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Mathematics (MATH) 1505 Mathematical Concepts for Elementary Teachers - Number Systems
(4 Units) CSU; UC

Prerequisite: Successful completion of Intermediate Algebra Math 1060 or equivalent with a grade of 'C' or better.

Prerequisite knowledge and skills: Before entering the course, the student should be able to:

1. identify numbers as belonging to specified sets, and graph discrete and continuous sets of real numbers,
2. perform the basic arithmetic operations with positive and negative real numbers, plus raising to powers,
3. know and apply the rules of exponents and the order of operations in algebraic calculations,
4. apply the properties of addition and multiplication for real numbers and identify their use in practice,
5. solve linear equations and inequalities in one variable, and analyze and solve applications leading to such equations or inequalities,
6. solve and graph the solutions of compound inequalities or absolute value inequalities in one variable,
7. perform addition, subtraction, multiplication and division of polynomials,
8. factor simple polynomials, with special emphasis on trinomials quadratic in form, and solve related polynomial equations,
9. add, subtract, multiply and divide rational algebraic expressions, and simplify to lowest terms,
10. solve equations involving rational algebraic expressions, and analyze and solve word problems leading to such equations,.
11. simplify radical expressions involving numbers and/or variables,
12. use fractional exponents,
13. perform addition, subtraction, multiplication and division of expression involving radicals and complex numbers and simplify the results, including rationalization of denominators,
14. solve equations that involve radicals,
15. solve quadratic equations in one variable, and equations quadratic in form, by factoring, completing the square, and the quadratic formula,
16. analyze and solve application problems requiring the use of quadratic equations,
17. solve and graph quadratic inequalities in one variable,
18. graph points in the rectangular coordinate system, and straight lines from ordered pairs obtained from its equation,
19. determine the slope of the line between any specified pair of points,
20. know the slope forms of the equation of a straight line, and be able to determine the equation of a particular straight line from specified input information,
21. solve and graph linear inequalities in two variables,

22. solve linear systems of equations in two or three variables algebraically, and solve those in two dimensions graphically,
23. analyze and solve application problems requiring the use of linear systems of equations in two or three variables,
24. evaluate determinants and use them to solve linear systems of equations,
25. determine whether or not a specified relation is a function,
26. for a function, compute the value of the function given the value of the independent variable, and be able to construct the inverse of simple functions in numeric or algebraic terms,
27. identify the quadratic equation representing a specific conic section, and be able to draw the graph of a conic section by analyzing its equation, or to write the equation of a specified conic section,
28. solve nonlinear systems of equation involving the intersection of two conic sections or a conic section and a straight line,
29. compute and graph specified exponential and logarithmic functions,
30. know the properties of logarithms (product, quotient, power and change of base rules) and be able to use them in practical numerical computations using a table of common logarithms or a calculator, and
31. solve simple exponential and logarithmic equations.

Hours and Unit Calculations: 64 hours lecture + 128 Outside of class hours (192 Total Student Learning Hours) = 4 Units.

Catalog Description: This course focuses on the development of quantitative reasoning skills through in-depth, integrated explorations of topics in mathematics, including real number systems and subsystems. Emphasis is on comprehension and analysis of mathematical concepts and applications of logical reasoning. Not recommended for majors in Physical Science or Mathematics. Transfer Credit: CSU; UC.

Type of Class/Course: Degree Credit

Texts: Long, Calvin T., et al. *Mathematical Reasoning for Elementary Teachers*, 7th ed., Pearson, 2015.

Additional Required Materials: N/A

Course Objectives:

By the end of the course, a successful student will be able to:

1. Perform calculations with place value systems;
2. Evaluate the equivalence of numeric algorithms and explain the advantages and disadvantages of equivalent algorithms in different circumstances;
3. Apply algorithms from number theory to determine divisibility in a variety of settings;
4. Analyze least common multiples and greatest common divisors and their role in standard algorithms;
5. Explain the concept of rational numbers, using both ratio and decimal representations; analyze the arithmetic algorithms for these two representations; and justify their equivalence;
6. Analyze the structure and properties of whole, rational, and real number systems; define the concept of rational and irrational numbers, including their decimal representation; and illustrate the use of a number line representation;

7. Develop and reinforce conceptual understanding of mathematical topics through the use of patterns, problemsolving, communication, connections, modeling, reasoning, and representation; and
8. Develop activities implementing curriculum standards.

