

MAT318– Linear Algebra (Spring 2025) Course Syllabus

Instructor

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Student Consultation Hours: 9:30-11:30 on TR and 10-11 on W

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Important Sites

D2L <https://d2l.ship.edu>

Zoom Office Hours <https://ship.zoom.us/j/94338091000>(by appointment)

Course Materials

D2L provides links to videos, notes, and homework.

Textbook: *Linear Algebra and its applications, 4th edition*, by David C. Lay, Addison Wesley

Reference book: [*Elementary Linear Algebra*](#) by James Hamblin

Calculator: TI-83/84 will be allowed.

Course Description

This course is an introduction to the study of matrices and linear systems, covering elementary row operations, row reduced echelon forms, matrix operations, determinants, vector spaces, the geometry of linear operators, linear transformations, linear independence, span, bases, eigenvalues, eigenvectors, diagonalization, etc..

Prerequisite: Grade of C or better in MATH212 or MATH225.

If you feel you're in the wrong course, please contact the Mathematics Department secretary (math@ship.edu) as soon as possible. **Your schedule can be changed only during the first week of class.**

Tentative Schedule

Exam 1: Thursday of February 20

Exam 2: Thursday of April 10

Final: To be announced (it will be on the final week, and cumulative)

Tutoring

Free, drop-in or appointment-required Learning Center Tutoring at Mowrey

Grading

Your grade will be based on your notes, homework, quizzes, and a cumulative Final. I will use the following grading scheme:

Class Activities	10%	Attendance +Note Submission+ Quizzes
Homework	20%	Online and Offline homework
Exams	70%	Exam1, 2, & Final (each 30%) + Online Quiz (10%)

At the end of the course, I will assign grades based on the following scale:

Percentage	90 -100	87-89	84-86	80-83	77-79	74-76	70-73	60-69	0-59
Final Grade	A	A-	B+	B	B-	C+	C	D	F

Expectations

In each face-to-face class, you will receive notes with many blanks that you are supposed to fill in during each class time period.

If you miss any class, please find **study materials (book, notes, videos) in d2l and contact me** immediately if you need any additional assistance.

Homework: Online Homework should be submitted by due date. Paper Homework should be turned in before the beginning of the class on each due date. During/after the class, even if it is the same day, no homework will be accepted. *All should be typed or written neatly and stapled, and the problems should appear in numerical order.*

Lab Activities: If there is no instruction forward, all the computer monitors are to be maintained as OFF. In each lab class, there will be a specific instruction for the usage of computers and programs. If you are found to use computer not on the given purpose, one point will be deducted from your class activity score (possibly multiple points for the same person can be deducted in the same class time). Especially, using internet is strongly prohibited.

Make-ups: There will be no make-ups for the quizzes/tests, without providing proper third-party documentation for your absence (a letter from your coach, a form from the Dean, a memo from your doctor, etc.). To have a make-up, it is your responsibility to contact me immediately, at least 3 hours before the following class time, in order to make a schedule for time and place.

Tentative Course Calendar

Adjustments and updates to the course schedule, due to inclement weather or other unforeseen events, will be announced in class.

Wk	Section and Topic	STUDENT LEARNING OBJECTIVES - TSWBT (the student will be able to):	Assignments
1	1.1 Systems of linear Equations	<ul style="list-style-type: none"> Interpret the words: systems of linear equations, solution sets, equivalent, in/consistent, elementary row operations, augmented matrix Transform a system of linear equations to its augmented matrix Apply elementary row operations to reduce matrices Find a solution of a linear system from its corresponding reduced matrix Demonstrate that a linear system has no solutions, exactly 1 solution, or infinitely many matrix 	<p>HW for each section</p> <p>Quiz for each week</p>
	1.2 Row Reduction and Echelon Forms	<ul style="list-style-type: none"> Identify a given matrix in Echelon form or Reduced Echelon form (RREF) Demonstrate that every matrix has a unique RREF Find the RREF of a given matrix using any TI calculator and Mathematica Identify pivot, pivot positions, pivot columns in a matrix Using basic variables and free variables to express infinitely many solutions of a linear system 	
2	1.3 Vector Equations	<ul style="list-style-type: none"> (Review) Find a scalar multiple of vectors and a sum of vectors algebraically and geometrically Rephrase the algebraic properties of vector space Identify and solve a vector equation using the RREF of the augmented matrix corresponding to the system of linear equations Interpret the set spanned by vectors and linear combination of vectors algebraically and geometrically 	
	1.4 The Matrix Equations	<ul style="list-style-type: none"> Identify and solve a matrix equation using the RREF of the augmented matrix corresponding to the system of linear equations Interpret and Rephrase the equivalences in Theorem 4 and provide a sketch of proof Determine if a statement related to Theorem 4 is true or false and justify it 	
3	1.5 Solution sets of linear systems	<ul style="list-style-type: none"> Tell a given linear system is homogeneous or non-homogeneous Recognize basic variables and free variables Express the solution set for a linear system in a parametric vector form Compare the solution set of non-homogeneous system and its associated homogeneous system Restate the theorem related to the solution set of the homogeneous and non-homogeneous system Provide a geometric interpretation of the solution set for a linear system with 2 or 3 variables 	
	1.7 Linear Independence	<ul style="list-style-type: none"> Restate the definition of linear independence and dependence Use the definition or tips to recognize linear in/dependence in a vector set or columns of a matrix 	
4	1.8 Introduction to linear transformation	<ul style="list-style-type: none"> Review domain, codomain, and range Differentiate transformations, linear transformations, and matrix transformations Find the dimension of domain, codomain, range 	
	1.9 The matrix of linear transformation	<ul style="list-style-type: none"> Find the standard matrix for a linear transformation Determine if a given linear transformation or matrix transformation is one-to-one mapping or not. 	
5		<ul style="list-style-type: none"> Exam Review Exam 	Exam 1 – Thursday 2/20
6	2.1 Matrix operation	<ul style="list-style-type: none"> Identify the ith column and jth column of a matrix and describe diagonal matrices Judge if an addition, subtraction, multiplication of two matrices is possible and if so, perform it Compare the properties of real number system and matrix system and tell the difference Transpose a matrix and comprehend and apply the properties of transposition Use the definition to find an inverse or to prove a statement or property Use the formula to find an inverse of a 2×2 matrix Find the elementary matrix for any elementary row operation 	

