Applied Linear Algebra: MATH 2002 - 64042

1 Contact Information

Professor:	Dr. Blake Farman
Phone Number:	(318) 342 - 1851
Email Address:	farman@ulm.edu
Website:	https://ulm.edu/~farman
Office:	Walker 3-34
Office Hours:	Monday/Wednesday: 8:00 AM - 11:00 AM
	12:15 PM - 12:30 PM
	1:45 PM - 3:30 PM

1.1 Preferred Method of Communication

The best way to communicate with me during the semester is through email. I monitor my email during regular business hours and try to respond within one business day.

1.2 Official University Email Addresses

The University provides each student with an email address, username@warhawks.ulm.edu, and all official course correspondence will **only** be conducted using official university email addresses.

1.3 Email Etiquette

When you send an email, your message should contain the following information

Subject:	A few words that describe the content of your email along with the course identifier (MATH 2002-64042).
Salutation:	A professional greeting such as "Dear" or "Hello" followed by the appropriate honorific and the recipient's last name.
Body:	A concise message that clearly expresses the purpose of your email.
Signature:	A simple closing (e.g. "Sincerely," "Thank you," "Best regards," etc.) followed by your first and last name.

For your convenience, included below is an example email.

> Subject: Homework Questions - Math 2002- 64042
>
> Dear Professor Farman
>
> I am having trouble with this week's homework. I have tried working through the examples in the text, but I am struggling to understand the concepts involved. Could we schedule a time to meet before the next class to discuss some of the concepts in more detail?
>
> Thank you,
>
> Jane Doe

2 Course Description

An introduction to the application of matrix algebra. Emphasis on the application of procedures and algorithms.

3   Course Prerequisites

You must have one of the following prerequisites to be eligible to be enrolled in Math 2002:

- A grade of C or better in MATH 1031 (or its equivalency), or

- A grade of C or better in MATH 1014 (or its equivalency).

4   Instructional Methods

This course is offered as a face-to-face course.

- Learning will be facilitated through face-to-face lectures and the textbook.

- Homework assignments and written assessments are to be submitted in class.

5   Evaluation

This course will use **Mastery Based Grading**. The content is broken into *standards* that you are expected to master by the end of the course.

This grading system is *iterative* in the sense that you will have multiple opportunities to display mastery of each standard, and *forgetful* in the sense that your previous unsuccessful attempts are discarded once you demonstrate mastery of a standard.

Mastering a standard is a two-step process:

1. Earn a grade of **M** on an Assessment.

2. Earn a grade of **M** on the Homework for that standard.

A description of the concepts and homework assignments that accompany each standard follows.

Systems of Equations

SE 1: I can

- identify whether or not a matrix is in Reduced Row Echelon Form,
- use Gaussian Elimination to put a matrix into Reduced Row Echelon Form,
- use the Reduced Row Echelon Form of an augmented matrix to describe the solution space to a system of linear equations using appropriate notation.

   Homework: Section 1.2.5, Exercises 1 - 2.

SE 2: I can

- use Pivot Positions to determine whether a linear system is consistent,
- determine whether the solution to a consistent linear system is unique.

   Homework: Section 1.4.4, Exercises 1 - 3.

Vectors and Matrices

VM 1: I can

- add vectors,
- scale vectors by a real number,
- determine whether a vector can be expressed as a linear combination of a set of given vectors.

    Homework: Section 2.1.4, Exercises 1, 2, 3, 5.

VM 2: I can

- add matrices,
- scale matrices by a real number,
- perform matrix-vector multiplication,
- perform matrix-matrix multiplication,
- translate a system of equations into a matrix equation of the form $A\mathbf{x} = \mathbf{b}$.

    Homework: Section 2.2.6, Exercises 1 - 6.

VM 3: I can

- determine whether a vector is in the span of a given set of vectors,
- describe the span of a set of vectors as a set,
- use the span to determine whether a linear system is consistent.