Course Scope and Content:

- Unit I Patterns, Problem Solving, Communication, Connections, Modeling, Reasoning, and Representation
- A. An Introduction to Problem Solving
 - B. Polya's Problem-Solving Principles
 - C. More Problem-Solving Strategies, Patterns & Modeling
 - D. Algebra as a Problem-Solving Strategy
 - E. Additional Problem-Solving Strategies, Communication & Connections
 - F. Reasoning Mathematically & Representational Reasoning
- Unit II Real Numbers: Structure and Basic properties, Arithmetic Operations and Number Line Representation
- A. Basic Properties
 - B. Problem Solving with Real Numbers
 - C. Addition and Subtraction of Real Numbers & Number Lines
 - D. Multiplication and Division of Real Numbers
- Unit III Numeration systems: History, Hindu-Arabic Numeration System, and Place Value Systems
- A. Numeration Systems & Hindu-Arabic Numeration System
 - B. Algorithms for Addition and Subtraction of Whole Numbers
 - C. Algorithms for Multiplication and Division of Whole Numbers
 - D. Mental Arithmetic & Estimation
 - E. Non-decimal Positional Systems & Place Value Systems
- Unit IV Basic Number Theory: Divisibility, Prime and Composite Numbers, Prime Factorization, Fundamental Theorem of Arithmetic, Least Common Multiple and Greatest Common Divisor
- A. Prime Factorization & Prime and Composite Numbers & Fundamental Theorem of Arithmetic
 - B. Tests for Divisibility
 - C. Least Common Multiple and Greatest Common Divisor
- Unit V Integers: Structure and Basic Properties, Computational Algorithms
- A. Representations of Integers
 - B. Addition and Subtraction of Integers
 - C. Multiplication and Division of Integers & Computational Algorithms
- Unit VI Rational Numbers: Structure and Properties
- A. The Basic Concepts of Fractions and Rational Numbers
 - B. Addition and Subtraction of Fractions
 - C. Multiplication and Division of Fractions
 - D. The Rational Number System

- Unit VII Rational and Irrational Numbers: Ratio and Proportion and Decimal Representation
- A. Decimals and Real Numbers
 - B. Computations with Decimals
 - C. Ratio & Proportion
 - D. Percent

- Unit VIII National and State Curriculum Standards for Elementary School Math including Common Core State Standards
- A. National and State Curriculum Standards for Elementary School Math
 - B. Common Core State Standards for Elementary School Math

Learning Activities Required Outside of Class:

The students in the class will spend a minimum of 8 hours per week outside of the regular class time doing the following:

- 1. Studying
- 2. Skill practice
- 3. Completing required reading
- 4. Problem solving activity or exercise

Methods of Instruction

- 1. Lecture-demonstrations and sample problems by instructor
- 2. Class discussions
- 3. Audiovisual presentations

Methods of Evaluation

- 1. Computational or non-computational problem-solving demonstrations, including:
 - a. exams
 - b. homework problems
 - c. quizzes
 - d. projects
- 2. Writing Assignment

Supplemental Data:

TOP Code:	170100: Mathematics, General
SAM Priority Code:	E: Non-Occupational
Funding Agency:	Y: Not Applicable (funds not used)

Program Status:	I: Program Applicable
Noncredit Category:	Y: Not Applicable, Credit Course
Special Class Status:	N: Course is not a special class
Basic Skills Status:	N: Course is not a basic skills course
Prior to College Level:	Y: Not applicable
Cooperative Work Experience:	N: Is not part of a cooperative work experience education program
Eligible for Credit by Exam:	E: Credit By Exam
Eligible for Pass/No Pass:	C: Pass/No Pass