

**MISSOURI WESTERN STATE UNIVERSITY**

**COLLEGE OF SCIENCE AND HEALTH**

**DEPARTMENT OF COMPUTER SCIENCE, MATHEMATICS, AND PHYSICS**

***COURSE NUMBER:*** MAT 116

***COURSE NAME:*** College Algebra

***COURSE DESCRIPTION:***

Linear, quadratic, and miscellaneous equations and inequalities; relations and functions including polynomial, rational, exponential, and logarithmic functions; graphing; systems of equations; and matrices.  
(3 credit hours)

***PREREQUISITE(S):***

One of the following must be met: ACT math subscore of at least 22; a sufficient score on the math placement exam; a minimum grade of C in MAT110E/110 or higher; departmental approval.

***TEXT:***

*College Algebra*, Mark Dugopolski, 6<sup>th</sup> Edition, Pearson, ISBN 9780321916600

***TECHNOLOGY:***

Use of graphing calculators will be required throughout the course and each student must have access to a suitable graphing calculator. The graphing calculator must have at least the capabilities of the TI-83 (the recommended calculator). Graphing calculators other than Texas Instruments calculators may be used but classroom instruction on calculators will be given for TI equipment only. Graphing calculators having the capabilities of the TI-89 or higher will not be allowed during course examinations.

***COURSE OBJECTIVES:***

This course is intended to satisfy the general studies mathematics requirement for a baccalaureate degree. It is also designed to serve as a prerequisite for future study in mathematics and science. In order to meet these goals, students will learn how to:

1. Use appropriate algebraic techniques to solve a variety of equations and inequalities.
2. Construct and graph a variety of functions.

3. Use systems of equations and appropriate problem solving techniques to solve problems involving two or more variables

***STUDENT COMPETENCIES:***

In order to meet the above objectives, successful students will be able to:

1. Determine the equation for a line given specific information about the line (e.g., passes through a given point, is perpendicular/parallel to a given line).  
(*Precalculus I.B.1, I.C.1, II.A.1, II.A.2*)
2. Solve the following types of equations *using algebraic methods*: linear, absolute value, quadratic, polynomial, rational, exponential, logarithmic, and equations involving radicals and rational exponents.  
(*Precalculus I.C.1, II.B.6, II.C.1, II.C.4, III.A.1, III.A.4, III.B.1, III.B.2, III.C.1, III.C.2*)
3. Solve the following types of inequalities *using algebraic methods*: compound linear, absolute value, quadratic, and rational. (*Precalculus I.C.1, III.A.2*)
4. Determine the domain and range for a given function. (*Precalculus I.A.1, I.A.2, I.A.3, II.B.3, II.C.1*)
5. Evaluate a function for a given value of  $x$ . (*Precalculus I.A.1, I.A.2, I.A.4*)
6. Compute the average rate of change of a function. (*Precalculus I.B.2, I.B.3*)
7. Construct and evaluate a sum, difference, product, quotient, or composition of two functions, and determine the domain of that new function.  
(*Precalculus I.A.3, I.A.4, II.D.2, II.D.3, II.D.4*)
8. Use transformations to sketch the graph of a function. (*Precalculus II.D.1*)
9. Write the equation for a graph obtained by a described transformation.  
(*Precalculus II.D.1*)
10. Determine if a function is odd, even, or neither. (*Precalculus II.C.2*)
11. Sketch the graph of  $f^{-1}$  for a given function  $f$ . (*Precalculus II.D.5*)
12. Find the equation for the inverse function of a given function  $f$ . (*Precalculus II.D.5*)
13. Determine the axis of symmetry, vertex, and  $x$ - and  $y$ -intercepts for a given quadratic function *using algebraic methods*. (*Precalculus I.C.1, II.C.3, II.C.4, III.A.1, III.A.3*)