    Homework: Section 2.3.4, Exercises 1 - 5, 10.

VM 4: I can determine whether a given set of vectors is linearly independent.

    Homework: Section 2.4.5, Exercises 1, 2, 5.

VM 5: I can

- define a matrix transformation,
- find the domain and range of a matrix transformation,
- compose matrix transformations,
- determine whether a given function is a matrix transformation.

    Homework: Section 2.5.4, Exercises 1 - 4.

Invertibility and Bases

IB 1: I can

- use Gaussian Elimination to determine whether a matrix is invertible,
- find the inverse of an invertible matrix.

    Homework: Section 3.1.5, Exercises 1 - 4.

IB 2: I can

- find a basis for a space,
- translate between the coordinate systems for different bases.

    Homework: Section 3.2.5, Exercises 1 - 4.

IB 3: I can

- compute the determinant of a given matrix,
- use the determinant to determine whether a matrix is invertible.

   Homework: Section 3.4.5, Exercises 1, 3, 4, 6.

IB 4: I can

- find a basis for the null space of a given matrix,
- find a basis for the column space of a given matrix,
- determine whether a given set satisfies the definition of a vector space.

   Homework: Section 3.5.5, Exercises 1, 2, 5.

Eigentheory

ET 1: I can

- determine whether a vector is an eigenvector of a given matrix,
- find the eigenvalue associated to an eigenvector.

   Homework: Section 4.1.4, Exercises 1, 2, 5, 6.

ET 2: I can

- use the characteristic polynomial to find the eigenvalues of a given matrix,
- find the algebraic and geometric multiplicities of eigenvalues,
- find a basis for the eigenspace associated to an eigenvalue.

   Homework Section 4.2.6, Exercises 1, 2, 5.

ET 3: I can

- determine whether a given matrix is diagonalizable,
- diagonalize a diagonalizable matrix.

   Homework: Section 4.3.5, Exercises 1, 2, 7.

Orthogonality

OR 1: I can

- compute the dot product of two vectors,
- use the dot product to find the angle between two vectors,
- determine whether two vectors are orthogonal.

   Homework Section 6.1.4, Exercises 1 - 4.

OR 2: I can

- compute the transpose of a matrix,
- use the transpose to find a basis for the orthogonal complement of a given vector space.

   Homework: Section 6.2.4, Exercises 1 - 3.

OR 3: I can perform Orthogonal Decomposition.

       Homework: Section 6.3.4, Exercises 1 - 6.

OR 4: I can

- use Gram-Schmidt Orthogonalization to find an orthogonal basis for a given vector space,
- find an orthonormal basis from an orthogonal basis for a given vector space.

      Homework Section 6.4.4, Exercises 1 - 5.

5.1   Grading Scale

Letter grades will be assigned based on the number of standards mastered in the course, as specified in the table below

Grade	Number of Standards Mastered
A	17 - 18
B	15 - 16
C	13 - 14
D	11 - 12
F	0 - 10

5.2   Assessments

The weekly Assessments contain problems corresponding to the standards covered that week. The standards are graded *independently* and, unlike quizzes or tests that you may have had in the past, there is no partial credit. You must master *each* of the problems that go with the standard.

5.3   Problem Scoring

Written assessments in this course will be scored on the following scale.

Mastery:	The given solution is correct with no content related errors. Appropriate justification is provided in a clear, easy to follow manner.
Progressing:	The given solution demonstrates an understanding of the material, but contains content related errors or lacks justification.
Needs Improvement:	The given solution was blank, illegible, or used inappropriate techniques.

5.4   Reassessment

5.4.1   Homework

You may resubmit one homework set that you have not mastered each week. When reassessing, you only need to correct and resubmit the exercises with mistakes.

5.4.2   Assessments

There are four scheduled Reassessment days for this course where you have the opportunity to reassess all of the standards that you have not yet mastered. You will be given an assessment that contains problems for *every* standard that you have not yet mastered, and you may attempt as many of those standards as time allows.

