

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 2137
Course Title Algebra and Coordinate Geometry for Teachers
Transcript Abbreviation Alg. Geom. Teach.
Course Description This is one of two independent courses which follow Math 1136 to provide necessary content for middle grade teachers. This course focuses on algebra, coordinate geometry, and their connections through equations in one or more unknowns. Modern and historical perspectives are woven throughout.
Semester Credit Hours/Units Fixed: 3

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 Lima, Mansfield, Marion, Newark, Wooster

Prerequisites and Exclusions

Prerequisites/Corequisites A grade of C- or above in 1136; and a grade of C- or above in 1149 or 1150, or credit for 150, or math placement level L.

Exclusions

Cross-Listings

Cross-Listings

Subject/CIP Code

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

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

- Understand polynomial arithmetic from the perspective of place value.
- Unified perspective on the real number system, including situations modeled by different numbers, and numbers as solutions to equations.
- Familiarity with complex numbers and matrices from algebraic and geometric points of view.
- Awareness of non-Euclidean geometries and the importance of the parallel postulate
- Ability to create and evaluate geometric proofs.
- Identify major historical developments in algebra and number systems including contributions of significant figures and diverse cultures.

Content Topic List

- Polynomials as "base-x" and binomial theorem.
- The real number system all together.
- Polynomial equations and their roots.
- Exp and log.
- Complex numbers.
- Matrices.
- Complex arithmetic and linear transformations in \mathbb{R}^2 .
- Geometry proofs.
- Taxicab geometry.

Attachments

- 2137-syllabus.pdf: Syllabus
(Syllabus. Owner: Husen, William J)
- UGSC support of Math#12E243.doc: Concurrence
(Concurrence. Owner: Husen, William J)
- rationale.pdf: Course Rationale
(Other Supporting Documentation. Owner: Husen, William J)

Comments

Workflow Information

Status	User(s)	Date/Time	Step
Submitted	Husen, William J	11/19/2013 12:54 PM	Submitted for Approval
Approved	Husen, William J	11/20/2013 09:42 AM	Unit Approval
Approved	Hadad, Christopher Martin	11/20/2013 10:28 AM	College Approval
Pending Approval	Vankeerbergen, Bernadette Chantal Nolen, Dawn Jenkins, Mary Ellen Bigler Hogle, Danielle Nicole Hanlin, Deborah Kay	11/20/2013 10:28 AM	ASCCAO Approval

Catalog Description. This is one of two independent courses which follow *Measurement and geometry for teachers* to provide necessary content for middle grade teachers. This course focuses on algebra, coordinate geometry, and their connections through equations in one or more unknowns. Modern and historical perspectives are woven throughout.

Credits: 3

Prereq: A grade of C- or above in 1136. A grade of C- or above in 1149 or 1150, or credit for 150, or math placement level L.

Text. Course notes

Recommended supplemental texts.

Lang: *Basic mathematics*

Extended Description. This course integrates the various types of numbers introduced in the previous course to present them as members of a single (real) number system. The notion that new numbers are discovered as solutions to equations is promoted, and motivated by connecting various equations with mathematical models.

Matrices are introduced and used as linear transformations, mainly in the plane. The complex numbers are introduced as general solutions to quadratic equations and the relationship between complex arithmetic and transformations in the plane is explored.

The course finishes with several weeks of geometry content for middle grade teachers, including more material on proofs, triangle congruence, and non-Euclidean geometry. The main example is “Taxicab geometry”, based on the ℓ_1 norm.

Grading. A student’s grade will be based on the student’s performance on homework, quizzes, midterm and final exams. Homework and quizzes will count for 30% of the course grade, midterms will count for 35% of the course grade, and a final exam will count for 35% of the course grade.

Learning goals.

- Understand polynomial arithmetic from the perspective of place value.
- Unified perspective on the real number system, including situations modeled by different numbers, and numbers as solutions to equations.
- Familiarity with complex numbers and matrices from algebraic and geometric points of view.
- Awareness of non-Euclidean geometries and the importance of the parallel postulate.
- Ability to create and evaluate geometric proofs.
- Identify major historical developments in algebra and number systems including contributions of significant figures and diverse cultures.

Outline. Roughly 13 weeks of content, leaving 1 week for exams. This is a general guide, and may need to be adjusted as we test the course.

