I. Catalog Description and Credit Hours of Course:

Selected mathematical topics for secondary non-mathematics education majors. Required of secondary mathematics education majors adding middle school certification. (3)

II. Prerequisite(s):

Secondary Education major and ACT Math subscore of 15 or higher or MA050 with a grade of 'NDC' or higher or MA 102 with a grade of 'C' or higher or a required score on an appropriate COMPASS placement test. Students with an ACT Math subscore below 22 will co-enroll in MA021.

III. Objectives of the Course:

This course satisfies the Logical Systems requirement for secondary (non-mathematics) education majors. It can also be used to waive the requirements of MA118, MA318, and MA418 for secondary education majors adding middle school certification. It cannot be taken by middle school, elementary, or early childhood majors. The primary objectives are to:

A. describe the various number systems, including historical perspectives.

B. define the four fundamental operations on whole numbers in terms of sets, describe the conceptualizations of each operation, and describe multiple algorithms for each operation.

C. describe numbers based on their properties, perform divisibility tests, find greatest common factors and least common multiples of at least two numbers.

D. develop the concept of fraction and explain operations on fractions using appropriate models.

E. solve proportion, rate, and percent problems.

F. define the four fundamental operations on rational numbers, describe the conceptualizations of each operation, and describe multiple algorithms for each operation.
G. simplify expressions, solve equations, graph functions.

H. describe the properties and relationships of polygons and polyhedra, develop the concept of measurement (area, perimeter, surface area, volume), explain the image of a two-dimensional transformation, and perform basic geometric proofs and constructions.

I. collect, organize, and describe data using descriptive statistics and appropriate graphical organizers.

J. compute basic probabilities and outcomes from single stage and multi-stage experiments.

IV. Student Learning Outcomes:

A. Students will be able to model and explain contextual understanding of the four basic operations within various number systems.

B. Students will be able to describe a function’s characteristics (graph, limits, end behavior, intercepts, asymptotes).

C. Students will be able to complete basic geometric proofs and constructions.

V. Expectations of Students:

A. Attend class regularly
B. Participate in class activities
C. Read all assigned material
D. Demonstrate mastery of course objectives

VI. Course Outline:

<table>
<thead>
<tr>
<th>Topics</th>
<th>Class hours</th>
</tr>
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<tbody>
<tr>
<td>A. Numbers and the Base-Ten System</td>
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<td>B. Whole Numbers and Their Properties and Operations</td>
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<tr>
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<tr>
<td>Conceptualization of the operations</td>
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<tr>
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<tr>
<td>Computation in the four fundamental operations using various algorithms</td>
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</table>
D. Conceptual Development of Fractions
   Unit fractions
   Conversions between fractions, decimals, and percents
   Equivalence, ordering, operations

E. Ratio and Proportional Reasoning
   Defining ratio and proportional relationships
   Solving proportion problems
   Unit rate
   Proportional relationships vs inversely proportional relationships
   Percent increase, percent decrease

F. Rational Numbers and Their Properties and Operations
   Definitions of the operations on rational numbers
   Conceptualization of the operations
   Algorithms – common, historic, and alternative
   Computation in the four fundamental operations using various algorithms

G. Algebra
   Simplifying expressions
   Solving equations
   Graphing equations including transformations (linear, quadratic, cubic, absolute value)
   Function components (domain, range, intercepts, asymptotes, end behavior, limits)

H. Planar Geometry (two-dimensional)
   Basic planar definitions, parallel lines and their associated angles, polygons and their properties (names, angle relationships, side relationships, diagonals, lines of symmetry, rotational symmetry), properties of circles
   Measurement of planar figures (area, perimeter, base, height)
   Geometric Proofs (similarity, congruence)
   Constructions (straight edge and compass, patty paper)

I. Solid Geometry (three-dimensional)
   Basic solid definitions, properties of solids (faces, vertices, edges, Euler’s formula)
   Measurement of solid figures (surface area, volume)

