



Syllabus

MATH 3100, Section 103, Spring 2021
Linear Algebra & Matrix Theory
MWF 12:00PM–12:50PM Distance learning

Instructor: Dr. Ahmed Kaffel

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Office Hours: MWF 3:00pm – 3:50pm, and by appointment (by using Microsoft teams).

Course material text:

Introduction to Linear Algebra with Applications, Jim DeFranza & Daniel Gagliardi, McGraw-Hill, ISBN 13: 978-1-4786-2777-7. Any additional material will be shared via Marquette University's Course Management System (<https://d2l.mu.edu/>).

Some notes will be shared for the course. These notes should only be used as a supplement and not as an alternative to your personal notes. The instructor will help you to understand the material taught in the lectures and will also help you by doing some review problems before the exams. It is very important that you practice these examples.

Course Description:

Covers systems of linear equation, algebra of matrices, linear transformations, determinants, N-dimensional vector spaces, inner product spaces, eigenvalues and eigenvectors, diagonalization and orthogonality, characteristic values, special matrices and applications to differential equations and geometry.

Prereq: MATH 2100, MATH 2105, MATH 2350, or MATH 2451.

Course Learning Objectives: Upon successful completion of the course, students will be able to:

1. Find solutions of systems of linear equations by using Gauss-Jordan elimination method.
2. Identify and compute algebraic properties of matrices and determinants.
3. Demonstrate a thorough knowledge of vector spaces and subspaces.
4. Find basis and rank for column, row and null spaces of a given matrix.
5. Find eigenvalues, eigenvectors and eigenspace of a square matrix and use them for matrix diagonalization.
6. Define linear transformations and examine their properties.
7. Identify inner product spaces and use Gram-Schmidt orthogonalization process to orthogonalize any given basis.
8. Understand and demonstrate the applications to linear ordinary differential equations and geometry

9. Use MATLAB as a tool to help understand linear algebra and to evaluate problems that would otherwise be too large to do by hand.
10. Determine if a linear system has a unique solution, infinitely many solutions, or no solution.
11. Perform fundamental matrix operations.
12. Determine if a set forms a subspace, a vector space, a spanning set.
13. Determine the linear independence/dependence of a variety of sets.
14. Find bases for different spaces; determine the dimension and rank of the space.
15. Find the inverse of a matrix, if one exists.
16. Perform the LU decomposition.
17. Compute the determinant of a matrix.
18. Determine when a matrix A is diagonalizable.

Recommended Equipment: A graphing calculator is recommended for this course. Calculators will generally be allowed on exams, but not on quizzes.

Homework assignments: will be assigned but will not be graded. I strongly recommend neatly writing up solutions to the homework and saving these solutions. These solutions will be a valuable resource when you come to office hours or review for an exam. Problems like the homework will appear on quizzes and exams. There is a link to the homework on D2L.

Online quizzes: Online quizzes will make up 30% of your final grade. We will generally have one or two online quizzes for each chapter which will be posted on D2L. There will be no make-up quizzes unless for sudden medical emergencies until proven. The lowest quiz score (including any '0' for absences) will be dropped. Unless explicitly stated, calculators and notes will not be allowed on quizzes.

Midterm exams: There will be two in-class exams: Exam 1 will be given on Friday *03/05/2021*, exam 2 will be given on Friday *04/16/2021* and the two exams are counted 40% toward the final grade. Each midterm exam is counted 20% toward the final grade. There will be no makeup exams unless for sudden medical emergencies.

Final Exam: There will be a comprehensive final exam grade will be counted as 30% of your final grade. The final exam will be on **Thursday 05/13/2021** from 10:30AM - 12:30PM.

Grading policy and Evaluation Criteria:

Graded work will include two-exams as well as quizzes and a Final exam. The final grade will be calculated using the following weights:

- Quizzes: 30 %
- Two midterm exams: 40 %
- Final exam: 30%.

$$Total = 0.25 * quizzes\ score + 0.45 * midterm\ exams\ score + 0.3 * Final\ exam\ score$$

Your final grade will be A, A-, B+, B, B-, C+, C, C-, D+, and D for course averages of 93%, 90%, 86%, 81%, 76%, 72%, 68%, 64%, 60% and 56%.

Grades for assignments and exams will be posted on D2L. Please check your recorded grades regularly to monitor your progress in the course and to ensure accuracy of recorded grades

Grade Corrections: If you believe that an exam or a homework was graded or tallied incorrectly you may submit the exam for a regrade along with explaining why you believe you deserve more points. Regrades will be accepted up to two class periods after the exam or the homework grade is posted. You must let me know (in writing; email is fine) within seven days of receiving the grade; otherwise, I can't promise that I will consider the issue.

