

MATH 265 LINEAR ALGEBRA  
WINTER 2022 (Jan 4 – Mar 11)

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Class Time: MTWR 12:00 - 12:50 PM

Office Hours: MTWT 9:00 --10:00 AM or appointment

Office: Samuelson 218J

Classroom: Samuelson 244

Hello! You are welcome to the MATH 265 Linear Algebra course.

**TEXTBOOK: zyBook: Math 265: Linear Algebra (zyBook code: CWUMATH265UpretreeWinter2022)**

Note: You need to subscribe textbook. A subscription is \$58 for Winter 202. To access this book please follow the following steps:

1. Sign in or create an account at [learn.zybooks.com](http://learn.zybooks.com)
2. Enter zyBook code: **CWUMATH265UpretreeWinter2022**
3. SubscribezyBook

**PREREQUISITES:** Math 173 with a grade of C or higher

**COURSE CONTENT:** This course will cover solving a system of linear equations, matrix operations, properties of determinants, vector space, linear transformations, eigenvalue, and eigenvectors.

**COURSE OUTCOMES:** At the end of the Math 265-course students will be able to:

- Solve systems of linear equations.
- Perform basic matrix operations.
- Determine and use vector space properties.
- Translate information between the context of systems of equations, coefficient matrices, and the domain and range of a linear transformation.
- Solve problems requiring the use of eigenvalues and eigenvectors.

***Chapter 1: System of linear equations***

System of linear equations, matrices, and linear systems. elementary row operations, echelon form of a matrix, solution set of a system of linear equations, Gauss-Jourdan elimination.

***Learning Outcomes***

The students will be able to:

- Identify a linear equation.
- Determine whether an n-tuple is a solution to a system of linear equations.
- Identify the size & types of matrices.
- Find the transpose & trace of a matrix.
- Perform elementary row operations on a matrix and the corresponding system of equations.
- Identify the pivot positions and pivot columns in a matrix in echelon or reduced echelon form.
- Perform Gaussian elimination to convert a matrix into an echelon form.
- Use Gauss-Jordan elimination to solve a system of equations.

## ***Chapter 2: Matrix and Determinants***

Matrix addition and scalar multiplication, matrix multiplication, matrix equations and linear systems, the inverse of a matrix, solving a system using an inverse matrix, elementary matrices. Introduction to determinants, cofactor expansions, application: area and volume, properties of determinants, invertibility, and determinants, Cramer's rule.

### ***Learning Outcomes***

The students will be able to:

- Perform scalar multiplication, matrix addition & subtraction.
- Identify and use properties of matrices and scalar multiplication.
- Identify properties of matrix multiplication.
- Represent a system of linear equations using a matrix equation.
- Identify whether two given matrices are inverses
- Use an inverse matrix to solve a system of linear equations.
- Use elementary matrices to perform Gaussian elimination.
- Find the determinant of a 3 by 3 matrix.
- Identify minors and cofactors of matrix entries.
- Use determinants to find the area and volume.
- Use Cramer's rule to solve systems of equations.

## ***Chapter 3: Vector Space***

Introduction to vectors, vector operations, dot product, cross product, vector spaces and subspaces, independence and dependence, basis and dimension.

### ***Learning Outcomes***

The students will be able to:

- Find a position vector given an initial and terminal point.
- Find the magnitude of a vector.
- Interpret addition and subtraction of vectors geometrically using the parallelogram rule.
- Find a unit vector.
- Find the vector & scalar projection of a vector onto another vector.
- Use a triple scalar product to calculate the volume of a parallelepiped and determine whether vectors are coplanar.
- Identify whether a set of vectors is independent or dependent.
- Find a minimal spanning set for a subspace spanned by a set.
- Find a basis for a subspace defined by the span of a set.
- Identify whether a given set is a subspace.

## ***Chapter 4: Transformations, Eigenvalues, and Eigenvectors***

Linear transformations between Euclidean spaces, rank, and nullity of a linear transformation, composition of linear transformations, general linear transformations, eigenvalues, and eigenvectors.

### ***Learning Outcomes***

The students will be able to:

- Use matrices to express linear transformations.
- Use properties of matrix transformations.

- Determine the null space and range of a linear transformation.
- Identify the rank and nullity of a linear transformation.
- Identify and use properties of the rank and nullity of a transformation.
- Calculate composition on linear transformations.
- Determine whether a linear transformation has an inverse.
- Find the inverse of a linear transformation, if the inverse exists.
- Derived the standard matrix for a given transformation.
- Use the characteristic equation to find the set of all eigenvalues (or spectrum) of a square matrix.
- Find the eigenvalues and eigenvectors for a given linear transformation.

