

MOHAWK VALLEY COMMUNITY COLLEGE

COURSE OUTLINE

MA 125

COLLEGE ALGEBRA AND TRIGONOMETRY

Prepared by: The Group, Russ Penner, Chair - September 2004

Reviewed and Found Acceptable by Russ Penner – 5/05

Reviewed and Found Acceptable by Russ Penner – 5/06

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Reviewed and Revised by John Swistak – 5/08

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Reviewed and Revised by John Swistak – 4/17

Reviewed and Revised by Russ Penner – 6/18

Course Outline

<u>Title:</u>	College Algebra and Trigonometry
<u>Catalog Number:</u>	MA 125
<u>Credit Hours:</u>	4
<u>Lab Hours:</u>	0
<u>Prerequisite:</u>	An appropriate placement test result or MA 115 Intermediate Mathematics.
<u>Catalog Description:</u>	This course prepares students for MA150 Precalculus. Topics include linear and quadratic equations; inequalities; rational expressions; trigonometric functions; graphs of linear, quadratic, piecewise, and trigonometric functions; and, systems of equations. Algebraic and trigonometric manipulations, and problem-solving are emphasized.

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 trigonometry and how they relate 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.

TOPIC 1: Fundamental Concepts and Algebraic Operations

Basic algebraic definitions and operations are developed. Manipulations in order to simplify algebraic expressions are studied.

Student Outcomes:

The student will:

- 1.1 Identify characteristics and ordering of subsets of the real numbers
- 1.2 Demonstrate an understanding of the properties of addition and multiplication of algebraic expressions
- 1.3 Simplify algebraic expressions by removing parentheses
- 1.4 Simplify or evaluate algebraic expressions using the order of operations agreement
- 1.5 Perform basic operations (addition, subtraction, multiplication, and division) on polynomials
- 1.6 Provide solutions to problems involving exponents or roots
- 1.7 Perform operations on exponential expressions
- 1.8 Perform operations on expressions involving radicals
- 1.9 Simplify expressions involving exponents or radicals
- 1.10 Change from radical form to rational exponent form, and vice-versa
- 1.11 Change from logarithmic expressions into exponential and vice-versa

TOPIC 2: Functions and Graphs

After the basic algebraic techniques are established, an introduction to the concept of, properties of, graphs of, and operations with functions are developed and studied.

Student Outcomes:

The student will:

- 2.1 Evaluate functions
- 2.2 Write functions from a given statement
- 2.3 Sketch the graph of a function by plotting points
- 2.4 Sketch the graph of piecewise-defined functions
- 2.5 Put the equation of a circle in standard form by completing the square
- 2.6 Determine whether a given expression represents a function
- 2.7 Determine the domain and range of a function, both algebraically and graphically
- 2.8 Use symmetry, translations, and reflections as aids in graphing functions
- 2.9 Add, subtract, multiply and divide functions
- 2.10 Form the composition of two functions
- 2.11 Determine if a function is one-to-one
- 2.12 Find the inverse function of a given one-to-one function
- 2.13 Given two functions, determine if one function is the inverse of the other
- 2.14 Given a graph (or equation) obtained from transformations of a basic function, write the equation (or draw the graph) of the transformed function
- 2.15 Determine the vertex of a quadratic function by completing the square

- 2.16 Use linear models to analyze a quantitative relationship
- 2.17 Use quadratic models to analyze a quantitative relationship

TOPIC 3: Operations with Algebraic Expressions

Special products and factoring are developed. Additionally, the manipulation of algebraic fractions is studied.

Student Outcomes:

The student will:

- 3.1 Factor trinomials over the rational numbers
- 3.2 Factor common factors and factor by grouping
- 3.3 Factor the difference of two squares and the sum or difference of two cubes
- 3.4 Perform operations (reducing, addition, subtraction, multiplication, division) on rational expressions
- 3.5 Simplify complex fractions
- 3.6 Solve equations involving fractions which lead to linear and quadratic equations, including those having extraneous solutions

TOPIC 4: Solutions of Equations and Inequalities

Solutions of linear and fractional equations are studied. The quadratic equation is solved by factoring, completing the square and by use of the quadratic formula. Algebraic solution of inequalities and inequalities involving absolute values complete this portion.