Important dates:

Exam 1 date: *Friday, 03/05/2021*

Exam 2 date: *Friday, 04/16/2021*

Final exam date: **Thursday 05/13/2021** from 10:30AM - 12:30PM.

Classes resume: Jan 25, 2021

Classes end: May 8, 2021

Withdrawal from Course: If you intend to withdraw, it is your responsibility to withdraw yourself from the course before the due date. Do not assume that just because you have stopped attending class you will be automatically withdraw from the course. If you quit attending and not officially withdraw, you could receive a grade of F.

Special Statement on COVID-19

Marquette University recognizes that this is a difficult time which may be filled with uncertainty as we move forward with the academic year. Your safety, health, and well-being, as well as that of our faculty and staff are our primary concern and we want to be able to support you in any way that we can. To live our Cura Personalis or care for the whole person, we ask that you adjust your behavior to best keep yourself and others safe. We have expectations that you act responsibly in order to mitigate risk to others. As your faculty, I too am committing to these behaviors that I will ask you to follow.

The University understands that at this time you may be facing some obstacles that would make it difficult to meet your academic goals. Please use the [Student Resources](#) page on the [Marquette COVID-19 Response webpage](#) for information and resources on basic needs such as housing, food, financial aid, and medical and mental health. The webpage also offers information on official University communications, access to technology, and student services. Your professors and advisors are also here for you. Visit the [Marquette COVID-19 Response Page](#) regularly as information may change as the semester rolls out.

Remember, you are not alone and together we will navigate these extraordinary and challenging times. We are Marquette!

Commitment to Inclusion and Equity

I would like to create a learning environment for my students that supports a diversity of thoughts, perspectives and experiences, and honors your identities (including race, gender, class, sexuality,

religion, ability, etc.). I also understand that the current crisis of COVID, economic disparity, and health concerns could impact the conditions necessary for you to succeed. My commitment is to be there for you and help you meet the learning objectives of this course. I do this to demonstrate my commitment to you and to the mission of Marquette to be people for and with others and to care for the whole student (Cura Personalis). If you feel like your performance in the class is being impacted by your experiences outside of class, please don't hesitate to come and talk with me. I want to be a resource for you (Marquette can provide financial assistance, food assistance, computers, and counseling services, and provide a specific request if you complete a [Concern and Care Form](#)).

Health-related Class Absences

Please regularly evaluate your own health according to current [CDC](#), [State of Wisconsin](#), and [city guidelines](#). Do not attend class or other on-campus events if you are ill.

You are encouraged to seek appropriate medical attention for treatment of illness from [Student Health Services](#). In the event of having a contagious illness such as influenza or COVID-19, please complete the [voluntary form](#) upon diagnosis and do not come to class or to campus to turn in any work. Instead, email me about your absence as soon as you are able so that appropriate accommodations can be explored.

Please note that documentation (a Doctor's note) for medical absences is not required. As part of their commitment to maintain confidentiality, to encourage more appropriate use of healthcare staff resources, and to support meaningful dialogue between instructors and students, Marquette Student Health Services will not provide documentation of illness.

I am committed to working with students with pre-existing medical and mental health needs, as well as new needs that may arise within the semester. I encourage you to reach out to me as early as possible to discuss any adjustments you think may be necessary in this course. Reasonable accommodations may include leveraging the course modules that have been developed in creative ways to maximize your access during times when students need to quarantine due to COVID exposure, or during an absence related to a disability or COVID-19 diagnosis. While I cannot guarantee any specific outcome, I am committed to working with you to explore all the options available in this course. To begin this process, contact the [Office of Disability Services \(ODS\)](#).

- Confirmed COVID-19 diagnosis and in isolation: student is expected to participate in all assignments to the extent possible based on severity of symptoms. *Students are expected to inform instructor of quarantine or isolation dates and to communicate regularly about their ability to participate during that time.* Medical documentation is NOT required for return to the classroom but may be required for return to some clinical sites. Students need to contact Office of Disability Services in the event they are not able to participate in coursework due to COVID-19 or symptoms of COVID-19 to explore if a reasonable accommodation can be afforded.
- Symptomatic in isolation and needs testing or awaiting results: student is expected to participate in all assignments to the extent possible based on severity of symptoms and seek out COVID-19 test through the Marquette University Medical Clinic [414-288-7184]. Same guidance as above for documentation and accommodation.

- Confirmed COVID-19 exposure and in quarantine: Student is expected to participate in all assignments. Should symptoms develop students should seek out COVID-19 testing through the Marquette University Medical Clinic [414-288-7184]. Same guidance as above for documentation and accommodations.
- For all isolation or quarantine: Student is expected to contact the instructor to indicate student's inability to join and participate.

