

# Linear Algebra - Math 304

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Spring 2023 -- Course Coordinator: Quincy Loney

Sec	Instructor	Office	Email(*)	Meets	Room
1	Sarah Lamoureux	WH-326	Lamoureux	MWF: 8:00-9:30	OH-G102
2	Luke Elliott	WH107	Elliott	MWF: 8:00-9:30	CW-204
3	Quincy Loney	WH-332	Loney	MWF: 9:40-11:10	WH-G002
4	Wei Yang	WH-326	Yang	MWF: 11:20-12:50	AA-G007
5	Quincy Loney	WH-332	Loney	MWF: 11:20-12:50	WH-G002
6	Sarah Lamoureux	WH-326	Lamoureux	MWF: 1:10-2:40	CW-321
7	Quincy Loney	WH-332	Loney	MWF: 2:50-4:20	WH-G002
8	Thomas Zaslavsky	WH-216	Zaslavsky	MWF: 4:00-5:30	LH-005

(\*): To send an email to your instructor, click on the link in the Email column of the table.

Below is a partial syllabus with information for all sections that you should know. Your instructor may have a more detailed syllabus about how your section will be run.

## Textbook (Required)

The [Math 304: Linear Algebra](#) zyBook for Spring 2023. To purchase the zyBook for your section:

1. Sign in or create an account at [learn.zybooks.com](https://learn.zybooks.com) using your [binghamton.edu](mailto:binghamton.edu) e-mail address.
2. Enter the zyBook code given to you by your instructor.
3. Subscribe for \$58.

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## Additional Textbooks and Resources (Supplemental)

Here are a few additional books that students and instructors may find helpful.

Linear Algebra by Jim Hefferon. One can access additional free resources at the textbook's official website.

A First Course in Linear Algebra by Robert A. Beezer

Elementary Linear Algebra by K.R. Matthews

Linear Algebra by D. Cherney, T. Denton, R. Thomas, and A. Waldron

There are also resources for Linear Algebra on the internet, which may supplement the textbook and homework. For example, the following link takes you to a free website with exercises and feedback on your answers: [MathMatize](#) by Jonathan Herman

Three evening exams during the semester, and a Final Exam during final exams week, will be scheduled. Details are as follows:

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Exam 1: Wednesday, February 15, LH-1, 8:15-9:45 PM

Exam 2: Wednesday, March 15, LH-1, 8:15-9:45 PM

Exam 3: Wednesday, April 26, LH-1, 8:15-9:45 PM

Final Exam: Tuesday, May 09, LH-1, 8:00-10:00 AM

**Anyone with a final exam conflict must contact their instructor to make an arrangement.**

Please arrive 10 minutes early for each exam to allow time for seating, and always bring your university ID. No calculators, cellphones or computers will be allowed during exams. A student who needs to leave the exam room during an exam must leave their cellphone in the room. Use of a cellphone to get answers to exam questions during an exam is cheating and will be treated as a violation of university honesty rules.

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## Grades

The course total will be determined as follows:

Quizzes: 15% (Quizzes should be given approximately once per week except in weeks when an exam is given.)

Exam 1: 15%

Exam 2: 15%

Exam 3: 15%

Final Exam: 30%

zyBook Assignments: 10% (Participation Activities (orange): 5% & Challenge Activities (blue) 5%)

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**Important:** Besides the zyBook Participation and Challenge Activities, you should do the Additional Exercises (black) at the end of each section. This will not be graded, but it could be important to your success in the course.

Quizzes are important for students to keep up with the progress of the course and to provide timely feedback on how the material is being absorbed. By ``Assessment Day'' enough quizzes should have been taken to evaluate each student's progress and make a risk assessment for early warning about problems.

At the end of the course, your grade in the course will be determined by your instructor based on your course total and the following approximate scale. (Borderline cases will be decided by other factors such as attendance or participation.)

A 90%, A- 85%, B+ 80%, B 75%, B- 70%, C+ 65%, C 55%, C- 50%, D 45%

## Health and Safety Procedures Due to COVID Pandemic

Binghamton University follows the recommendations of public health experts to protect the health of students, faculty, staff and the community at large. Safeguarding public health depends on each of us strictly following requirements as they are instituted and for as long as they remain in force. Health and safety standards will be enforced in this course.

Current rules make face coverings optional, but when they are worn, they should completely cover **both the nose and mouth** while indoors (unless they are eating or alone in a private space like an office). A face shield is not an acceptable substitute. Classroom safety requirements will continue to be based on guidance from public health authorities and will be uniformly applied across campus. If these requirements change, a campus-wide announcement will be made to inform the University.

## Expected workload

You are expected to spend about 12.5 hours per week on average for this class, including in-class lectures, watching instructional videos, solving homework problems (graded and ungraded), reviewing the material, and preparing for the tests. Expect the work load to be higher than average in the weeks before the exams.

## Expected behavior in class

During classes all students are expected to participate in a way that maximizes their learning and minimizes disruptions for their classmates. If you have any concerns, limitations, or circumstances, please communicate with your instructor to find the most appropriate solution.

## Academic Code of Honor

For all graded assignments and exams, you are not allowed to use any help not explicitly authorized by your instructor. This includes, but is not limited to, problem-solving websites, notes, help from other people, etc. All instances of academic dishonesty will be investigated, penalized, and referred to the appropriate University officials for maximal possible punishment. **Cheating will not be tolerated.**

## Getting Help

If you fall behind in class, or need extra help to learn the material, talk to your instructor as soon as you can. They should be able to help you and also point you to other resources. We also encourage you to talk to your classmates, and, in particular, to form informal study groups to prepare for the exams.