Student Outcomes:

The student will:

- 4.1 Solve linear equations in one unknown
- 4.2 Solve applied work problems (including applications which use formulas) that yield a linear equation with one unknown.
- 4.3 Solve quadratic equations having real or complex roots
- 4.4 Solve absolute values and inequalities
- 4.5 Solve quadratic inequalities
- 4.6 Solve rational inequalities
- 4.7 Solve exponential and logarithmic equations leading to linear equations
- 4.8 solve applied problems involving pH

TOPIC 5: Systems of Equations

Systems of linear equations are solved using graphical, algebraic and matrix methods.

Student Outcomes:

The student will:

- 5.1 Graph linear equations in two variables
- 5.2 Solve systems of two linear equations in two unknowns algebraically (by substitution and also by elimination)
- 5.3 Solve systems of linear equations with three unknowns algebraically
- 5.4 Determine whether a system of linear equations is consistent, dependent, or inconsistent, and discuss what this means algebraically and geometrically
- 5.5 Solve a non-linear system of equations algebraically

TOPIC 6: Introduction to Trigonometry

This portion of the course assumes no prior study of trigonometry and is taught as a first course for the student on this subject. Angle measure (using both degree and radians) is developed. Right triangle trigonometry is first developed, followed by the development of the general trigonometric functions through the use of the unit circle.

Student Outcomes:

The student will:

- 6.1 Determine the values of the trigonometric functions in exact form for multiples of $\pi/2$, π , $\pi/4$, $\pi/3$, and $\pi/6$
- 6.2 Convert the measure of an angle from degrees to radians, and vice-versa, by using a calculator, and also exactly
- 6.3 Determine any number of angles that are coterminal with a given angle
- 6.4 Use the definitions of the trigonometric functions to find the value of a trigonometric function of an angle
- 6.5 Determine the sign of a trigonometric function of an angle
- 6.6 Use the reference angle to find the values of trigonometric functions of any angle
- 6.7 Determine the angle(s), given the value of a trigonometric function of an angle
- 6.8 Use proper notation for inverse trigonometric functions

TOPIC 7: Applications of Trigonometry

Use of the calculator to find the trigonometric values is taught. The method of finding the trigonometric values of special angles (30° , 45° , 60° and the quadrantal angles) is shown. Applications of right triangle trigonometry are studied.

Student Outcomes:

The student will:

- 7.1 Use right triangle trigonometry to find unknown parts of a right triangle
- 7.2 Solve applied problems involving right triangles

TOPIC 8: More Topics in Trigonometry

Graphing the sine and cosine functions is studied. Oblique triangles with the Law of Sines and the Law of Cosines are studied.

Student Outcomes:

The student will:

- 8.1 Sketch the graphs of $y = \sin(x)$ and $y = \cos(x)$
- 8.2 Solve oblique triangles using the law of sines
- 8.3 Solve oblique triangles using the law of cosines

Teaching Guide

<u>Title:</u>	College Algebra and Trigonometry
<u>Catalog Number:</u>	MA 125
<u>Class Period:</u>	4
<u>Practicum Hours:</u>	0
<u>Credit Hours:</u>	4
<u>Prerequisite:</u>	An appropriate placement test result or MA 115 Intermediate Mathematics.
<u>Catalog Description:</u>	This course prepares students for MA150 Precalculus. Topics include linear and quadratic equations; inequalities; rational expressions; trigonometric functions; graphs of linear, quadratic, piecewise, and trigonometric functions; and, systems of equations. Algebraic and trigonometric manipulations, and problem-solving are emphasized.
<u>Text:</u>	<u>College Algebra Building Skills and Modeling Situations</u> , Charles P. McKeague, Katherine Yoshiwara, and Denny Burzynski, XYZ Textbooks, 2013. <u>Trigonometry Supplement</u> , Revathi Narasimhan, XYZ Textbooks, 2017

