

## Term Information

Effective Term Autumn 2014

## General Information

Course Bulletin Listing/Subject Area Mathematics  
Fiscal Unit/Academic Org Mathematics - D0671  
College/Academic Group Arts and Sciences  
Level/Career Undergraduate  
Course Number/Catalog 4480  
Course Title Algebra for Teaching  
Transcript Abbreviation Algebra for Teach  
Course Description Algebra connections between school mathematics and undergraduate mathematics, focusing on the algebra in the Common Core State Standards for Mathematics.  
Semester Credit Hours/Units Fixed: 2

## Offering Information

Length Of Course 14 Week, 7 Week  
Flexibly Scheduled Course Never  
Does any section of this course have a distance education component? No  
Grading Basis Letter Grade  
Repeatable No  
Course Components Lecture  
Grade Roster Component Lecture  
Credit Available by Exam No  
Admission Condition Course No  
Off Campus Never  
Campus of Offering Columbus

## Prerequisites and Exclusions

Prerequisites/Corequisites Prereq: Enrollment in the M.Ed. program for secondary mathematics, or permission of instructor. Prereq or concur: Math 4580.  
Exclusions

## Cross-Listings

Cross-Listings

## Subject/CIP Code

Subject/CIP Code 27.0101  
Subsidy Level Baccalaureate Course  
Intended Rank Junior, Senior, Masters

## Quarters to Semesters

**Quarters to Semesters**

New course

**Give a rationale statement explaining the purpose of the new course**

This is a permanent course request for a 4194 course which has been successfully run. It was created at the request of the Mathematics Education group in EHE and they plan to require this course for all pre-service high school math M.Ed students.

**Sought concurrence from the following Fiscal Units or College**

Mathematics Education Group in EHE

## Requirement/Elective Designation

The course is an elective (for this or other units) or is a service course for other units

## Course Details

**Course goals or learning objectives/outcomes**

- Develop multiple explanations and proofs of key algebra ideas in Common Core State Standards for secondary mathematics, including the trajectories of those ideas from elementary through undergraduate mathematics.
- Recognize, compare, and contrast groups, rings, and fields across school mathematics, including polynomial rings; integers, rational, real, and complex numbers; roots of unity; and modular arithmetic.
- Demonstrate algebraic reasoning in other areas of mathematics (e.g., calculus, geometry) and vice versa.

**Content Topic List**

- Number systems, their history, and expanding number systems as solving equations.
- Field of fractions of an integral domain, and models for fractions and their arithmetic.
- Decimal representations of rational and irrational numbers.
- Inverses and identities across the systems of school mathematics.
- Extending exponents from counting numbers to integers, rational, and real numbers.
- Algebra versus functions in the Common Core State Standards: Polynomials vs. polynomial functions.
- Functions: Sequences as functions, especially arithmetic and geometric and sequences as linear and exponential functions.
- Rings and fields in school mathematics: Relationships between  $\mathbb{Z}$  and  $[x]$  and between  $\mathbb{Q}$  and  $(x)$ , factor and remainder theorem for polynomials and the Fundamental Theorem of Algebra.
- Linear algebra as algebra and geometry.
- Complex numbers: The geometry of complex arithmetic and roots of unity, Polar coordinates, Euler's formula, and ambiguity of roots of complex numbers.

## Attachments

- MathDeptCourseRequest.pdf: Concurrence  
*(Concurrence. Owner: Husen, William J)*
- 4480\_Algebra\_for\_Teaching\_syllabus\_update.pdf: Syllabus (updated)  
*(Syllabus. Owner: Husen, William J)*
- Re\_Math for Teaching Courses.txt: Course level support  
*(Other Supporting Documentation. Owner: Husen, William J)*

**Comments**

- An updated syllabus is attached and a letter of support from EHE for 4000-level. Subsidy level and student ranks have been adjusted. *(by Husen,William J on 01/23/2014 01:34 PM)*
- -This is an undergraduate course so neither the subsidy level nor the intended rank can be master's.  
-Please see p. 13 of curriculum manual: [http://ascas.osu.edu/files/ASC\\_CurrAssess\\_Operations\\_Manual.pdf](http://ascas.osu.edu/files/ASC_CurrAssess_Operations_Manual.pdf)  
In particular, syllabus should address points 7 (texts), 8 (detailed information about assignments), 9 (grading information), and 13 (weekly topical outline w/ topics, readings, hw). *(by Vankeerbergen,Bernadette Chantal on 07/03/2013 04:11 PM)*