## Disability Information

If you have a disability for which you are or may be requesting an accommodation, please contact both your instructor and the Services for Students with Disabilities office (119 University Union, 607-777-2686) as early in the term as possible. Note: extended time for the examinations may require special scheduling.

## Suggested problems from our supplemental textbooks

The table below contains suggested problems from sections of our additional textbooks in the format “Chapter:Section.Subsection.ProblemNumber”. Your instructor may suggest other problems or exercises. **These problems are for practice only and are not to be turned in.**

The order in which material is presented in class meetings will be determined by your instructor, and may not precisely follow the order of topics below.

Topics	Text	Problems
Introduction, preview, examples; linear combination	Hefferon Ch. 1, I.1	1:I.1.17,19,21
Gaussian elimination (reduction)	Hefferon Ch. 1, I.1	1:I.1.22,24,27,32
(Augmented) matrix of a system, solution set	Hefferon Ch. 1, I.2	1:I.2.15,16,17,18,21,25
Basic logic: statements, connectives, quantifiers	Hefferon Appendix	
Set theory, general functions	Hefferon Appendix	
Homogeneous and non-homogeneous systems (no formal induction in Lemma 3.6)	Hefferon Ch. 1, I.3	1:I.3.15,17,18,20,21,24
Points, vectors, lines, planes	Hefferon Ch. 1, II.1	1:II.1.1,2,3,4,7
Distance, dot product, angles, Cauchy-Schwarz and Triangle Inequalities	Hefferon Ch. 1, II.2	1:II.2.11,12,14,16,17,21,22
Gauss-Jordan reduction, reduced row echelon form	Hefferon Ch. 1, III.1	1:III.1.8,9,10,12,13,14,15
Linear combination lemma, uniqueness of RREF (no proofs of 2.5, 2.6)	Hefferon Ch. 1, III.2	1:III.2.11,14,20,21,24
Matrix operations, including the transpose. Linear system as a matrix equation	Matthews 2.1	3:III.1.13,14,15,16
Linear maps (transformations) given by matrices	Matthews 2.2	3:III.1.19; 3:III.2.12,17,30
Vector spaces: definition, examples	Hefferon Ch. 2, I.1	2:I.1.17,18,19,21,22,29,30
Linear maps between vector spaces	Hefferon Ch. 3, II.1	3:II.1.18,19,20,22,24,25,26,28
Subspaces. Span	Hefferon Ch. 2, I.2	2:I.2.20,21,23,25,26,29,44,45
Linear independence	Hefferon Ch. 2, II.1	2:II.1.21,22,25,28
Properties of linear independence	Hefferon Ch. 2, II.1	2:II.1.29,30,32,33
Basis of a vector space	Hefferon Ch. 2, III.1	2:III.1.20,21,22,23,24,25,26,30,31,34
Dimension of a vector space	Hefferon Ch. 2, III.2	2:III.2.15,16,17,18,19,20,21,24,25,28
Column space, row space, rank	Hefferon Ch. 2, III.3	2:III.3.17,18,19,20,21,23,29,32,39
Range space and Kernel (Null space)	Hefferon Ch. 3, II.2	3:II.2.21,23,24,26,31,35
Invertible matrices: definition, equivalent conditions; inverse matrix	Hefferon Ch.3, IV.4	3:IV.4.13,14,15,16,17,18,19,26,29
Elementary matrices. Row reduction using elementary matrices	Hefferon Ch. 3, IV.3; CDTW Ch. 2, 2.3	3:IV.3.24,25,32
Determinant of a matrix, properties	Hefferon Ch. 4, I.1, I.2	4:I.1.1,3,4,6,9; 4:I.2.8,9,12,13,15,18
More on Determinants	Hefferon Ch. 4, II.1, III.1	4:III.1.11,14,16,17,20,21,22
Matrix of a linear transformation, matrix of the composition, inverse	Hefferon Ch. 3, III.1, IV.2	3:III.1.13,17,18,19,21,23
Change of basis, similar matrices	Hefferon Ch. 3, V.1, V.2; Ch. 5, II.1	3:V.1.7,9,10,12; 5:II.1.5,8,11,13,14
Complex numbers	Matthews 5.1-5.6	Matthews 5.8.1,2,5,6,7,9
Eigenvectors, eigenvalues, eigenspaces for matrices and linear operators. Characteristic polynomial	Matthews 6.1, 6.2; Hefferon Ch. 5, II.3	5:II.3.23,24,25,26,27,28,29,30,31
Diagonalization of matrices	Hefferon Ch. 5, II.2, II.3	5:II.3.22,33,36,46
Orthogonal and orthonormal bases of $\mathbb{R}^n$ and its subspaces; orthogonal matrices	Hefferon Ch. 3, VI.1, VI.2	3:VI.1.6,7,17,19; 3:VI.2.10

Orthogonal complement of a subspace, orthogonal projection	Hefferon Ch. 3, VI.3	3:VI.3.11,12,13,14,26,27
Gram-Schmidt process; orthogonal diagonalization of matrices	Hefferon Ch. 3, VI.2	3:VI.2.13,15,17,18,19,22

## Syllabi from previous semesters

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The syllabus for Math 304 in Fall 2022 is available through this link:

[Fall 2022 page](#)

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The syllabus for Math 304 in Spring 2022 is available through this link:

[Spring 2022 page](#)

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The syllabus for Math 304 in Fall 2021 is available through this link:

[Fall 2021 page](#)

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The syllabus for Math 304 in Spring 2021 is available through this link:

[Spring 2021 page](#)

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The syllabus for Math 304 in Fall 2020 is available through this link:

[Fall 2020 page](#)

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