

**MATH 221 ALL SECTIONS.
2020–2021, WINTER TERM 1**

WEBSITE

The course website is <https://canvas.ubc.ca/courses/66172>. That contains a version of this syllabus. We expect that the reality of teaching online will require some adaptations to this syllabus as the term progresses. The version on the website will be updated more frequently than this pdf version. In case of a disagreement between the two versions, treat the website syllabus as correct.

DESCRIPTION

Math 221: Matrix Algebra is an introductory course in linear algebra. Linear algebra is a fundamental and extremely important topic in mathematics. Many other branches of mathematics are concerned with reducing more complicated questions to problems in linear algebra. For instance, calculus tries to reduce questions about curves and surfaces (or higher dimensional shapes) to ones about their tangent lines or tangent planes. These lines and planes are concepts in linear algebra.

This course is a study of linear maps. We will learn what they are, how to manipulate them as well as tools (determinants, eigenvectors/eigenvalues, diagonalization) to visualize them better. Along the way we will also touch on various applications.

LECTURES

As you can see below, each week we will cover approximately 3 sections of the textbook.

Lectures take two forms in this course:

- Pre-recorded mini-lectures (about 10 minutes each, usually 3 each week);
- Synchronous, scheduled lectures on Collaborate Ultra.

The mini-lectures are to be found on the Course Modules page. You should watch them before the synchronous lectures that correspond to them.

The synchronous lectures will be held using Collaborate Ultra on your own section's Canvas website (e.g., Math 221 101 2020W). Go there for the specific link.

Section Number	Time	Instructor	Email
101	TuTh 9:30-11am	Prof. Sujatha	sujatha@math.ubc.ca
102	MWF 10-11am	Prof. Sujatha	sujatha@math.ubc.ca
103	MWF 8-9pm	Dr Jeong	hajeong@math.ubc.ca
104	MWF 1-2pm	Dr Williams	tbjw@math.ubc.ca
106	MWF 3-4pm	Dr Jeong	hajeong@math.ubc.ca

OFFICE HOURS

You may prefer to attend the office hours of your own instructor, but all office hours are available to all students.

Office hours will begin in the week starting 13 September 2020, and the website will be updated to reflect this.

You can contact your instructor using the Canvas messaging system or using their UBC email addresses.

You may also be able to make an appointment to meet your instructor at some other time.

TEXTBOOK

The textbook for this course is the online textbook *Interactive Linear Algebra: UBC Edition*.

Note that you can download a pdf version of the textbook from the linked website.

The textbook is based on *Interactive Linear Algebra* by Dan Margalit and Joe Rabinoff. Most of the chapters are the same, but the initial topics have been reordered and more material has been added to the UBC edition about discrete dynamical systems.

In previous years, this course was taught using *Linear Algebra and Its Applications* (4th edition). Most of the material is the same, so you might benefit from having a used copy of this book to hand, but it is not the official textbook for this version of Math 221.

ASSESSMENT AND GRADE

There are 5 different kinds of assessment in this course. For several of them (WeBWorK, MATLAB and Quiz assignments), we will drop your lowest-scoring submission automatically. For instance, you will be assigned 12 WeBWorK homeworks, but we will count only the best 11 for your grade.

This policy means that we will not make exceptions if you have an illness or other circumstance that causes you to miss one submission. The policy automatically handles this. If you have some illness or other circumstance that means you will miss more than one submission of a particular kind, please contact your instructor.

Type	Number	Points each	Total points
WeBWorK homework	11 best of 12	3%	33%
MATLAB assignments	5 best of 6	3%	15%
Quizzes	5 best of 6	3%	15%
Participation			7%
Final	1 best of 1	30%	30%
			100%

HOMEWORK

WebWork. Homework assignments in this course will mostly take the form of automated WebWork assignments. These will be worth a total of 33% of the course grade. They will be posted online each week, and will be due on the Friday of the following week. Please note the following items:

- (1) For most questions, you may attempt each question as often as you like until you solve the problem. There is no penalty for a wrong answer. This is to help you correct your own mistakes, and to get instant feedback on your attempts.
- (2) The questions are generated randomly, and the numbers are different for each student.
- (3) You are encouraged to discuss these problems with other students in this course, either on the Piazza website or independently.
- (4) If you think there is a mistake in the question, contact the instructor on WeBWork (but for math help, look on Piazza)
- (5) The deadlines are enforced by the system, and it will shut down automatically when time is up, so give yourself plenty of extra time in case of difficulties.
- (6) Your lowest WebWork grade out of 12 will be dropped in the final course calculation. The other assignments will be worth 3% each, for a total of 33%.

MATLAB. There will be 6 MATLAB assignments. They will also be due on Fridays, starting on 18th September, and then every two weeks. We will award 15% of the course grade for these, by making each one worth 3% and dropping the lowest score for each student.