**Workflow Information**

Status	User(s)	Date/Time	Step
Submitted	Husen,William J	07/01/2013 11:28 AM	Submitted for Approval
Approved	Husen,William J	07/01/2013 11:30 AM	Unit Approval
Approved	Hadad,Christopher Martin	07/01/2013 12:33 PM	College Approval
Revision Requested	Vankeerbergen,Bernadette Chantal	07/03/2013 04:14 PM	ASCCAO Approval
Submitted	Husen,William J	01/23/2014 01:34 PM	Submitted for Approval
Approved	Husen,William J	01/23/2014 01:34 PM	Unit Approval
Approved	Hadad,Christopher Martin	01/24/2014 09:15 AM	College Approval
Pending Approval	Vankeerbergen,Bernadette Chantal Nolen,Dawn Jenkins,Mary Ellen Bigler Hogle,Danielle Nicole Hanlin,Deborah Kay	01/24/2014 09:15 AM	ASCCAO Approval

# Algebra for Teaching

## Math 4480

Math 4480 is designed to connect abstract algebra, as learned in undergraduate mathematics, with school algebra. In particular, students will learn how topics in abstract algebra can provide understanding in the teaching of algebra in school.

### Math 4480: Algebra for Teaching

**Catalog Description:** Algebra connections between school mathematics and undergraduate mathematics, focusing on the algebra in the Common Core State Standards for Mathematics. This is a 2-credit course to be required in the M.Ed. for students intending to be secondary mathematics teachers. (Note: The course may also be included in the B.S.Ed. program that is under development.)

**Credits:** 2

**Purpose of Course:** To promote deep understanding of algebra topics in school mathematics with strong connections to undergraduate mathematics. To develop multiple explanations of key ideas in school mathematics. Knowing the mathematics for you is not the same as knowing the mathematics for teaching.

**Follow-up Courses:** None.

**Textbook:** Notes on Abstract Algebra, by Ron Solomon (Math 4580 text) and additional class notes.

**Prerequisite:** Enrollment in the M.Ed. program for secondary mathematics, Math 4580 (may be taken concurrently), or permission of instructor.

**Grading:** Problem sets and exams. Students are expected to do all of the problems and are asked to write up careful solutions and explanations for some of the problems. Their responses are graded based on their quality as instructional explanations. They are encouraged to typeset these responses using, for example, a word processor with an equation editor. Grades will be based on 40% homework, 30% midterm exams and 30% final exam. Standard percentage cut-off scores will be used to determine letter grades.

## Learning Goals:

- Develop multiple explanations and proofs of key algebra ideas in Common Core State Standards for secondary mathematics, including the trajectories of those ideas from elementary through undergraduate mathematics.
- Recognize, compare, and contrast groups, rings, and fields across school mathematics, including polynomial rings; integers, rational, real, and complex numbers; roots of unity; and modular arithmetic.
- Demonstrate algebraic reasoning in other areas of mathematics (e.g., calculus, geometry) and vice versa.

## Topics:

- (2 weeks) Modular arithmetic, divisibility rules, and the Fundamental Theorem of Arithmetic.
- (1 week) Number systems, their history, and expanding number systems as solving equations.
- (1 week) Field of fractions of an integral domain, and models for fractions and their arithmetic.
- (1 week) Decimal representations of rational and irrational numbers.
- (1 week) Inverses and identities across the systems of school mathematics.
- (1 week) Extending exponents from counting numbers to integers, rational, and real numbers.
- (1 week) Algebra versus functions in the Common Core State Standards:
  - Polynomials vs. polynomial functions.
- (1 week) Functions:
  - Sequences as functions, especially arithmetic and geometric.
  - Sequences as linear and exponential functions.
- (2 weeks) Rings and fields in school mathematics:
  - Relationships between  $\mathbf{Z}$  and  $\mathfrak{R}[x]$  and between  $\mathbf{Q}$  and  $\mathfrak{R}(x)$ .
  - Factor and remainder theorem for polynomials.
  - Fundamental Theorem of Algebra.
- (1 week) Linear algebra as algebra and geometry.
- (2 weeks) Complex numbers:
  - The geometry of complex arithmetic and roots of unity.
  - Polar coordinates, Euler's formula, and ambiguity of roots of complex numbers.

**Disability Statement:**

Students with disabilities that have been certified by the Office for Disability Services will be appropriately accommodated, and should inform the instructor as soon as possible of their needs. The Office for Disability Services is located in 150 Pomerene Hall, 1760 Neil Avenue; telephone (614) 292-3307 and VRS (614) 429- 1334; webpage <http://www.ods.ohio-state.edu>.

