This is the syllabus for Math 211 Linear Algebra. See the links to the right for updated information. Here you'll find information on prerequisites, grading policy, homework, study resources and a tentative course calendar. See the box in the upper right for more links and information for the course.

Textbook

The (required) textbook we will use for this course is *Linear Algebra with Applications, by Williams, 7th Edition, published by Jones & Bartlett* by Gareth Williams. I will use the Seventh Edition, which is available at the University Bookstore. It is pictured below along with a link to places to buy it on the web. Other editions will be somewhat similar, but be wary of the Fifth Edition and the Alternate Version of the Seventh Edition as they were written quite differently then our text. If you have a different edition, find a friend with the fifth edition to make sure the exercises you work match your friend's. This is an great text, it is carefully written with clear explanations and lots of cool applications.

Office Hours

I am often in my office NSF 1211, you are free to stop by and see if I am available, or email me to make an appointment. My official office hours are:

- Monday: 11am - 12 pm
- Tuesday: 10am - 11am
- Wednesday: 11am - 12 pm & 2pm - 3pm
- Thursday: 11am - 12pm

Other Resources

There is a Student Solutions Manual for this textbook. The link on the right Linear Algebra Resources contains links to mostly free sites & documents that will help you get off on the right foot. Both free and paid tutoring is available, in the tutoring lab in NSF 3810.

Prerequisites

You need a B- or better in MA 161 or written permission from me, the instructor.

Quizzes

Unannounced group quizzes will be given on a bi-weekly basis. Groups will chosen randomly each week.

Calculators

Calculators are allowed on all homework, quizzes and exams. Unless otherwise notificed, you are not allowed to have any information saved in your calculators during quizzes and exams.

Laptops

Links for Math 211
- Syllabus
- Homework
- Class Notes
- Generate Groups
- Writing Suggestions
- Computing Resources
- Some Fundamental Facts
- Tentative Class Schedule
- Linear Algebra Resources

Other Links
- Courses Previously Taught
- My Teaching Statement
- Important Dates
- NMU Home
- NMU Math
- MyNMU
- MyWeb
- EduCat
In order to promote a positive classroom experience, Do not use your laptop in class unless we're doing something hands on.

Grading

- Homework 20%
- Group Quizzes 5%
- Exams 50% (2 @ 25% each)
- Final 25%

Exams

- Exam 1 - October 10
- Exam 2 - November 14
- Final - Tuesday, December 11, 2012, 12 noon - 1:50 pm

Make sure that you will be able to attend the exams at the given dates and times. Exceptions can only be accepted in case of time conflicts with other courses, or serious illness with a physician's certification.

Course Description

In the first few weeks of course, we will cover basic material that will form the foundation for the remainder of the semester. It is important to keep up and not get behind these first few weeks.

Matrices & Linear Equations

After seeing what linear equations can do for us, we will see how matrices are used to solve systems of linear equations. We'll see that solutions are usually not unique, but rather are members of an infinite family of solutions. This infinite family has inherits interesting geometrical properties from the larger space in which it lives, and we'll study how to describe and build these so-called subspaces. Finally, we learn how this abstract nonsense is the perfect way to describe how traffic flows around the Marquette Round-About.

Matrices & Linear Transformations

After learning the basic arithmetic of matrices, we'll see how some special matrices are used in cool applications such as Archaeology and Cryptography. The fun will continue when we learn how to make shapes move, grow and deform using matrix transformations. We'll tie all of this together with applications to economics, population dynamics, sociology, fractals and computer graphics.

Determinants & Eigenvectors

We'll associate a special number, called the determinant, to a matrix and then be amazed at how much information is contained in this one number. Concepts such as area and invertibility are just a few of the nuggets of knowledge hidden inside a matrix's determinant. We'll learn how another special number, an eigenvalue, determines the amount of stretching involved in a transformation. A special vector associated to this eigenvalue is called an eigenvector and we'll see how Google uses an eigenvector to sort web pages in a search.

Vector Spaces

We'll learn to see images and videos as vectors and discover some more general types of vector spaces, and explore ideas such as linear combinations, independence, bases and rank. We'll use special orthonormal bases to project images onto one another and learn how to transform one basis onto another.

Coordinate Representations

We'll learn how to think of a vector as a point in space, like a GPS. We can create objects in 3-D, and use matrix transformations to move them, i.e., to change their coordinates. We can do so without changing the shape of the object an isometry, or we can deform it in a variety of ways. A discussion of diagonalization of matrices will allow us to separate transformations into complementary mini-transformations. In this way, we can view any transformation as a combination of rotations, translations and dilations.

The Singular Value Decomposition
We'll build on the ideas of diagonalization to construct an important decomposition widely used in industry. This will allow us to peer into and through a matrix to learn things such as: its fundamental subspaces, directions of maximal and minimal energy of a point cloud and more.

**Inner Product Spaces**

Just as there is more than one way to skin a cat, there is more than one way to do geometry. Just be changing your ruler, geometry can get exciting quickly. Such changes are not merely rescalings, but relativistic; the length of your ruler depends on where you are! This has surprising applications to function approximation and coding theory.

**Non-Euclidean Geometry**

We'll explore a few special inner product spaces in depth. We'll learn how to construct hyperbolic geometry, spherical geometry and the geometry of special relativity. We'll learn how to measure distances, compute angles as well as the relevant isometries.

**Applications to Video Processing**

We'll apply the SVD and most of what we've learned to tackle cool image processing problems like image segmentation and data clustering.

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**University Policies**

**Academic Honesty:** Cheating is not only unethical and pathetic, but is a violation of the Northern Michigan University Student Code and University Policy and grounds for your dismissal from the University.

**Discrimination & Harassment:** Northern Michigan University does not unlawfully discriminate on the basis of race, color, religion, national origin, gender, age, height, weight, martial status, handicap/disability, sexual orientation or veteran status. If you have a civil rights inquiry, contact the [Affirmative Action Office](tel:906-227-2420) at 906-227-2420.

**Americans with Disabilities Act Statement:** The University seeks to provide equal access to its programs, services and activities for people with disabilities. If you have a need for disability-related accommodations or services, please inform the Coordinator of [Disability Services](tel:906-227-1700) in the Dean of Students Office at 2001 C. B. Hedgcock Building (227-1700) as soon as possible. Reasonable and effective accommodations and services will be provided to students if requests are made in a timely manner, with appropriate documentation, in accordance with federal, state, and University guidelines.

**The Registrar:** Withdrawing from any course or any matters relating to registration are the responsibility of the student. For more information regarding this topic, check out the [Registrars Website](http://euclid.nmu.edu/~joshthom/Teaching/MA211/syllabus/).