



MAT 117

College Algebra

Course Objectives

We expect the student to be able to handle any of the following topics. Also any material covered in class, assigned as reading, or assigned as homework is testable.

Implicit throughout: We expect the student to know the **vocabulary** related to the mathematical processes taught in this course.

The following sections are the important concepts of College Algebra. The Student should be able to show a mastery of these concepts.

Plane Coordinate Geometry

1. Cartesian Plane
 - a. Plot points in the Cartesian plane
 - b. Find distance between two points in the Cartesian Plane Distance Formula
 - c. Use the Distance formula to solve Geometry and real life application problems
 - d. Find the Midpoint of the segment joining two points in the Cartesian Plane
 - e. Use the Midpoint formula to solve application problems
2. Graphs of equations
 - a. Determine whether a point lies on the graph of an equation
 - b. Sketch graphs using a table of values and a graphing utility
 - c. Find the x and y -intercepts of the graph of an equation (algebraically and graphically)
 - d. Determine the symmetry of the graph of an equation (algebraically and graphically)
 - e. Write the General Form Equation of a circle in Standard Form and determine the center and radius of the circle
3. Equations of the Line and Linear Inequalities
 - a. Understand solutions and solutions sets of linear equations.
 - b. Find all intercepts algebraically.
 - c. Know the definition and understand the meaning of the slope of a line.
 - d. Know different forms of representations of linear equations:
 - e. Standard form: $Ax + By = C$ where A , B , and C are any real numbers.
 - f. Slope-intercept form: $y = mx + b$ where m is the slope of a line and b is the y -intercept.
 - g. Point-slope form: $y - k = m(x - h)$ where (h, k) is any point on the line.
 - h. Know how to find the slope of a line when given its equation or when given two points on the line.
 - I. Know about the slopes of
 - Horizontal lines ($m = 0$)
 - Vertical lines (m is undefined)
 - Parallel lines ($m_1 = m_2$)
 - Perpendicular lines ($m_1 m_2 = -1$)
 - j. Determine if lines are parallel or perpendicular using slope
 - k. Write equation of a line parallel or perpendicular to a given line
 - l. Graph a line under these conditions
 - when given an equation, or
 - when given two points, or
 - when given a slope and a point.
 - m. Associate average rate of change and direct variation with a slope of a line.
 - n. Apply the concept of slope to simple real world situations.

4. Linear Modeling
 - a. Construct linear models
 - b. Use linear models with slope as the rate of change
 - c. Find a linear model that fits a set of data (Linear Regression)

Functions

5. Function Basics
 - a. Determine if an equation or a set of ordered pairs represents a function
 - b. Use function notation
 - c. Evaluate a function
 - d. Find the domain of a function algebraically
 - e. Interpret input and output of Real life functions
 - f. Solve an application problem involving Real life functions
6. Graphs of functions
 - a. Find the domain and range using the graph of a function
 - b. Vertical Line Test
 - c. Describe the increasing and decreasing behavior of a function
 - d. Classify a function as even or odd
 - e. Identify six common graphs: constant, identity ($y = x$), squaring, absolute value, square root, cube root
7. Transformations of Functions
 - a. Sketch the graph of a function using common graphs and transformations
 - b. Write the equation of function using common graphs and transformations
8. Algebra of Functions
 - a. Find the sum, difference, product, and quotient of functions
 - b. Find the composition of two functions and determine the domain
 - c. Identify a function as the composition of two functions
 - d. Solve real life problems involving combinations and composition of functions
9. Inverse Functions
 - a. Determine if a function has an inverse function (Horizontal Line Test)
 - b. Find the Inverse of a function
 - c. Graph a function and its Inverse (Know that the graph of *the inverse of function* is a reflection of the graph of the *function* across the line $y = x$.)

Polynomial Functions

10. Polynomial division
 - a. Divide polynomials using long division
 - b. Synthetic division
 - c. Use the Remainder Theorem to evaluate a polynomial
 - d. Use the Factor Theorem to factor a polynomial
11. Quadratic Functions
 - a. Definition of polynomial function
 - b. Sketch the graph of a quadratic function (parabola and identify its vertex and intercepts (algebraically and graphically))
 - c. Write a quadratic function in standard form and identify the vertex from the standard form
 - d. Find the quadratic function given the vertex and a point on the graph
 - e. Solve real life problems involving quadratic functions

12. Polynomial functions with higher degree

- a. Apply the Leading Coefficient Test to determine right and left behavior of the graph of a polynomial function
- b. Find all possible rational zeros of a polynomial function using the Rational Zero Test
- c. Find the real zeros of a polynomial function algebraically
- d. Approximate the real zeros of a polynomial using a graphing utility
- e. Use the Fundamental Theorem of Algebra and the Linear Factorization Theorem to write a polynomial as the product of linear factors
- f. Find all real zeros of a polynomial function
- g. Use the Leading Coefficient Test and the zeros of a polynomial to sketch the graph of a polynomial
- h. Apply techniques for approximating real zeros to solve an application problem

13. Rational Functions

- a. Find the domain of a rational function
- b. Find the vertical and horizontal asymptotes of the graph of a rational function
- c. Sketch the graph of a rational function
- d. Use a rational function model to solve an application problem

Exponential and Logarithmic Functions

14. Exponential Functions

- a. Sketch the graph of an exponential function
- b. Investigate basic characteristics of an exponential function (domain, range, intercepts, increasing/decreasing behavior, horizontal asymptote)
- c. Write formulas of transformed exponential functions
- d. Use an exponential model to solve an application problem (in particular, models involving the natural exponential function)
- e. Use the compound interest formula to solve finance problems

15. Logarithmic Functions

- a. Properties of logarithms (including the change of base formula)
- b. Solve Logarithmic and Exponential Equations
- c. Sketch the graph of a logarithmic function
- d. Investigate basic characteristics of a logarithmic function (domain, x -intercept, vertical asymptote)
- e. Write formulas of transformed logarithmic functions
- f. Use a logarithmic model to solve an application problem (in particular, models involving the natural logarithmic function)
- g. Construct and use a model for exponential growth or exponential decay

16. Systems in two variables

- a. Solve a linear system of equations by the method of substitution
- b. Solve a linear system of equations by the method of elimination
- c. Solve a linear system of equations graphically
- d. Construct and use a linear system of equations to solve an application problem
- e. Nonlinear systems
- f. Solve a nonlinear system of equations by the method of substitution
- g. Solve a nonlinear system of equations graphically
- h. Construct and use a nonlinear system of equations to solve an application problem