MOHAWK VALLEY COMMUNITY COLLEGE

 UTICA and ROME, NEW YORK

 COURSE OUTLINE

 MA115

 INTERMEDIATE MATHEMATICS

Reviewed and Found Acceptable February 2022

 COURSE OUTLINE

Title: Intermediate Mathematics

Catalog Number: MA115

Class Period: 3

Practicum Hours: 2

Credit Hours: 4

Prerequisite: An appropriate high school GPA, or placement test score, or MA 089 Arithmetic.

Catalog

Description: This course introduces intermediate algebra skills. Topics include exponents and radicals, polynomial and rational expressions, functions and relations and their graphs, inequalities, and systems of linear equations. Linear, quadratic, rational, and radical equations are solved. Applications are included.

Note: A supplement with the names of some famous mathematicians and their contributions relating to the course topics is attached. Instructors should include these or other mathematicians in classroom discussion. *See Learning Goal C.*

**COURSE TEACHING GOALS FOR ALL TOPICS:**

**GOAL A**: Use mathematical processes to acquire and convey

 knowledge.

**GOAL B**: Systematically solve problems.

**GOAL C:** Demonstrate an awareness of the historical development of algebra and how it relates to various disciplines.

**SUNY Learning Outcomes**

1. The student will develop well reasoned arguments.
2. The student will identify, analyze, and evaluate arguments as they occur in their own and other’s work.
3. The student will demonstrate the ability to interpret and draw inferences from mathematical models such as formulas, graphs, tables, and schematics.
4. The student will demonstrate the ability to represent mathematical information symbolically, visually, numerically, and verbally.
5. The student will demonstrate the ability to employ quantitative methods such as arithmetic, algebra, geometry, or statistics to solve problems.
6. The student will demonstrate the ability to estimate and check mathematical results for reasonableness.

Topics and Student Learning Outcomes

**1. Types of Numbers (Whole, Integer, Rationals (decimals and fractions)) and Algebraic Expressions**

1.1 Perform basic operations on the different types of numbers

1.2 Simplify and evaluate algebraic expressions using order of operations, and distribution of a constant over an expression

**2. Linear Equations and Linear Inequalities**

2.1. Solve linear equations, including those involving fractions and decimals, by using the properties of the real numbers

2.2 Identify conditional equations, contradictions, and identities

2.3 Solve a formula for a specified variable

2.4 Perform conversions between percents and fractions and decimals as needed

2.5 Translate given verbal sentences into equations and solve

2.6 Solve applications of linear equations such as investment, mixture, and uniform motion problems.

2.7 Locate real values on a number line and use order relations to compare the values

2.8 Solve simple linear inequalities in one variable

2.9 Represent solutions to linear inequalities in interval notation

**3. Equations of Lines and Linear Systems**

3.1 Graph ordered pairs on a rectangular coordinate system

3.2 Determine solutions to given linear equations in two variables (complete a table of values)

3.3 Graph solutions of given linear equations in two variables

3.4 Write equations of vertical and horizontal lines, and graph

3.5 Determine the x and y-intercepts of linear equations and use them to graph the line

3.6 Determine and interpret the slopes of lines given a) two points on the line; b) the equation of the line; and c) the graph of the line

3.7 Determine an equation of a line given a) a point and the slope; b) the graph; and c) two points on the line

3.8 Determine an equation of a line parallel or perpendicular to a given line

3.9 Graph lines using the slope-intercept method of graphing

3.10 Solve systems of linear equations in two variables by graphing, substitution and elimination

**4. Functions**

4.1 Define relations and functions and determine if a relation is a function by using the definition and by using the vertical line test

4.2 Interpret the graphical and algebraic representation of a function in an applied setting

4.3 Find the domain and range from a set of ordered pairs and from a graph

4.4 Use function notation and evaluate functions

**5. Polynomials** (linear and quadratics also have their own heading)

5.1 Use the rules of exponents that pertain to the arithmetic of polynomials

5.2 Add and subtract polynomials

5.3 Multiply any two polynomials

5.4 Divide a polynomial by a monomial

5.5 Divide a polynomial by a polynomial of two or more terms using long division, where neither the dividend nor the divisor has a missing term

5.6 Factor the greatest common factor from a polynomial; factor by grouping; factor monic quadratic trinomials; factor non-monic quadratic trinomials; and factor the difference of two perfect squares