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| <p>[1 week] Polynomials as “base-x” and binomial theorem</p> <p>[2 weeks] The real number system all together</p> <ul style="list-style-type: none"> • negative and rational numbers as solutions to equations, e.g., $x + 1 = 0$, $3x = 1$. • equations and solutions motivated by models & story problems • roots on graphs • rational v.s. irrational numbers • Cantor and the diagonal argument <p>Polynomial equations and their roots</p> <ul style="list-style-type: none"> • radicals (algebraic numbers) • solutions to, e.g., $x^2 = 2$. • curves as solutions ($x^2 + y^2 = 1$) • solutions to the cubic <p>[2 weeks] exp and log</p> <ul style="list-style-type: none"> • introduce, discuss e.g. $2^x = 3$, give models for such equations <p>complex numbers</p> <ul style="list-style-type: none"> • solutions to $x^2 + 1 = 0$ • history of complex numbers | <p>[2 weeks] Matrices</p> <ul style="list-style-type: none"> • coordinates • arithmetic with matrices • linear transformations • affine transformations (linear transformations in \mathbb{R}^3 fixing $\{z = 1\}$) • systems of equations <p>[2 weeks] Complex arithmetic and linear transformations in \mathbb{R}^2</p> <ul style="list-style-type: none"> • translations, rotations, dilations of polygons • with and without coordinates <p>[3 weeks] Geometry proofs</p> <ul style="list-style-type: none"> • triangle congruence • similarity • triangles, quadrilaterals, circles • Thales of Miletus/Pythagoras <p>[1 week] Taxicab geometry</p> <ul style="list-style-type: none"> • revisit $x^2 + y^2 = 1$ • history related to parallel postulate |
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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>

BLENDING MATH COURSES FOR EARLY CHILDHOOD AND MIDDLE CHILDHOOD EDUCATION MAJORS

We propose four new math courses in a sequence designed specifically for the regional campuses. The first two of these form a sequence to serve both the Early Childhood and Middle Childhood education majors:

- (1135) Number and operations for teachers
- (1136) Measurement and geometry for teachers

These contain all of the mathematics content for the Early Childhood Education major (ECE) and some additional content for the Middle Childhood Education major (MCE). Two further courses contain the additional content necessary for the MCE math concentration:

- (2137) Algebra and coordinate geometry for teachers
- (2138) Calculus and its history for teachers

History of math topics are integrated throughout the four courses.

Rationale and additional benefits.

- Support both ECE and MCE majors at regional campuses with a minimum of low-enrollment courses.
- Address weaker backgrounds of students on open-enrollment campuses. MCE students benefit from starting with more elementary material, and ECE students benefit from seeing slightly more advanced material
- ECE students who also earn an EC 4–5 Generalist Endorsement are credentialed to teach grades 4–5 with no further math courses. The additional content in 1135–1136 will help them be more prepared for this role.
- MCE students who do not concentrate in math but earn the MC Generalist Endorsement are credentialed to teach math in grades 4–6 with no further math courses. Here too, the additional content in 1135–1136 will provide better preparation.
- Allow interested students to transition from ECE to MCE with relative ease. (Or from MCE to ECE.)
- To further mitigate low enrollment, 2137 and 2138 are independent courses, to be offered in alternating years.

Comparison with existing program. The first two courses, 1135/36, use the same text and cover essentially all of the content in 1125/26 and those parts of 1165/66 which overlap substantially with 1125/26. Additional history topics are added, and some topics are developed in more depth for the MCE licensure requirements.

The licensure requirements for MCE students covered in 1165/66 and 2167/68 are also covered in the full 1135–2138 sequence. Those topics of 1165/66 not covered in 1135/23 are treated mainly in 2137. The notable exceptions to this are material on functions, sine/cosine, and log/exp—these are treated in 2137. Calculus for middle-grade teachers is covered in 2137 and history of mathematics is integrated throughout the sequence.

It would not generally be possible to substitute any of the 1135–2138 courses for any of 1165/66, 2167/68, or vice-versa. The content of 1135–2138 is dramatically rearranged (although not substantially different) from that of the current MCE math sequence, so single substitutions are problematic. Rather 1135–2138 as a complete block of courses would satisfy the same requirements in the MCE major as the block 1165/66, 2167/68. Each campus would have the choice of which block to offer, depending on the needs of their students.

BS-Ed. These courses have been developed in consultation with the College of Education and Human Ecology and will be used by the BS-Ed. program in that college.



College of Education & Human Ecology
29 West Woodruff Avenue
200 Ramseyer Hall
Columbus, Ohio 43210

November 17, 2013

Dr. William Husen
MW 124A Mathematics Building
231 W 18th Avenue
Columbus, OH 43210

Dear Dr. Husen:

The Undergraduate Studies Committee of the Department of Teaching and Learning met on Friday, November 14th and discussed the proposed blended math courses for early childhood and middle childhood education majors. We expect that they will, as they proposal suggests, allow our regional campuses to offer the required courses more regularly so that students may take them when they need them. Further, these courses will strengthen the math skills of those in the major for whom this is an area of weakness. Moreover, students will, with these new courses, be able to switch from early to middle, or vice versa, without losing course credit. For these reasons, we support the proposed courses and are eager for the offering of them, should they be approved.

Sincerely,

A handwritten signature in black ink that reads "M Blackburn" with a horizontal line extending to the right.

Mollie V. Blackburn, Ph. D.
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