Note1: consistent with the current attendance policy and medical excuse policy (<https://www.marquette.edu/medical-clinic/rights-policies.php>), the Marquette University Medical Clinic does not provide medical excuses for short-term absences that result in missed classes, exams, or assignments due to illness or injury. Requiring medical excuses places an additional burden on healthcare systems and diverts resources from patient care. Quarantine/isolation does not require formal certification by healthcare provider.

Note2: “exposed and in quarantine” vs “diagnosed and in isolation,” is distinct based on a few things. Those in quarantine will be out of class for a finite 14 days (unless they become symptomatic). Also, those in quarantine can leave their residence for essentials such as picking up food or medicine, etc., while those in isolation cannot leave their residence during isolation. Also time in isolation is variable, the least amount of time is 10 days but could be longer such as 2-4 weeks as it is based on when their symptoms resolve. The other difference is those in quarantine are not ill and can perform all work assignments remotely, while those that are sick may not be able to keep up depending on how sick they are.

Attendance

Our class meets remotely on MWF, 12:00pm–12:50 p.m. Note ***attendance is required***. Attendance is essential to succeed in this course. Missing class almost always results in poorer performance on tests and homework. Absences prevent you from getting the full benefit of the course, generally resulting in lower scores. If absent, you are responsible for all material missed due to that absence. If you like missing a lot of class without any good reason, drop this course and sign up for something else. You are expected to attend class on time with the appropriate lecture notes for the class, having completed the assigned reading for the current lecture and assigned problems for the previous lecture. You are expected to join the class on time, stay through the entire lecture, be prepared to ask questions, and be willing to learn mathematics. The attendance policy of this course follows the College of Arts and Sciences policy in the Undergraduate Bulletin.

<http://bulletin.marquette.edu/undergrad/academicregulations/#attendance>

Specifically:

- Attendance will be taken in every class. If you have a good reason to miss a class, please inform the instructor as soon as possible (preferably via email) to mitigate penalties.
- The university attendance policy considers more than 6 or 7 absences to be excessive. With 8 absences you may lose a full letter grade and you may be dropped from the class. The University does not make a distinction between excused and unexcused absences. Excused absences related to COVID-19 and/or medical emergencies will be waived.
- If you miss a class, it is your responsibility to obtain and learn the material you missed. In the event that you miss a class I will be happy to answer your questions about the missed class

only after you have obtained the material you missed (e.g., from another student) and made an attempt to learn it yourself (or with a tutor).

Participation

Class participation and active learning are important aspects of this class, so your engagement is critical to your success regardless of modality/delivery. However, I understand that sometimes you must miss examinations or other academic obligations affecting your grades because of illness, personal crises, and other emergencies. As long as such absences are not excessive (no more than a total of 8 absences per semester), I will work with you as best I can to help you succeed in the course. Please contact me as soon as possible when such absences arise so we can make arrangements to get you caught up. This policy will not apply in the case on non-emergency absences. All students who participate in class will receive extra credit points for *(correctly) answering specific extra credit questions. Do not miss this opportunity to improve your grade.*

Technology Requirements:

To be successful in this course, you will need to have foundational experience with D2L, the University's Learning Management System, and the videoconferencing tool Microsoft Teams. If you're not familiar with these technologies, review the [D2L Student Help resources](#) and [Students Use Microsoft Teams for online/live classes webpage](#).

I recommend you also visit the [Technology for Remote Learning webpage](#) for information on the technology you will need to be successful.

For general questions about technology, contact the ITS Help Desk at helpdesk@mu.edu or 414-288-7799.

Academic honesty policy:

Academic dishonesty will not be tolerated. Here is the Honor Pledge: I recognize the importance of personal integrity in all aspects of life and work. I commit myself to truthfulness, honor, and responsibility, by which I earn the respect of others. I support the development of good character, and commit myself to uphold the highest standards of academic integrity as an important aspect of personal integrity. My commitment obliges me to conduct myself according to the Marquette University Honor Code.

See the Undergraduate Bulletin for the approved University Academic policy. The University's policy is at <http://bulletin.marquette.edu/undergrad/academicregulations/>. Your program or college may have more strict regulations so please address each below accordingly. Love of truth is at the center of the university's enterprise, and academic honesty, in all its forms, is an explicit value of the university. The development and practice of academic honesty and integrity, both inside and outside of the classroom, are expectations for all members of the university community. Acts of academic dishonesty include, but are not limited to:

- The illegitimate use of materials (electronic devices, crib sheets, or phones, etc.) in any form during a quiz or examination.

