

Math E-303, Theory and Practice of Teaching Algebra

Fall 2005

Syllabus

Instructor: Dr. Angela Vierling-Claassen,

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Time and Location: Wednesdays, 4:30–6:30, Science Center 309, beginning September 21.

Goals and Prerequisites

This course introduces middle grade and high school teachers to the foundations and concepts in elementary algebra. The course is focussed on mathematical content, but it also addresses educational theory and educational practice, and includes the process of creating, testing, and refining lesson plans. It aims to give the teacher a foundation in the fundamental working and structure of mathematical theory. Prerequisites include knowledge of and experience teaching algebra.

Text and Readings

The textbook for the course is Algebra by I. M. Gelfand and A. Shen, ISBN # 0-8176-3677-3. This is a terrific text by superior mathematicians, with excellent exposition and nice applications. We will use it primarily to supplement the lectures, and in general, the homework will be based more on the classroom discussion. There will also be notes and additional readings distributed. Everyone should also have at least one middle-school or high-school algebra textbook for reference.

Homework

Homework will be assigned daily and will be due at the start of the next class. Problems will come in four distinct flavors: computational, exploratory, theoretical, and discussion, each with a different purpose. Computational exercises are meant to strengthen fundamental understanding. Exploratory problems are meant to engage creativity to solve open-ended problems. Theoretical problems address the underpinnings of computations and techniques. Discussions will focus on how students learn the subject matter and what techniques are most likely to be useful in the classroom.

Homework will be corrected and returned at the next session.

You are encouraged to work with classmates on all of the homework assignments. Please note any close collaborators on your homework, and if you receive substantial assistance from any textbook or individual, be sure to credit that person for their contribution.

Class Notes

Each class session, a pair of students will be responsible for taking notes and writing them up. These notes will be corrected, and then the pair of students will revise them and distribute them to the rest of the class.

Lesson Plan Project

In small groups, students will plan a lesson in algebra. These lessons will be presented, discussed, in class at times to be arranged. The lesson should be abbreviated, 30 minutes long, in order to leave time for discussion afterward. After the lesson has been presented, the students will write up the lesson, including what they learned from the presentation and discussions and how they would revise the lesson before using it with their classes.

Grades

Grades will be based on homework performance (30%), final exam (30%), take-home midterm exam (20%), lesson plan (15%), and class notes (5%).

Tentative Schedule

Date	Topics
September 21	Algebraic Thinking, Arithmetic, Patterns
September 28	Integers, Sets
October 5	Division, Division by zero?, Rational numbers
October 12	Real numbers, Irrational numbers, Complex numbers
October 19	Modular arithmetic, Algebra of Sets
October 26	Variables, Truth, Proof, and Counterexamples
November 2	Functions and graphs
November 9	Functions, patterns, and groups of permutations
November 16	Linear functions, rate of change, modeling
November 30	Polynomials, Analogy with Arithmetic, Rings
December 7	Polynomial functions and Equations
December 14	Exponents (why is $a^0 = 1$?), exponential functions
December 21	Logarithms