6   Class Policies and Procedures

At a minimum, all policies stated in the current ULM student policy manual & organizational handbook should be followed (see http://www.ulm.edu/studentpolicy/). Additional class policies include:

6.1   Textbook

The required text for this course is *Understanding Linear Algebra* by David Austin, which is freely available:

<div align="center">

https://davidaustinm.github.io/ula/ula.html.

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6.2   Attendance Policy

Students are expected to adhere to the Class Attendance Policy outlined in the ULM Student Policy Manual.

- Class attendance is regarded as an obligation and a privilege, and all students are expected to attend all required classes in which they are enrolled regularly and punctually. Failure to do so may jeopardize a student's scholastic standing and may lead to suspension from the University. **Students are responsible for the effect absences have on all forms of evaluating course performance.**

- In accordance with University policy, the instructor will take roll regularly. It is the student's responsibility to ensure that his/her attendance is recorded. To be marked present for a given class period, students must stay until the class is completed.

- Each student is responsible for all class material and assignments whether or not the student is present. If a student misses class, then he/she is expected to check Moodle and ULM email for announcements and to work on the assignments listed on Moodle.

- A student accumulating absences of 25% of the class meetings regardless of the reasons (excused or unexcused) will be reported to the Dean of Arts, Education, & Sciences which could result in academic withdrawal from the course or a course grade of F. This may be avoided if the course is dropped; however, it is the responsibility of the student to drop the course. Class removal carries with it the penalties of being assigned a grade of W or F, whichever is appropriate, and no credit for the course. Academic withdrawal may negatively impact a student's full-time status.

- If a student comes to class late, it is his/her responsibility to let the instructor know after class to be counted present and to receive the appropriate attendance credit.

- University Excuses: Any University-related activity requiring an absence from class will count as an absence when determining if a student has met the minimum attendance requirement.

6.3   Make-up Policy

In the event of a missed assessment due to absence, the student will be provided an opportunity to reassess on the next Reassessment day.

6.4   Academic Integrity

Faculty and students must observe the ULM published policy on Academic Dishonesty (see the ULM Student Policy Manual – http://www.ulm.edu/studentpolicy/).

Any student caught turning in work that is not their own will receive an F in the course.

6.5   Course Evaluation Policy

At a minimum, students are expected to complete the online course evaluation.

7 Academic Services

8 Student Services

You can find information about the following available ULM student services at the websites listed below.

- Student Success Center (http://www.ulm.edu/cass/).

- Counseling Center (http://www.ulm.edu/counselingcenter/).

- Special Needs (http://www.ulm.edu/counselingcenter/special.htm).

- Library (http://www.ulm.edu/library/referencedesk.html)

- Computing Center Help Desk (http://www.ulm.edu/computingcenter/helpdesk)

Additional information can be found on The Student Services web site (http://www.ulm.edu/studentaffairs/).

8.1 Disability Accommodations

The University of Louisiana at Monroe strives to serve students with special needs through compliance with Sections 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act. These laws mandate that postsecondary institutions provide equal access to programs and services for students with disabilities without creating changes to the essential elements of the curriculum. While students with special needs are expected to meet our institution's academic standards, they are given the opportunity to fulfill learner outcomes in alternative ways. Examples of accommodations may include, but are not limited to, testing accommodations (oral testing, extended time for exams), interpreters, relocation of inaccessible classrooms, permission to audiotape lectures, note-taking assistance, and course substitutions.

Current policies on serving students with disabilities can be obtained from the ULM website: http://ulm.edu/counselingcenter/. If you need accommodation because of a known or suspected disability, you should contact the director for disabled student services at:

- Voice phone: (318) 342 - 5220

- Fax: (318) 342 - 5228

- Walk In: ULM Counseling Center, 1140 University Avenue (this building and room are handicapped accessible).

If you have special needs of which I need to be made aware, you should contact me within the first two days of class.

