Math 281-3 Accelerated Mathematics for ISP: First Year Spring 2016

Instructor: Jason Siefken (siefkenj@math.northwestern.edu)

Office: Lunt 213

Class: MTWF 11:00–11:50 in ISP 203

Office Hours: T 1:00–2:00, W 2:00–4:00, or by appointment

Dicussion Section: Th 11:00–11:50 in ISP 203

Webpge: http://www.math.northwestern.edu/~siefkenj/math281-3

Textbook: *Introduction to Linear Algebra for Science and Engineering* Second Edition, by Norman and Wolczuk

Math 281-3 finished the first year of our accelerated dive into mathematics by exploring Linear Algebra, the theory that has been lurking in the background of much of what we've done over the last two terms.

Linear Algebra is the study of vectors, "flat spaces" like lines and planes, and linear transformations like rotations and scalings. Vectors originated in the study of physics and the 3D world, but through the mathematical practice of *abstraction*, we now use vectors to represent non-spacial things like music in addition to computer graphics and physical forces.

Transformations are functions that move vectors around, and in this class we will focus on *linear transformations*. Why? Because although mankind has strived to understand the non-linear phenomena of the universe, we haven't gotten very far—the non-linear equations governing fluid flow still haven't been solved! However, we have a complete theory of linear equations and linear transformations. Our approach to answering general questions about the universe is often to convert the problem into a linear one—one that we can actually understand.

Learning Outcomes

After taking this course, you will be able to:

- Solve systems of linear equations and matrix equations, write vectors in different bases, use the geometry of subspaces like row spaces, column spaces, null spaces, and eigen spaces to solve problems, and switch between geometric and algebraic points of view to aid problem solving.
- Work independently to understand concepts and procedures that have not been previously explained to you.
- Clearly and correctly express the mathematical ideas of linear algebra to others.

Prerequisites

To be prepared for this course, you should have a solid understanding of vectors in $\mathbb{R}^n$, dot and cross products, and complex numbers.

To Succeed

Learning is hard! It is exercise for the mind, and like exercise, when you're doing it, it feels pretty uncomfortable (and if it doesn't, you're probably doing it wrong). Here are some tips to help you succeed academically (getting the grade you want) and intellectually (learning the most you can).

- Form a regularly-meeting study group of 3–4 people. Having others studying around you will help you study, and having someone to talk about confusing problems with will help you both productively struggle (struggling with others is how real-world problems are solved).
- Read the textbook *before* class. In class we will be working on problems that we haven't gone over before. If you expose yourself to the concepts prior to class, you'll get a lot more out of it.
- Visit the tutors, paid for by the university, at the **Calculus, Chemistry and Physics Re-**

source Room at Tech HG04 and Allison 1021 (http://www.math.northwestern.edu/undergraduate/tutoring-advising/tutoring/). Also, take advantage of the ISP upperclassmen. They've been through this struggle before!

Assessment

Midterm 1 (15%) In-class midterm on Thursday, April 21.

Midterm 2 (15%) In-class midterm on Thursday, May 12.

Homework and Quizzes (30%) **Homework**: Homework will be assigned throughout the term and typically due at the beginning of class on Thursdays. You are encouraged to work together to solve homework problems, but *you* must write up your solutions to be turned in.

Some homework will focus on explaining problems rather than just "solving" them. If you'd like your write-ups to look like a pro's, I suggest you use the LaTeX typesetting software. LaTeX is the industry-standard for scientific write-ups in math, physics, chemistry, computer science, and engineering. It has a learning curve but is well worth the effort. See the course webpage for details.

Quizzes: Quizzes will take place at the beginning of discussion section on Thursdays (though not necessarily every Thursday). They may be announced or unannounced.

Final (40%) A comprehensive 2 hour final will be held on Monday, June 6 at 3:00–5:00 PM in ISP 203.

Policies

I have carefully planned the midterm dates, so please ensure you are available for each midterm. If you miss a midterm for a justified reason (illness, family affliction, or other reason recognized by Northwestern's policies), I can excuse it for you by weighting other tests more heavily. However, *there will be no makeup exams.*

If you have a disability/health consideration that may require accommodations, please contact the Office of Services for Students with Disabilities and register for AccessibleNU as soon as possible. All information will remain confidential. http://www.northwestern.edu/accessiblenu

For the rest of Northwestern's polices, please see http://policies.northwestern.edu