5.7 Solve equations by factoring

5.8 Evaluate polynomial functions

5.9 Graph the squaring function and the cubing function and find the domain and range

**6. Rational Expressions and Rational Functions**

6.1 Find the domain of a rational function

6.2 Write rational expressions in lowest terms

6.3 Add and subtract rational expressions with and without a common denominator

6.4 Multiply and divide rational expressions

6.5 Simplify complex fractions

6.6 Solve rational equations and formulas for a specified variable

**7. Exponents, Radicals, Root Functions, and Complex Numbers**

7.1 Approximate radical values using a calculator with emphasis on approximating the square root of a number

7.2 Simplify expressions with integer and rational exponents

7.3 Convert between radical form and rational exponential form

7.4 Simplify radical expressions

7.5 Rationalize a denominator containing a square root

7.6 Use the imaginary unit i to simplify square roots of negative numbers

7.7 Graph the square root function and cube root function and find the domain and range

7.8 Solve radical equations that do not involve squaring more than once

**8. Quadratic Equations and Functions**

8.1 Solve a quadratic equation using the square root property, by factoring, and by the quadratic formula

8.2 Solve formulas involving squares and square roots for specified variables

8.3 Solve applied problems involving the Pythagorean Theorem and projectiles

Supplement of Names of Mathematicians:

Pythagoras – Pythagorean Theorem

Descartes – Cartesian Plane; applied algebra to geometry

Euclid – “Parallel Postulate”

Pascal – invented the first digital calculator, called the Pascaline, in 1642

Newton – generalized the simplification of expressions of the type (a + b)n

Riemann – tracked the occurrence of prime numbers

Cantor – worked with infinite sets, defined countable, Q, and uncountable, R, sets

Polya – Four-Step problem solving process

 TEACHING GUIDE

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Text: Intermediate Algebra, Lynn Maracek, Santa Ana College. OpenStax.CNX. 2017

 <https://open.umn.edu/opentextbooks/textbooks/intermediate-algebra-2017>

Calculator: The student is expected to have a scientific calculator.

Note: A supplement with the names of some famous mathematicians and their contributions relating to the course topics is included with the course outline. Instructors should include these or other mathematicians in classroom discussion.

**Chapter 1 Foundations 3 hours**

1.1 Use the Language of Algebra

1.2 Integers

1.3 Fractions

1.4 Decimals

1.5 Properties of Real Numbers

**Chapter 2 Solving Linear Equations 5 hours**

 2.1 Use a General Strategy to Solve Linear Equations

 2.2 Use a Problem Solving Strategy

 2.3 Solve a Formula for a Specific Variable

 2.4 Solve Mixture and Uniform Motion Problems

 2.5 Solve Linear Inequalities

2.6 **(OMIT)**

2.7 **(OMIT)**

**Chapter 3 Graphs and Functions 5 hours**

 3.1 Graph Linear Equations in Two Variables

 3.2 Slope of a Line

 3.3 Find the Equation of a Line

 3.4 **(OMIT)**

3.5 Relations and Functions

3.6 Graphs of Functions

**Chapter 4 Systems of Linear Equations 3 hours**

 4.1 Solve Systems of Linear Equations in Two Variables

 4.2 **(OMIT)**

 4.3 **(OMIT)**

 4.4 **(OMIT)**

 4.5 **(OMIT)**

 4.6 **(OMIT)**

 4.7 **(OMIT)**

**Chapter 5 Polynomials and Polynomial Functions 5 hours**

 5.1 Add and Subtract Polynomials

5.2 Properties of Exponents and Scientific Notation

5.3 Multiply Polynomials

5.4 Dividing Polynomials

Chapter 6 Factoring 4 hours

 6.1 Greatest Common Factor and Factor by Grouping

 6.2 Factor Trinomials

 6.3 Factor Special Products

6.4 General Strategy for Factoring Polynomials

6.5 Polynomial Equations

**Chapter 7 Rational Expressions and Functions 7 hours**

 7.1 Multiply and Divide Rational Expressions

 7.2 Add and Subtract Rational Expressions

 7.3 Simplify Complex Rational Expressions

 7.4 Solve Rational Equations

 7.5 Solve Applications with Rational Equations

 7.6 (**OMIT)**

**Chapter 8 Roots and Radicals 5 hours**

8.1 Simplify Expressions with Roots

8.2 Simplify Radical Expressions

8.3 Simplify Rational Exponents

8.4 Add, Subtract and Multiply Radical Expressions

 8.5 Divide Radical Expressions

 8.6 Solve Radical Equations

 8.7 Use Radicals in Functions

 8.8 Use the Complex Number System

**Chapter 9 Quadratic Equations and Functions 5 hours**

 9.1 Solve Quadratic Equations using the Square Root Property

9.2 (**OMIT)**

9.3 Solve Quadratic Equations using the Quadratic Formula

 9.4 (**OMIT)**

 9.5 Solve Applications of Quadratic Equations

 9.6 **(OMIT)**

 9.7 **(OMIT)**

 9.8 **(OMIT)**

**Assessments**

**The teaching guide allows 3 additional hours for the in-class assessment of student learning. The practicum experience will be included as a portion of the final grade for the course. A two hour comprehensive final examination will also be given.**