



# ILLINOIS VALLEY COMMUNITY COLLEGE

## COURSE OUTLINE

**DIVISION:** Natural Sciences and Business

**COURSE:** MTH 1009 Structure of Number Systems I

Date: Spring 2022

Credit Hours: 3

*Complete all that apply or mark "None" where appropriate:*

Prerequisite(s): MTH 0908 and MTH 0920 with a C or better

Enrollment by assessment or other measure?  Yes  No

If yes, please describe: By appropriate assessment

Corequisite(s): None

Pre- or Corequisite(s): None

Consent of Instructor:  Yes  No

Delivery Method:  **Lecture**                      **3 Contact Hours** (1 contact = 1 credit hour)  
 **Seminar**                              **0 Contact Hours** (1 contact = 1 credit hour)  
 **Lab**                                        **0 Contact Hours** (2-3 contact = 1 credit hour)  
 **Clinical**                                **0 Contact Hours** (3 contact = 1 credit hour)  
 **Online**  
 **Blended**  
 **Virtual Class Meeting (VCM)**

Offered:  **Fall**     **Spring**     **Summer**

### **CATALOG DESCRIPTION and IAI NUMBER (if applicable):**

This course is a study of the basic structure of the real number system, set theory, basic algorithms, informal geometry, and problem solving. The goal of this course is to increase the student's knowledge and understanding of mathematical theories and concepts. This is not a course in computational arithmetic skills. This course is recommended for students majoring in elementary or junior high education.

## **ACCREDITATION STATEMENTS AND COURSE NOTES:**

None

## **COURSE TOPICS AND CONTENT REQUIREMENTS:**

- I. Critical Thinking
  - A. Problem solving intro
  - B. Problem-solving principles
  - C. Problem-solving strategies, including algebra
  - D. Logic
  
- II. Sets and Whole Numbers
  - A. Describing sets and using set operations
  - B. Sets, counting, and the whole numbers
  - C. Whole number addition and subtraction
  - D. Whole number multiplication and division
  
- III. Numeration and Computation
  - A. Numeration Systems
  - B. Whole number addition and subtraction algorithms
  - C. Whole number multiplication and division algorithms
  - D. Mental arithmetic and estimation
  - E. Nondecimal positional systems including addition, subtraction, and multiplication
  
- IV. Number Theory
  - A. Divisibility, primes, and composites
  - B. Tests for divisibility
  - C. Greatest common divisor and least common multiple
  
- V. Integers
  - A. Representations of integers
  - B. Addition and subtraction of integers
  - C. Multiplication and division of integers
  
- VI. Rational Numbers and Fractions
  - A. Basics of fractions and rational numbers
  - B. Addition and subtraction of fractions
  - C. Multiplication and division of fractions
  - D. Rational number system
  
- VII. Decimals, Real Numbers, and Proportional Reasoning
  - A. Decimals and real numbers
  - B. Computations with decimals
  - C. Proportional reasoning
  - D. Percent

## **INSTRUCTIONAL METHODS:**

Lecture

Class discussion, participation, activities

Audio-visual aids - calculator, document camera, computers, etc.

Written assignments (reflection journals, etc)  
Quizzes and examinations

### **EVALUATION OF STUDENT ACHIEVEMENT:**

Unit Tests  
Comprehensive final exam  
Projects  
MyMathLab assignments  
Quizzes

### **INSTRUCTIONAL MATERIALS:**

#### **Textbooks**

Mathematical Reasoning for Elementary Teachers, 7<sup>th</sup> Edition, Long, DeTemple,  
Millman, 2015  
Student Access Kit for MyMathLab

#### **Resources**

A Problem Solving Approach to Mathematics, Billstein, Libeskind, Lott, Addison Wesley  
Longman.  
Mathematics: A Practical Odyssey, Johnson, Mowry, Brooks/Cole  
The Nature of Mathematics, Smith, Brooks/Cole  
Illinois Common Core Standards

### **LEARNING OUTCOMES AND GOALS:**

#### **Institutional Learning Outcomes**

- 1) Communication – to communicate effectively;
- 2) Inquiry – to apply critical, logical, creative, aesthetic, or quantitative analytical reasoning to formulate a judgement or conclusion;
- 3) Social Consciousness – to understand what it means to be a socially conscious person, locally and globally;
- 4) Responsibility – to recognize how personal choices affect self and society.

#### **Course Outcomes and Competencies**

##### **1. Students will demonstrate knowledge of Critical Thinking**

- 1.1. Students will be able to distinguish between different explorations with patterns.
- 1.2. Students will be able to discuss mathematics and problem solving.
- 1.3. Students will be able to apply algebraic thinking to problem solving situations.
- 1.4. Students will be introduced to the concept of logic as it applies to mathematics.

##### **2. Students will demonstrate knowledge of Sets and Whole Numbers**

- 2.1. Students will be able to describe sets in different ways.
- 2.2. Students will be able to apply set operations and their properties to real world applications.
- 2.3. Students will be introduced to techniques for understanding addition and subtraction of whole numbers at an elementary level.
- 2.4. Students will be introduced to techniques for understanding multiplication and division of whole numbers at an elementary level.
- 2.5. Students will be able to use functional notation to describe mathematical relationships.

- 3. Students will demonstrate knowledge of Whole Number Computation.**
  - 3.1. Students will be introduced to other cultural numeration systems.
  - 3.2. Students will be introduced to algorithms for whole number addition and subtraction, including use of manipulatives and clock arithmetic; and addition and subtraction of numbers in bases other than ten.
  - 3.3. Students will be introduced to algorithms for whole number multiplication and division, including use of manipulatives; and multiplication in bases other than 10.
  - 3.4. Students will be able use mental mathematics and estimation techniques to better understand whole number operations including strategies for front-end, clustering, rounding, and nice number estimation.
- 4. Students will demonstrate knowledge of Number Theory.**
  - 4.1. Students will be able to use different tests of divisibility vital to understanding the concept of factoring.
  - 4.2. Students will understand the concepts of prime and composite numbers and how they relate to applications.
  - 4.3. Students will be able to determine a set of numbers greatest common divisor and least common multiple.
- 5. Students will demonstrate knowledge of Integers.**
  - 5.1. Students will understand representations of integers with colored counters, real-time scenarios, and number lines; also, include absolute value.
  - 5.2. Students will understand the operations of addition and subtraction of integers using various representations.
  - 5.3. Students will understand the operations of multiplication and division of integers using various representations.
- 6. Students will demonstrate knowledge of Fractions and Rational Numbers.**
  - 6.1. Students will be able to define and use the set of rational numbers including identifying equivalent fractions, simplifying fractions, and ordering rational numbers.
  - 6.2. Students will be able to add and subtract fractions and mixed numbers.
  - 6.3. Students will be able to multiply and divide fractions using various algorithms and express reciprocals as multiplicative inverses.
  - 6.4. Students will be able to use the properties of addition, subtraction, multiplication, and division of rational numbers including the density property of rational numbers, estimations, and mental arithmetic.
- 7. Students will demonstrate knowledge of Decimals, Proportional Reasoning, and Real Numbers.**
  - 7.1. Students will understand how decimals are related to rational numbers; properties and manipulations of terminating and repeating decimals; irrational numbers; combine all number systems covered into the larger number system of real numbers.
  - 7.2. Students will be able to perform basic operations involving decimals including adding, subtracting, multiplying, and dividing; also introduced to scientific notation.
  - 7.3. Students will be introduced to proportional reasoning including the ratio, proportion, and applications.
  - 7.4. Students will understand the definition of a percent, how it relates to decimals and fractions, and work application problems involving percents, compound interest, and growth.