8.2 Mental Wellness

If you are having any emotional, behavioral, or social problems, and would like to talk with a caring, concerned professional please call one of the following numbers:

- The ULM Counseling Center (318) 342 - 5220

- The Marriage and Family Therapy Clinic (318) 342 - 9797

- The Community Counseling Center (318) 342 - 1263.

8.3 Title IX

Title IX of the Education Amendments of 1972 prohibits sex discrimination against any participant in an educational program or activity that receives federal funds, including federal loans and grants. Furthermore, Title IX prohibits sex discrimination to include sexual misconduct, sexual violence, sexual harassment and retaliation. If you encounter unlawful sexual harassment or gender-based discrimination, please contact Student Services at (318) 342 - 5230 or to file a complaint, visit www.ulm.edu/titleix.

Remember that all services are offered free to students, and all are strictly confidential.

8.4   Emergency Procedures

The emergency number for the ULM Police Department is (318) 342 - 5350 and should be used for emergency calls. If the campus police are contacted about an emergency for a student, they will go to the student's class to inform the student.

8.5   Discipline / Course Specific Policies

Any policies given here may be altered by the professor if deemed necessary. If this occurs, ample notice will be given.

8.6   FERPA

Do not email or call your professor regarding your course grades. The Family Education Rights and Privacy Act (FERPA) prohibits your professor from discussing your grade in any manner except in person. Please do not have family members, friends, or anyone else contact your professor about your grade as FERPA prohibits your professor from sharing that information with them.

9   Tentative Course Schedule

9.1   Contact Information

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Week 1

Day	Date	Standard Covered
Thu	1/12	Systems of Equations 1

Week 2

Day	Date	Standard Covered
Tue	1/17	Computation with Sage
Thu	1/19	Systems of Equations 2

Week 3

Day	Date	Standard Covered
Tue	1/24	Vectors and Matrices 1
Thu	1/26	Vectors and Matrices 2

Week 4

Day	Date	Standard Covered
Tue	1/31	Vectors and Matrices 3
Thu	2/2	Vectors and Matrices 3

Week 5

Day	Date	Standard Covered
Tue	2/7	Vectors and Matrices 4
Thu	2/9	Vectors and Matrices 5

Week 6

Day	Date	Standard Covered
Tue	2/14	Review
Thu	2/16	Reassessment 1

Week 7

Day	Date	Standard Covered
Tue	2/21	*No Classes - Mardi Gras Break*
Thu	2/23	Invertibility and Bases 1

Week 8

Day	Date	Standard Covered
Tue	2/28	Invertibility and Bases 2
Thu	3/2	Invertibility and Bases 3

Week 9

Day	Date	Standard Covered
Tue	3/7	Invertibility and Bases 4
Thu	3/9	Eigentheory 1

Week 10

Day	Date	Standard Covered
Tue	3/14	Eigentheory 2
Thu	3/16	Eigentheory 3

Week 11

Day	Date	Standard Covered
Tue	3/21	Review
Thu	3/23	Reassessment 2

Week 12

Day	Date	Standard Covered
Tue	3/28	Orthogonality 1
Thu	3/30	Orthogonality 2

Week 13

Day	Date	Standard Covered
Tue	4/4	Orthogonality 2
Thu	4/6	Orthogonality 3

Week 14

Day	Date	Standard Covered
Tue	4/11	*No Classes - Spring Break*
Thu	4/13	*No Classes - Spring Break*

Week 15

Day	Date	Standard Covered
Tue	4/18	Orthogonality 3
Thu	4/20	Orthogonality 4

Week 16

Day	Date	Standard Covered
Tue	4/25	Review
Thu	4/27	Reassessment 3

Week 17

Day	Date	Standard Covered
Tue	5/2	Review

Finals Week

Dates	Assessment	Standards Covered
Thu 5/4 3:00 PM - 4:50 PM	Final Reassessment	Cumulative