REQUIRED CALCULATOR: A scientific calculator is required.

IMPORTANT DATES:

First Class: Jan 4

Class End: Mar 11

Martin Luther King Jr. holiday: Jan 17 - No Class

Presidents Day: Feb 21 – No Class

Study Day: Mar 14

Midterm Exam One: Feb - 10

Midterm Exam Two: Mar- 02

Comprehensive Final Exam: Update later

EVALUATIONS:

Class Participation:	5%
Weekly Assignments:	30%
Midterm Exam One:	20%
Midterm Exam Two	20%
Comprehensive Final Exam:	25%

Note: Class attendance is required. In the Class Participation, I expect your active involvement while discussing in the classroom.

GRADING SCALE (MINIMUM CUTOFFS):

A	A-	B+	B	B-	C+	C	C-	D+	D	D-	F
93	90	87	83	80	77	73	70	67	63	60	below 60

HOW TO SUBMIT WORK: You'll scan the document and resubmit online. ***The submission must be legible and oriented correctly for me to read it on the computer.*** To accomplish this you can:

- You can edit the PDF and resubmit that - rather than printing to begin with, <https://type-on-pdf.com/>
- You can scan the document to a PDF document using a cell phone camera. Some apps that do this (you can do a Google search to find more apps if you don't like these!) Android: Adobe (free), CamScanner (free version) iPhone: use the built-in Notes App, CamScanner (free version).

- You can take a well-lit, easy-to-read photograph, insert it into a *Microsoft Word* or *OpenOffice Writer* document so that you make sure the photo is oriented correctly and easy to read, then save the document as a PDF file for upload to Canvas.

## DAILY ACTIVITIES

Class (Date)-Day	Content	Assignment Due
01-04-2022	Systems of linear equations	
01-05-2022	Matrices and linear systems	
01-06-2022	Elementary row operations	HW 1 Due
01-10-2022	Echelon forms of a matrix	
01-11-2022	Solution set of a system of linear equations	
01-12-2022	Gaussian elimination	
01-13-2022	Gauss-Jordan elimination	HW2 Due
01-18-2022	Matrix addition and scalar multiplication	HW 3 Due
01-19-2022	Matrix multiplication	
01-20-2022	Matrix equations and linear systems	HW4 Due
01-24-2022	Inverse of a matrix	HW 5 Due
01-25-2022	Solving a system using an inverse matrix	
01-26-2022	Elementary matrices	
01-27-2022	LU decomposition	HW 6 Due
01-31-2022	Introduction to determinants	HW 7 Due
02-01-2022	Cofactor expansions	
02-02-2022	Application: Area and volume	
02-03-2022	Invertibility and determinants	HW 8 Due
02-07-2022	Cramer's rule	HW 9 Due
02-08-2022	Introduction to vectors	
02-09-2022	Exam 1 Review	
02-10-2022	Exam 1	HW 10 Due
02-14-2022	Vector operations	
02-15-2022	Dot product	
02-16-2022	Cross product	
02-17-2022	Vector spaces and subspaces	HW 11 Due
02-22-2022	Linear independence and dependence	HW 12 Due
02-23-2022	Basis and dimension	
02-24-2022	Linear transformations between Euclidean spaces	
02-28-2022	Rank and nullity of a linear transformation	HW 13 Due
03-01-2022	Exam 2 Review	
03-02-2022	Exam 2	
03-03-2022	Composition of linear transformations	HW 14 Due
03-07-2022	General linear transformations	HW 15 Due

03-08-2022	Eigenvalues and eigenvectors	
03-09-2022	Problem Solving: Eigenvalues and eigenvectors	HW 16 Due
03-10-2022	Final Exam Review	

EMAIL CORRESPONDENCE: I will respond to student communications during business hours (M-F, 8 am-5 pm). You can typically expect a reply within approximately 24 hours, not including weekends. If you email me with questions about specific problems, I can be more helpful if you send pictures of what you've tried so far.

HOMEWORK: Each week two homework will be assigned, and due dates will be announced in the Canvas. I will select homework problems from the textbook. Students are encouraged to discuss with friends but do not copy others' work directly. If I find identical solutions, then both parties will get zero points. Your work should be clear, in a logical order, and provide sufficient explanation. You must upload a single pdf file of the homework into Canvas or may submit your work in the classroom.

EXAM POLICY: There will be two midterm exams and one comprehensive final exam. All exams are cumulative. You will be allowed to use a one-page formula sheet for each exam.