**Academic Misconduct Statement:**

It is the responsibility of the Committee on Academic Misconduct to investigate or establish procedures for the investigation of all reported cases of student academic misconduct. The term academic misconduct includes all forms of student academic misconduct wherever committed; illustrated by, but not limited to, cases of plagiarism and dishonest practices in connection with examinations. Instructors shall report all instances of alleged academic misconduct to the committee. For additional information, see the Code of Student Conduct: [http://studentaffairs.osu.edu/resource\\_csc.asp](http://studentaffairs.osu.edu/resource_csc.asp)

From: "Brosnan, Patricia" <brosnan.1@osu.edu>  
Subject: Re: Math for Teaching Courses  
Date: December 19, 2013 5:54:40 PM EST  
To: "Findell, Bradford R." <findell.2@osu.edu>  
Cc: "Husen, William J." <husen@math.ohio-state.edu>, "Garner, Mark" <mwgarner@math.ohio-state.edu>, "Manouchehri, Azita" <manouchehriazita@gmail.com>, "Battista, Michael" <battista.23@osu.edu>

Hi Brad,

Thanks for the information as provided below. And yes, we do want these courses to be offered as follows:  
4480 for Autumn 2014 and  
4407 for Spring of 2015 and in a similar rotation in the subsequent years.

Bill, please do put these in for official approval and all the other information is also correct.

Thanks all,

Patti

Patti Brosnan, PhD  
Associate Professor  
Mathematics Education  
Director Mathematics Coaching Program  
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1945 N High Street  
Columbus, Ohio 43210  
614-292-8060  
Brosnan.1@osu.edu  
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From: <Findell>, Brad\_Findell <Findell.2@osu.edu>  
Date: Thursday, December 19, 2013 at 2:57 PM  
To: Patti Brosnan <brosnan.1@osu.edu>  
Cc: "Husen, William J." <husen@math.ohio-state.edu>, Garner <mwgarner@math.ohio-state.edu>  
Subject: Math for Teaching Courses

Dear Patti,

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I am writing to follow up on some previous conversations and e-mails about the Mathematics for Teaching Courses.Â

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The course numbers that have been identified are as follows:Â

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Math 4407 Geometry for Teaching

Math 4480 Algebra for Teaching

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As I mentioned, the course approvals were delayed by the request that they be offered at the 5000 level.Â The undergraduate committee approved the courses at the 4000 level, and it would be a much more difficult for the graduate committee to approve the courses at the 5000 level.Â

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Nonetheless, university policy allows 4000-level courses to be taken for graduate credit outside the offering department.Â So it seems that the 4000 level will be sufficient for both your M.Ed. students and your B.S.Ed.

students, as that program gears up. And it appears that the 4000 level is even sufficient for your Ph.D. students from your program.

If this is sufficient, then please let Bill Husen (copied on this e-mail) know in some official way. He will then restart the process for full approval.

In addition, would you please confirm that you next want this courses offered in Autumn 2014 and Spring 2015, for the M.Ed. cohort that begins in Summer 2014. I am copying Mark Garner, who handles course scheduling, so that he is aware of the plans.

Thanks. And have happy holidays!

Best regards,

Brad Findell





Professor Caroline Clark, Chair  
Department of Teaching and Learning  
1945 N High Street  
Columbus, Ohio 43210

To Whom It May Concern:

I am writing to support and request the offering of the two Mathematics for Teaching courses, namely Math 4194 Geometry for Teaching (Summer 2013) and Math 4194 Algebra for Teaching (Autumn 2013). These two courses were developed collaboratively between the Department of Mathematics and the Mathematics Education faculty as a natural outcome of the Woodrow Wilson Program. With the onset of the Common Core State Standards, that are now part of secondary mathematics teacher licensure requirements, along with a national Science and Mathematics Teacher Imperative (SMTI), it is essential that our pre-service teachers become proficient at the mathematics knowledge base necessary for successful teaching of mathematics at the secondary level.

After running these two courses this past year as pilot courses and with the successful student outcomes and positive feedback, our department has decided to make these two courses requirements for all secondary mathematics pre-service teachers. We have at least 22 students ready to enroll for this summer's offering and plan to require these same two courses for our new BSEd degree program as well. Brad Findell has done a great job in designing, teaching, and providing the leadership on these two experiences for our students and we are in full support of the continued offering of the Mathematics for Teaching classes annually.

Thank you for your consideration,

Caroline Clark, Chair  
Department of Teaching and Learning

*Patti Brosnan*

Patti Brosnan  
Mathematics Education, MED Coordinator