J. Transformational Geometry
   Reflections, translations, rotations
   Symmetry, congruence

K. Statistics
   Data collection and organization of data
Descriptive statistics: mean, median, mode, and range
Summarizing, describing, and comparing data distributions

L. Probability
Basic principles of probability
Calculating outcomes in single stage and multi-stage experiments

M. Assessment

Total hours

VII. Textbook


VIII. Basis of Student Evaluation:

Homework (at least eight assignments) 20%
Projects (standards-based material, statistics project, historical perspective presentation) 20%
Quizzes (at least four quizzes) 20%
Tests (three tests and a final) 40%
US 1. Extensive Course Description:
Selected mathematical topics from school mathematics for secondary non-mathematics education majors. Required of secondary mathematics education majors adding middle school certification. Topics include: number systems, four fundamental operations on various number systems, properties of numbers, algebraic manipulations within expression and equations, explaining functions and their behaviors, properties of planar and solid geometric figures, transformations, geometric proofs and constructions, simple data analysis, probabilities. Students will be engaged in various activities that expand their understanding of school mathematics through standards-based materials and technology rich classrooms. (3)

US 2. Interdisciplinary Nature of the Course:

US 3. Objectives of the Course:
This course satisfies the Logical Systems requirement for secondary (non-mathematics) education majors. It can also be used to waive the requirements of MA118, MA318, and MA418 for secondary education majors adding middle school certification. It cannot be taken by middle school, elementary, or early childhood majors. The primary objectives are to:

A. describe the various number systems, including historical perspectives. (US Obj. 1, 3, 4)

B. define the four fundamental operations on whole numbers in terms of sets, describe the conceptualizations of each operation, and describe multiple algorithms for each operation. (US Obj. 1, 2, 3, 4)

C. describe numbers based on their properties, perform divisibility tests, find greatest common factors and least common multiples of at least two numbers. (US Obj. 2)

D. develop the concept of fraction and explain operations on fractions using appropriate models. (US Obj. 2, 4)

E. solve proportion, rate, and percent problems. (US Obj. 2)

F. define the four fundamental operations on rational numbers, describe the conceptualizations of each operation, and describe multiple algorithms for each operation. (US Obj. 1, 2, 3, 4)

G. simplify expressions, solve equations, graph functions. (US Obj. 2)

H. describe the properties and relationships of polygons and polyhedra, develop the concept of measurement (area, perimeter, surface area, volume), explain the image
of a two-dimensional transformation, and perform basic geometric proofs and constructions. (US Obj. 1, 2, 3, 4)

I. collect, organize, and describe data using descriptive statistics and appropriate graphical organizers. (US Obj. 1, 2, 3)

J. compute basic probabilities and outcomes from single stage and multi-stage experiments. (US Obj. 2)

**US 4. Student Learning Outcomes:**
A. Students will be able to model and explain contextual understanding of the four basic operations within various number systems. (US Obj. 2, 3)
B. Students will be able to describe a function’s characteristics (graph, limits, end behavior, intercepts, asymptotes). (US Obj. 2)
C. Students will be able to complete basic geometric proofs and constructions. (US Obj. 2, 3)

**US 5. Course Outline:**

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Percent increase, percent decrease

F. Rational Numbers and Their Properties and Operations (US Obj. 1, 2, 3, 4) 4
   Definitions of the operations on rational numbers
   Conceptualization of the operations
   Algorithms – common, historic, and alternative
   Computation in the four fundamental operations using various algorithms

G. Algebra (US Obj. 2) 5
   Simplifying expressions
   Solving equations
   Graphing equations including transformations (linear, quadratic, cubic, absolute value)
   Function components: domain, range, intercepts, asymptotes, end behavior, limits

H. Planar Geometry (two-dimensional) (US Obj. 1, 2, 3, 4) 5
   Basic planar definitions, parallel lines and their associated angles, polygons and their properties (names, angle relationships, side relationships, diagonals, lines of symmetry, rotational symmetry), properties of circles
   Measurement of planar figures (area, perimeter, base, height)
   Geometric Proofs (similarity, congruence)
   Constructions (straight edge and compass, patty paper)