14. Determine the domain, the equations for the asymptotes (vertical, horizontal, and oblique), the  $x$ - and  $y$ -intercepts, and the sketch of a given rational function *using algebraic methods*. (*Precalculus I.A.3, I.C.1, II.C.3, II.C.4, II.C.5*)
15. Use appropriate division techniques (i.e., long division or synthetic division) to determine the quotient and remainder for a given dividend and divisor.
16. Use appropriate division techniques (i.e., long division or synthetic division), and the Remainder Theorem, to determine the value of a function at a specified  $x$ -value. (*Precalculus I.A.4*)
17. Determine whether a given binomial is a factor of a polynomial, and if so, factor the polynomial completely.
18. Find all real and imaginary zeros (and their multiplicities) for a given polynomial function. (*Precalculus II.C.4, III.A.4*)
19. Perform operations with complex numbers. (*Precalculus III.A.3*)
20. Determine the behavior of a polynomial function at its  $x$ -intercepts by noting the multiplicities. (*Precalculus II.C.3*)
21. Use the Leading Coefficient Test to determine the end-behavior of a polynomial function. (*Precalculus II.C.3*)
22. Use behavior at  $x$ -intercepts and the end-behavior given by the Leading Coefficient Test to give a *rough* sketch of a given polynomial function. (*Precalculus II.C.4*)
23. Evaluate exponential and logarithmic expressions without a calculator. (*Precalculus I.C.1, II.B.3, II.B.6*)
24. Apply the properties of logarithms to write a logarithmic expression as a sum or difference of multiples of logarithms. (*Precalculus III.B.1*)
25. Apply the properties of logarithms to write a sum or difference of logarithms as a single logarithmic expression. (*Precalculus III.B.1*)
26. Solve application problems involving the following types of equations: linear, quadratic, and exponential. (*Precalculus I.C.1, II.A.1, II.B.1, II.B.2, II.B.3, II.B.4, II.B.5, II.B.6*)
27. Solve systems of linear equations in two or three variables *using algebraic methods* (i.e., substitution, elimination by addition, augmented matrices) and *graphing calculator techniques* (e.g., *rref* command), including both consistent and inconsistent systems. (*Precalculus III.D.1, III.D.3*)

28. Set up and solve a system of two linear equations in two variables for a given application problem. (*Precalculus III.D.1*)
29. Solve systems of linear inequalities in two variables graphically. (*Precalculus III.D.4*)
30. Perform operations with matrices (including matrix addition, scalar multiplication, and matrix multiplication). (*Precalculus III.D.2*)

NOTE: It is expected that the graphing calculator will be used throughout to enhance student understanding of the course content.

***COURSE OUTLINE:***

- I. Equations, Inequalities, and Modeling
  - A. Equations in One Variable
  - B. Constructing Models to Solve Problems
  - C. Equations and Graphs in Two Variables
  - D. Linear Equations in Two Variables
  - E. Quadratic Equations
  - F. Linear and Absolute Value Inequalities
- II. Functions and Graphs
  - A. Functions
  - B. Graphs of Relations and Functions
  - C. Families of Functions, Transformations, and Symmetry
  - D. Operations with Functions
  - E. Inverse Functions
- III. Polynomial and Rational Functions
  - A. Quadratic Functions and Inequalities
  - B. Zeros of Polynomial Functions
  - C. The Theory of Equations
  - D. Miscellaneous Equations
  - E. Graphs of Polynomial Functions
  - F. Rational Functions and Inequalities
- IV. Exponential and Logarithmic Functions
  - A. Exponential Functions and Their Applications
  - B. Logarithmic Functions and Their Applications
  - C. Rules of Logarithms
  - D. More Equations and Applications
- V. Systems of Equations
  - A. Systems of Linear Equations in Two Variables
  - B. Systems of Linear Equations in Three Variables
  - C. Inequalities and Systems of Inequalities in Two Variables
- VI. Matrices
  - A. Solving Linear Systems Using Matrices
  - B. Operations with Matrices
  - C. Multiplication of Matrices

## ***GENERAL EDUCATION GOALS AND COMPETENCIES:***

As noted above, this course is intended to satisfy the general studies mathematics requirement for a baccalaureate degree at Missouri Western State University. Specifically, upon successful completion of this course, students will have demonstrated the ability to think critically and reason analytically, and will have developed an understanding of fundamental mathematical concepts and their applications.

Furthermore, upon successful completion of this course, the following state-level goals and competencies will have been met:

### **I. Skills Areas**

#### **a. Communicating**

Students will demonstrate the ability to...

6. Use mathematical and statistical models, standard quantitative symbols and various graphical tactics to present information with clarity, accuracy and precision.

#### **b. Higher-Order Thinking**

Students will demonstrate the ability to...

1. Recognize the problematic elements of presentations of information and argument and to formulate diagnostic questions for resolving issues and solving problems.
2. Use linguistic, mathematical or other symbolic approaches to describe problems, identify alternative solutions, and make reasoned choices among those solutions.
3. Analyze and synthesize information from a variety of sources and apply the results to resolving complex situations and problems.
4. Defend conclusions using relevant evidence and reasoned arguments.
5. Reflect on and evaluate their critical-thinking processes.

### **II. Knowledge Areas**

#### **c. Mathematics**

Students will demonstrate the ability to...

1. Describe contributions to society from the discipline of mathematics.
2. Recognize and use connections within mathematics and between mathematics and other disciplines.
3. Read, interpret, analyze and synthesize quantitative data (e.g., graphs, tables, statistics, survey data) and make reasoned estimates.
4. Formulate and use generalizations based upon pattern recognition.
5. Apply and use mathematical models (e.g., algebraic, geometric, statistical) to solve problems.