISO).** Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

9. **Undergraduate Examinations Policy:** The official document explaining the policies, procedures and guidelines regarding undergraduate examinations, can be found:

   `https://www.mcmaster.ca/policy/Students-AcademicStudies/UndergraduateExaminationsPolicy.pdf`

10. **2019 - 2020 sessional dates.** Can be viewed at

    `https://registrar.mcmaster.ca/dates-and-deadlines/`

11. **Important Message:** The instructor and the University *reserve the right to modify elements of the course during the term.* The University may change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster email and course websites weekly during the term and to note any changes.

12. **On-line Statement for Courses Requiring Online Access or Work.** In this course we will be using Crowdmark and ChildsMath, a local website hosted by the department. Students should be aware that, when they access the electronic components of this course, private information such as first and last names, user names for the McMaster e-mail accounts, and program affiliation may become apparent to all other students in the same course. The available information is dependent on the technology used. Continuation in this course will be deemed consent to this disclosure. If you have any questions or concerns about such disclosure please discuss this with the course instructor.

MATH 1B03/1ZC3 (TENTATIVE) CALENDAR - SPRING 2020

We will be using the following schedule. Please note that there may be changes; always refer to the Avenue for the most recent information. Lecture are set every week on Tuesdays and Thursdays 7:00pm - 10:00pm, however, due to these unprecedented circumstances the lectures will be *pre-recorded and uploaded to Avenue* on those dates.

Week 1: May 4 - 8	
Lecture 1	Introduction 1.1 System of Linear Equations 1.2 Gaussian Elimination
Lecture 2	1.3 Matrices and Matrix Operations 1.4 Inverses, Properties of Matrices
⋆LAB # 1 (Matlab)⋆	Due Saturday May 9 at 11:59pm
Week 2: May 11 - 15	
ASSIGNMENT #1	Due Monday May 11 at 11:59pm
Lecture 3	1.5 Elementary Matrices 1.6 More Linear Systems and Invertible Matrices
Lecture 4	1.7 Diagonal, Triangular, and Symmetric Matrices 1.8 Linear Transformations
⋆LAB # 2 (Matlab)⋆	Due Saturday May 16 at 11:59pm
Week 3: May 18 - 22	
ASSIGNMENT #2	Due Monday May 18 at 11:59pm
Lecture 5	MIDTERM #1
Lecture 6	2.1 Determinant by Cofactor Expansion 2.2 Evaluating Determinants by Row Reduction 2.3 Properties of Determinants (including Cramer's rule)
Week 4: May 25 - 29	
ASSIGNMENT #3	Due Monday May 25 at 11:59pm
Lecture 7	5.1 Eigenvalues and Eigenvectors 5.2 Diagonalization 10.1 (9th Ed.) Complex Numbers
Lecture 8	10.2 (9th Ed.) Division of Complex Numbers 10.3 (9th Ed.) Polar Form of Complex Numbers 5.3 Complex Eigenvalues and Eigenvectors
⋆LAB # 3 (Matlab)⋆	Due Saturday May 30 at 11:59pm
Week 5: June 1 - 5	
ASSIGNMENT #4	Due Monday June 1 at 11:59pm
Lecture 9	MIDTERM #2
Lecture 10	3.2 Norm, Dot Product, and Distance in $\mathbb{R}^n$ 3.3 Orthogonality 4.1 Real Vector Spaces 4.2 Subspaces
⋆LAB # 4 (Matlab)⋆	Due Saturday June 6 at 11:59pm

Week 6: June 8 - 12	
ASSIGNMENT #5	Due Monday June 8 at 11:59pm
Lecture 11	4.3 Linear Independence 4.4 Coordinate and Basis
Lecture 12	6.3 Gramm-Schmidt Process 4.5 Dimension
⋆LAB # 5 (Matlab)⋆	Due Saturday June 13 at 11:59pm

Week 7: June 15 - 19	
Lecture 13	4.7 Row Space, Column Space, and Null Space 4.8 Rank, Nullity, and Fundamental Matrix Spaces
Lecture 14	FINAL EXAM
ASSIGNMENT #6	Due Thursday June 18 at 11:59pm