I. Solid Geometry (three-dimensional) (US Obj. 1, 2, 3) 3
   Basic solid definitions, properties of solids (faces, vertices, edges, Euler’s formula)
   Measurement of solid figures (surface area, volume)

J. Transformational Geometry (US Obj. 1, 2, 3) 3
   Reflections, translations, rotations
   Symmetry, congruence

K. Statistics (Us Obj. 1, 2, 3) 3
   Data collection and organization of data
   Descriptive statistics: mean, median, mode, and range
   Summarizing, describing, and comparing data distributions

L. Probability (US Obj. 2) 3
   Basic principles of probability
   Calculating outcomes in single stage and multi-stage experiments

M. Assessment 3

Total hours 45
US 6. Justification for Inclusion in the University Studies Program:

**US Objective 1: Demonstrate the ability to locate and gather information**
*Emphasis: significant*
A. Content: (1) Students will utilize the class e-book, online resources, virtual manipulatives, and standards-based materials to support their learning. (2) Students will complete a statistics project.
B. Teaching Strategies: Demonstrative teaching, class discussion
C. Student Assignments: (1) Students will create a list of resources to be utilized in conjunction with current standards-based teaching. (2) Students will collect, organize, and describe data around a current educational issue using descriptive statistics and appropriate graphical organizers.
D. Student Evaluation: Rubrics

**US Objective 2: Demonstrate capabilities for critical thinking, reasoning and analyzing**
*Emphasis: significant*
A. Content: All course material will include this objective.
B. Teaching Strategies: Demonstrative teaching, class discussions, group activities
C. Student Assignments: Students will complete homework problems and group activities which incorporate this level of thought.
D. Student Evaluation: Graded homework assignments

**US Objective 3: Demonstrate effective communication skills**
*Emphasis: significant*
A. Content: Students will utilize effective communication skills in their study of geometry.
B. Teaching Strategies: Demonstrative teaching, class discussions, group activities
C. Student Assignments: Students will share geometric proofs with others, verbally and in written form.
D. Student Evaluation: Graded homework assignments via board problems/presentations

**US Objective 4: Demonstrate an understanding of human experiences and the ability to relate them to the present**
*Emphasis: some*
A. Content: Students will research the historical perspectives of various mathematical concepts: numbers and number systems, mathematical algorithms, and geometry.
B. Teaching Strategies: Demonstrative teaching, class discussion
C. Student Assignments: Students will create a presentation of their findings regarding the historical importance/impact of numbers and number systems, mathematical algorithms, and geometry as they relate to PK – 8 curriculum.
D. Student Evaluation: Rubric

**US Objective 5: Demonstrate an understanding of various cultures and their inter-relationships**
*Emphasis: not emphasized*
A. Content:
US Objective 6: Demonstrate the ability to integrate the breadth and diversity of knowledge and experience
Emphasis: not emphasized
A. Content:
B. Teaching Strategies:
C. Student Assignments:
D. Student Evaluation:

US Objective 7: Demonstrate the ability to make informed, intelligent value decisions
Emphasis: not emphasized
A. Content:
B. Teaching Strategies:
C. Student Assignments:
D. Student Evaluation:

US Objective 8: Demonstrate the ability to make informed, sensitive aesthetic responses
Emphasis: not emphasized
A. Content:
B. Teaching Strategies:
C. Student Assignments:
D. Student Evaluation:

US Objective 9: Demonstrate the ability to function responsibly in one’s natural, social and political environment
Emphasis: not emphasized
A. Content:
B. Teaching Strategies:
C. Student Assignments:
D. Student Evaluation:

US 7. Background:
The expertise and background required of the faculty members who teach this class is successful PK – 12 experience or successful past experience teaching other mathematics education classes or appropriate terminal degree in mathematics education.

US 8. Class Size:
Maximum optimal class size for MA218 is 25 due to the high demand for the instructor to interact with the teacher candidates in a rich, technological environment with concrete and virtual manipulatives while modeling a variety of teaching strategies.