#### TIME INVESTMENT REQUIREMENT:

The information listed below illustrates the total investment of time by an average student to achieve the learning goals of the course. (30 hours/credit x 5 = 150 hours)

The amount of time that an average student should expect to spend on this class is as follows:

- 50 hours - Time spent in the classroom, online instruction, taking exams and doing worksheets, etc.
- 100 hours - Time for preparation and study for in-class worksheets, homework, monthly and final exams, discussion during office hours.

#### COURSE POLICIES

#### COVID-19 STATEMENT

In compliance with Governor Inslee's Proclamation 20-12.4 and Proclamation 21.14.1, CWU has made obtaining a vaccination an urgent priority. CWU administration, with advice from the Kittitas County Public Health Department, believes a fully vaccinated community is the best way to protect our individual and collective health and safety.

Additionally, it is only through widespread vaccinations that CWU can begin to loosen or remove restrictions that have impacted social and mental well-being and increase access to a more complete in-person campus living and learning experience for more students.

#### FACE COVERING POLICY WINTER 2022

Face coverings will continue to be required inside all campus facilities during the winter quarter, as well as outside for large gatherings. CWU strongly recommends N95/KN95 masks, which have been found to be more effective than other face coverings against the spread of the omicron variant, according to the Centers for Disease Control and Prevention.

All members of the campus community are required to wear face coverings inside all campus buildings through the end of the winter quarter in March 2022. The policy will be evaluated following the advice of public health officials. If you have questions, please read the CWU face-covering policy (<https://www.cwu.edu/resources-reports/CWUP%202-40-145%20face-covering>). Ellensburg employees and students may collect free masks at the Student Union and Recreation Center (SURC).

#### MENTAL HEALTH STATEMENT:

*“Stress and other life circumstances that may be out of your control can make learning and focusing difficult. If you find stress or other mental health concerns make academics difficult, Central has resources to support you. I encourage you to reach out as soon as you notice you’re struggling.”*

#### RESOURCES FOR STUDENTS:

*CWU Counseling Center:* <https://www.cwu.edu/medical-counseling/counseling-clinic>

*Mental Health Crisis Support outside normal business hours:* 1-800 – 273 - 8255, Text HOME to 741741 or call 911.

*Wellness Center:* <https://www.cwu.edu/wellness/> 509-963 -3213

*Student Rights and Responsibilities:* <https://www.cwu.edu/student-rights/office-student-rights-responsibilities>

CENTRAL WASHINGTON UNIVERSITY COVID-19 REPORTING FORM: available on <http://cwu.edu/student-success/covid-form>

#### POLICY ON ACADEMIC DISHONESTY:

Students are on their honor to follow the student conduct code as outlined in the Washington Administrative Code. Violations of this section will result in a failing grade in the course in addition to further possible university sanctions. (See <http://apps.leg.wa.gov/WAC/default.aspx?cite=106-125> )

#### POLICY ON DIVERSITY:

University-level education is about broadening horizons and looking at academic issues from a variety of perspectives. With this in mind, the participants in this class are encouraged to bring their own life experiences and viewpoints to bear on classroom discussions and assignments. Along with the freedom to express one's views comes the responsibility to respect the views of others. No student will be discriminated against based on race, ethnicity, age, creed, religion, gender, sexual orientation, marital status, or political ideology.

#### DISABILITY SERVICES:

Central Washington University is committed to creating a learning environment that meets the needs of its diverse student body. If you anticipate or experience any obstacles to learning, contact Disability Services to discuss a range of available options. Student Disability Services is located in Hogue 126. Call (509) 963-2214 or email [ds@cwu.edu](mailto:ds@cwu.edu) for more information. (see <https://www.cwu.edu/disability-services/> )

#### SUBMITTING ELECTRONIC FILES:

All electronic files must be submitted in .doc, .docx or .pdf format. If you don't have Microsoft Office, you can download it for free, using your CWU email and password from the MS Office website. Here is the guide on (<https://cwu.teamdynamix.com/TDClient/2015/Portal/KB/ArticleDet?ID=9080>), how to download MS Office. Mac users make sure to save documents with visible extension (.docx or .rtf).

**RELIGIOUS HOLIDAY ABSENCES:** In compliance with RCW 28B.137.010, CWU makes every effort to deal reasonably and fairly with students who, because of religious obligations, have conflicts with scheduled exams, assignments, or required attendance. Students must present written notice to their instructor within the first two weeks of the class listing the specific dates on which accommodations are required. Contact the Dean of Student Success at (509) 963-1515 for further information or questions.

I reserve the right to change the policies contained in this syllabus as dictated by developments during the quarter.