- Asking someone to provide you with the answers, or the step-by-step instructions for completing exams or quizzes. Copying answers from the examination paper of another student.
- Obtaining, through theft, bribery, or collusion, or otherwise improperly securing an examination paper prior to the time and date for the administration of the examination. Also, use of an examination paper previously administered (e.g., during an earlier term) without the consent of the instructor who authored the examination is considered an act of academic dishonesty.
- Communicating examination answers with other students during an examination.
- Impersonating a candidate at an examination or availing oneself of such an impersonation.
- Tempering with an examination after it has been corrected and then returning it for more credit. Aiding or abetting any such offenses.
- Copying material from a Web page and submitting it as one's own work.
- Copying answers from the quiz or examination paper of another student.
- Plagiarizing (submitting the work of another as one's own ideas) or falsifying materials or information used in the completion of any assignment, which is graded or evaluated as the student's individual effort.
- Intentionally interfering with any person's scholastic work (e.g., by damaging or stealing laboratory experiments, computer files or library materials).
- Using another student's clicker in class or handing your clicker to another student to have them answer for you.

Other than possibly calculators, no electronic devices may be operated during the course of any exam or assignment without the explicit consent of the instructor. Instances of academic dishonesty will be handled in accordance with College policy and may lead to expulsion from the University. Academic Dishonesty is not tolerated at Marquette University. If you observe any misconduct it is your duty to report to the professor. If I find any misconduct it is my duty to report it to the Academic Integrity Council. Please refer to Marquette University's Academic Honesty Policy at <http://marquette.edu/rc/academichonesty.shtml>.

Ethics and Behavior: High standards of personal conduct and consideration of others are required in order to create a classroom climate conducive to learning. Disruptive behavior will not be tolerated.

Department: Norms for classroom conduct are based on respect for the instructor and the fellow students. Behavior such as texting, updating social media, playing games, or otherwise distracting fellow students is inappropriate.

Academic Support: It is your responsibility to keep abreast of the course, to master the material covered, and to take the initiative for getting the help you need. You are encouraged to obtain help from the course instructor. However, if you miss a class, you are responsible for the missed materials. The MUSC Tutorial Program offers tutorial. For more information see the MUSG website at <http://www.mu.edu/oses/>.

Disability: If you have a disability and require accommodations, please contact me early in the semester so that your learning needs may be appropriately met. You will need to provide documentation of your disability to the Office of Disability Services. If you are unsure of what you need to qualify for services, visit the [Office of Disability Service's website](#) or call the Office of Disability Services at 414-288-1645. The office of Disability Services is also prepared to help students process accommodation requests based on medical or personal needs related to COVID-19. Please contact ODS@marquette.edu as soon as possible if you feel you may need to explore modifications related to a disability or COVID-19, even if that need may not be immediate.

Communication standards

Marquette University's policy on email: "E-mail is an appropriate and preferred method for official communication by Marquette with students unless otherwise prohibited by law. The university has the right to send official communication to students by e-mail with the assumption that students will receive, read and, if necessary, act in a timely manner based upon these e-mails."

If I need to contact you outside of class, I will use your Marquette email address, and expect that you will read and respond to this communication in a timely manner. Additionally, please recognize standard email etiquette. Initial emails to me should contain (minimally) a subject, greeting and closing.

I will attempt to respond to students within 24 hours. If you have not received a reply from me within 24 hours, please resend the email.

Since this is a fully online course, your communications with me and other students are critical to your learning experience. Please be respectful to others as you communicate. In addition to Netiquette at Marquette policy, I would like to ask you to be cautious of dominating any discussion, keep an open mind and be sure to proof read and edit prior to publishing anything to D2L.

Subject to Change Clause: This syllabus is subject to change at the discretion of the instructor to accommodate instructional and/or student needs. Such change will be announced to the class at the appropriate time.

MATH-3100

Linear Algebra

Spring 2021

Course Outlines

Course contents: The table below lists the main textbook sections and topics to be covered in class.

Chapter #	Textbook sections and topics
1	1.1 Systems of Linear Equations 1.2 Matrices & Elementary Row Operations
	1.3 Matrix Algebra 1.4 The Inverse of a Square Matrix
	1.5 Matrix Equations 1.6 Determinants
	1.7 Elementary Matrices & LU Factorization Periodic Functions
2	2.1 Vectors in \mathbb{R}^n 2.2 Linear Combinations
	2.3 Linear Independence
3	3.1 Vector Spaces 3.2 Subspaces
4	4.1 Linear Transformations 4.2 The Null Space and Range
	4.4 Matrix Representation of a Linear Transformation
5	5.1 Eigenvalues & Eigenvectors 5.2 Diagonalization
6	6.1 The Dot Product on \mathbb{R}^n 6.3 Gram-Schmit Process