	2.2 Inverse of a matrix	<ul style="list-style-type: none"> • Discuss the proof for the theorem: the invertible matrix is row equivalent to I • Use elementary row operations to find an inverse 	
7	2.3 Characterizations of invertible matrices 3.1 Introduction to determinants	<ul style="list-style-type: none"> • Discuss the equivalent statements regards to invertible matrices • Determine if a statement related to invertible matrices is true or false and justify it • Identify submatrices and cofactors regards to the notation • Use the definition to find the determinant of a matrix • Use cofactors to find the determinant of a matrix • Use diagonal entries of a triangular matrix to find the determinant 	
8	3.2 Properties of determinants 4.1 Vector spaces and subspaces	<ul style="list-style-type: none"> • Compute the determinant of a matrix using elementary row operations • Find the determinant of a product of matrices and transpose of a matrix • Read the definition of vector spaces and see the examples • Demonstrate and use the definition of subspaces and use it to show a subset is not a subspace of a vector space • Express a subset as a set spanned by vectors in a vector space to show it is a subspace 	
9	4.2 Null spaces, column spaces, and linear transformation 4.3 Linear independent sets; basis	<ul style="list-style-type: none"> • Find a null space and column space of a matrix, and identify its dimensions • Determine if a vector is in the null space or column space of a matrix • State the definition of a linear transformation, and find the kernel and range of a linear transformation • Use the definition of basis to determine if a set of vectors is a basis or not for a vector space • Find the basis for column spaces and null spaces 	
10	4.4 Coordinate systems 4.5 The dimension of vector spaces 4.6 Rank	<ul style="list-style-type: none"> ▪ Find coordinates according to a given basis ▪ Read the theorems related to basis to build the definition of dimensions ▪ Find a geometric interpretation of a subspace of R^3 ▪ Restate Rank Theorem and apply rank theorem to solve a story problem ▪ Discuss more equivalent statements to invertible matrices 	
11		<ul style="list-style-type: none"> ▪ Exam Review ▪ Exam 	Exam 2 – Thursday 4/10
12	5.1 Eigenvectors and Eigenvalues 5.2 The characteristic equation	<ul style="list-style-type: none"> • State the definition of Eigenvectors, Eigenvalues, and Eigen space and discuss why we study them • Use the characteristic equation to find Eigenvalues • Describe what it means by two matrices are similar 	
13	5.3 Diagonalization	<ul style="list-style-type: none"> ▪ Discuss why diagonalization is important ▪ Determine if a matrix is diagonalizable or not ▪ Diagonalize a matrix if possible 	
14	Review	<ul style="list-style-type: none"> • Review for final 	
16	Final	<ul style="list-style-type: none"> • Final date will be announced later. The exam will be commutative. 	Final Exam

Course Syllabus Language for Faculty

Title IX Reporting Requirements

Shippensburg University of Pennsylvania and its faculty are committed to assuring a safe and productive educational environment for all students. To comply with the requirements of Title IX of the Education Amendments of 1972 **based on the 2020 Regulations** and the university's commitment to offering supportive measures in accordance with the 2020 regulations issued under Title IX, Shippensburg University of Pennsylvania requires faculty members to report incidents of sexual violence shared by students to the university's Title IX Coordinator, Dr. John Burnett [JABurnett@ship.edu] or [Title9@ship.edu]. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a university-approved research project. **Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred to the person designated in the university's Protection and Supervision of Minors on Campus Policy.**

Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence are available on the Office of Human Resources website:

https://www.ship.edu/about/offices/hr/title_ix_statement/

Reports may be made to the following individuals:

Dr. John Burnett
Title IX Coordinator
Office of Human Resources
Old Main 106-A
Shippensburg, PA 17257
771-477-1323
Cell: 724-317-6415
Email: JABurnett@ship.edu

Nipa Browder
Deputy Title IX Coordinator
Office of Human Resources
Ph: 717-477-1124
Email: Nbrowder@ship.edu

Jennifer Milburn
Deputy Title IX Coordinator
Housing/ResLife/Conferences
Ph: 717-477-1904
Email: JSMilburn@ship.edu

Trejon Dinkins
Deputy Title IX Coordinator
Retention and Student Success
Ph: 717-477-1123 x3027
Email: TADinkins@ship.edu

Alix Rouby
Deputy Title IX Coordinator
Career Center
Ph: 717-477-1595
Email: AJRouby@ship.edu

Mary Burnett
Deputy Title IX Coordinator
International Programs
Ph: 717-477-1279
Email: MEBurnett@ship.edu

Link for the online reporting form: (This is for reporting an issue, not making a formal complaint)

https://cm.maxient.com/reportingform.php?ShippensburgUniv&layout_id=3

Link for the Formal Complaint form:

https://cm.maxient.com/reportingform.php?ShippensburgUniv&layout_id=21

Link for campus resources:

https://www.ship.edu/about/offices/hr/title_ix_statement/resources/