Chapter 1	<u>Algebra Review</u>	9 hours
1.1	Definitions, Properties, and Simplifying Expressions	
1.2	Exponents and Scientific Notation	
1.3	Polynomials, Sums, Differences, and Products	
1.4	Review of Factoring	
1.5	Rational Expressions	
1.6	Roots and Radicals	
1.7	Complex Numbers	
Chapter 2	<u>Solving Equations and Inequalities</u>	12 hours
2.1	Linear and Quadratic Equations	
2.2	More Quadratic Equations	
2.3	Additional Equations and Formulas	
2.4	More Applications and Modeling	
2.5	Linear, Quadratic, and Rational Inequalities	
2.6	Equations and Inequalities with Absolute Value	

Chapter 3 Functions and Graphs 8 hours

- 3.1 Paired Data and Graphing
- 3.2 Introduction to Functions and Relations
- 3.3 Function Notation and More Graphing
- 3.4 Transformations and Other Graphing Techniques
- 3.5 Algebra and Composition with Functions

Chapter 4 Slope, Rates of Change, and Linear Functions 2 Hours

- 4.1 The Slope of a Line
- 4.2 Linear Functions and Equations of Lines
- 4.3 OMIT
- 4.4 OMIT

Chapter 5 Polynomial and Rational Functions 2 hours

- 5.1 Quadratic Functions and Models
- 5.2 Division with Polynomials

Note: Synthetic division and its associated examples and problems may be omitted.

- 5.3 OMIT
- 5.4 OMIT
- 5.5 OMIT
- 5.6 OMIT

Chapter 6 Exponential and Logarithmic Functions 5 hours

- 6.1 Exponential Functions

Note: Cover the definition and graphing of Exponential functions and The Natural Exponential Function, but omit Compound Interest, continuous compounding, and exponential models.

- 6.2 The Inverse of a Function

Note: It is recommended that inverse functions be included with composition of functions at the end of chapter two.

- 6.3 Logarithms are Exponents

Note: Omit example 6, and any exercises that relate to this example.

- 6.4 Properties of Logarithms
- 6.5 Common Logarithms and Natural Logarithms
- 6.6 Exponential Equations and Change of Base

Chapter T Trigonometric Functions 14 hours

- T.1 Angles and Their Measure
- T.2 Right Angle Trigonometry
- T.3 Trigonometric Functions of any Angle Using Right Triangles
- T.4 Graphs of the Sine and Cosine Functions

Note: The only part of this sections that is included is the graphs of $y=\sin(x)$ and $y=\cos(x)$, without changes to the amplitude, period, and translations. The emphasis is on the use of the graph to enhance understanding of the behavior and exact values of the functions.

- T.5 Graphs of Other Trigonometric Functions

Note: The only part of this section that is included is the Properties of the functions.

- T.6 OMIT
- T.7 The Law of Sines
- T.8 The Law of Cosines

Chapter 7 Systems of Equations 2 hours

- 7.1 Systems of Linear Equations in Two Variables
- 7.2 Systems of Linear Equations in Three Variables

Chapter 9 Conic Sections

- 9.3 Second Degree inequalities and Nonlinear Systems 2 Hours

(Note: this is found in the online version of the test at xyztextbooks.com The only portion of this section covered is systems of equations: Examples 4-7.)

The teaching guide allows four additional hours for the in-class assessment of student learning. Testing may include any combination of exams and quizzes. A two hour comprehensive final examination will also be given.

List of Mathematicians related to this course:

Rene Descartes
Leonhard Euler
Pierre deFermat
Galileo Galelei
Karl (Carl) F. Gauss
Heron of Alexandria
Hipparchus of Nicaea
George Polya
Pythagoras