PARTICIPATION

7% of the overall grade will be determined by participation in synchronous lectures or some other way chosen by your instructor. This will be different between sections, because instructors are different between sections. The details of how you earn this 7% will appear on your section's website.

QUIZZES

There will be 6 Quizzes in this course. These are timed exams: you will have 40 minutes from the moment you start until the system locks you out. They will be held every second Wednesday:

- Wednesday, 23 September;
- Wednesday, 7 October;
- Wednesday, 21 October;
- Wednesday, 4 November;
- Wednesday, 18 November;
- Wednesday, 2 December.

They will theoretically cover material up to the previous week.

You should take these quizzes without help from anyone, although class notes, the textbook, calculators (including MATLAB and any other computer software that does not have a human at the other end of it) is allowed.

We will drop your lowest-scoring quiz, and the remaining quizzes will be worth 3% each, for a total of 15%.

FINAL

There will be a final exam, in the final exam period. It will be like a quiz, but longer, and will be worth 30%.

TOPICS TO BE COVERED

More detailed Learning Goals will be available elsewhere on the website. Here is a list of the topics to be covered on a weekly basis. Because this is our first time teaching this course as a web-oriented course, we are not certain that we will cover exactly these topics.

Week	Section	Titles	Notes
1	1.1,1.2	Vectors, Vector Equations and Spans	
2	2.1,2.2,2.3	Systems of Linear Equations, Row reduction, Parametric Form	MATLAB 1
3	2.4,3.1,3.2	Matrix Equations, Solution Sets, Linear Independence	Quiz 1
4	3.3,3.4,3.5	Subspaces, Basis and Dimension, Bases as Coordinate Systems	MATLAB 2
5	3.6,4.1,4.2	Matrix Transformations, One-to-one and Onto, Linear Transformations	Quiz 2
6	4.4,4.5,4.6	Matrix multiplication, Matrix inverses, the Invertible Matrix Theorem	Thanksgiving long weekend, MATLAB 3
7	5.1,5.2,5.3	Determinants: Definition, Cofactor Expansions, Determinants and Volumes	Quiz 3
8	6.1, 6.2	Determinants (review), Eigenvalues and Eigenvectors, the Characteristic Polynomial	MATLAB 4
9	6.3, 6.4, 6.5	Similarity, Diagonalization Complex eigenvalues	Quiz 4
10	6.6, 6.7 (in part)	Discrete dynamical systems	Remembrance day week, MATLAB 5
11	7.1, 7.2, 7.3	Dot Products and Orthogonality, Orthogonal Complements, Orthogonal Projection,	Quiz 5
12	7.4, 7.5	Orthogonal Sets, the Method of Least Squares.	MATLAB 6
13		Review	Quiz 6

MATERIALS

Lecture notes will be provided as lectures are given. Lectures will be recorded and the recordings put online. The textbook is fully online (see link above).

You may wish to download a student edition of MATLAB (it takes about 3 GB of space on your computer), but it is not necessary to do this, since you can use MATLAB in the cloud instead. Instructions are on the MATLAB page.

There are no other required materials.

EXPECTATION AND LEARNING GOALS

A page describing learning goals, broken down by section, will appear on the website. In order to get a B-grade or better in this course, you should meet these goals and be able to apply what you have learned accurately in straightforward problems. To get an A-grade in the course, you should meet these goals, be able to apply what you have learned quickly and accurately and in more complicated problems.

WHERE TO LOOK FOR HELP, AND OTHER ADVICE

For problems of a non-personal nature, please use the Piazza software (there is a link to this from the Canvas website). This is the best way to have a question answered quickly.

There will be a MATLAB help centre that you can turn to for assistance with MATLAB assignments.

You can also attend the office hours of your instructor or of any other instructor for Math 221. These hours will be listed on the website.

For enrolment problems, talk to the math office.

For all other problems, contact your instructor—via UBC email or through the website.

A NOTE ABOUT TIMES

All times on this website and in this course refer to Vancouver Time. This is Pacific Daylight Time (UTC -7) until 1 November 2020, at which point it changes to Pacific Standard Time (UTC -8).

University Values and Policies

UBC provides resources to support student learning and to maintain healthy lifestyles but recognizes that sometimes crises arise and so there are additional resources to access including those for survivors of sexual violence.

UBC values respect for the person and ideas of all members of the academic community. Harassment and discrimination are not tolerated nor is suppression of academic freedom.

UBC provides appropriate accommodation for students with disabilities and for religious, spiritual and cultural observances.

UBC values academic honesty and students are expected to acknowledge the ideas generated by others and to uphold the highest academic standards in all of their actions.

Details of the policies and how to access support are available [here](#).