Course Title: Advanced Algebra 5-6P
Grade Level: 10-11
Length of course: 1 Year
Prerequisites: Algebra 1-2 P with a C or better
Algebra A and Algebra B both with a B or better
(It is recommended that Geometry 3-4 P be taken before Advanced Algebra 5-6P; however they may be taken concurrently with the approval of the department chair.)
Credit: 5 units per semester

Course Description:
This course is the third of a three-year college prep sequence. Students will be expected to explore and solve mathematical problems, think critically, explore analytical geometry, use counting theorems, and investigate functions. They are expected to read and use mathematical language of algebra correctly, work cooperatively with others and communicate mathematical ideas clearly.

Goal Statements:
The student who successfully completes the course will:

- Be actively involved in their learning.
- See connections between algebra and other branches of mathematics.
- Try a wide variety of types of problems.
- Communicate mathematical ideas in different formats.
- Use a calculator and computer effectively.

Scope and Sequence:
Topic 1 Linear Representations
Topic 2 Properties of Real Numbers and Introduction to Functions
Topic 3 Investigation of Systems of Linear Equations and Inequalities
Topic 4 Solving Systems of Equations by Matrices
Topic 5 Quadratic Functions
Topic 6 Exponential and Logarithmic Functions and the Relationship between Them
Topic 7 Polynomial Functions
Topic 8 Rational Functions
Topic 9 Radical Functions
Topic 10 Conic Sections
Topic 11 Counting Principles and Probability
Topic 12 Sequences and Series

Curriculum:
Topic 1 Linear Representations
Students will:

- Use tables and graphs to define linear equations.
- Review the concept of slope and intercepts.
- Write linear equations in two variables.
- Write equations for lines parallel and perpendicular to another line.

- Write, solve and apply direct variation equations.
- Solve multi-step linear equations in one variable.
- Solve a literal equation for a given variable.
- Write, solve and graph simple and compound linear inequalities in one variable.
- Write solve and graph absolute-value equations and inequalities in one variable.

Topic 2 Properties of Real Numbers and Introduction to Functions

Students will:

- Identify and use properties (field axioms) of real numbers to evaluate expressions by using proper order of operations.
- Review properties of exponents.
- Evaluate and simplify expressions involving exponents.
- Differentiate between relations and functions, using domain and range.
- Write a function in function notation and evaluate it.
- Perform basic operations on functions to write new functions.
- Find the composition of two functions.
- Find the inverse of a function or relation and determine if the inverse is a function.
- Write, graph and apply absolute-value, piece-wise and step functions.

Topic 3 Investigation of Systems of Linear Equations and Inequalities

Students will:

- Solve systems of linear equations of two and three variables by graphing, substitution, and elimination.
- Graph linear inequalities in two variables.
- Solve systems of linear inequalities in two variables.

Topic 4 Solving Systems of Equations by Matrices

Students will:

- Add, subtract, multiply, and scalar multiplication of matrices.
- Find the determinant and inverse of a matrix when possible.
- Solve systems of linear equations in two and three variables by matrices ($A^{-1}B$) using a graphing calculator.
- Solve systems of linear equations in two and three variables by augmented matrices using row reduction.

Topic 5 Quadratic Functions

Students will:

- Review the definition of and graphs of quadratic functions.
- Transform quadratic functions from factored form to standard form by multiplying binomials.
- Solve quadratic equations by factoring, completion of the square and quadratic formula.
- Use the vertex form of a quadratic function to identify the axis of symmetry of its graph.
- Use the roots of a quadratic equation to locate the axis of symmetry of a parabola.
- Define, graph and perform operations on complex numbers.
- Classify using the discriminant and find all roots of a quadratic equation.

Topic 6 Exponential and Logarithmic Functions

Students will:

- Determine the rate of change for exponential growth and decay.
- Write and evaluate exponential expressions to model growth and decay situations.
- Calculate the growth of investments and compoundage of interest on loans under various conditions.
- Write equivalent forms for exponential and logarithmic equations.
- Use definitions of exponential and logarithmic functions to solve equations.
- Prove the properties of logs using exponents.
- Solve equations involving logarithms by simplifying and evaluating expressions.
- Solve exponential functions using logarithms and vice versa.

Topic 7 Polynomial Functions

Students will:

- Identify, evaluate, add, subtract, multiply, and divide (using both long division and synthetic division).
- Classify polynomials by degree and describe the shapes of their graphs.
- Locate the maximum and minimum values and examine end behavior of polynomial functions.
- Find the real zeros of polynomial functions and state the multiplicity of each.

Topic 8 Rational Functions

Students will:

- Identify inverse joint and combine variation.
- Find the constant of variation and use it to write an equation to model real world problems.
- Identify and evaluate rational functions.
- Graph a rational function finding its domain, range, asymptotes and any holes in the graph.
- Add, subtract, multiply, divide and reduce rational expressions.
- Solve rational equations or inequalities algebraically.

Topic 9 Radical Functions

Students will:

- Analyze the graphs of radical functions.
- Evaluate Radical expressions.
- Find the inverse of a quadratic function.
- Simplify radical expressions to add, subtract, multiply and divide them.
- Rationalize a denominator.
- Solve radical equations and inequalities.

Topic 10 Conic Sections

Students will:

- Recognize a conic section as the intersection of a plane and a double cone.

- Write and graph the standard equation of a parabola, circle, ellipse, and hyperbola given the geometric parameters.
- Given the equation of a parabola, circle, ellipse, and hyperbola in any form, graph it and label the vertices, foci, equation of asymptotes, eccentricity and directrix where applicable.
- Classify conic sections from the standard form.

Topic 11 Counting Principles and Probability

Students will:

- Find the theoretical probability of an event by applying the fundamental counting principle.
- Compute probabilities involving linear permutations of distinct or indistinguishable objects.
- Compute probabilities involving combinations.
- Distinguish between combinations and permutations.

Topic 12 Sequences and Series

Students will:

- Find the terms of a sequence.
- Evaluate the sum of a series expressed in sigma notation.
- Recognize arithmetic and geometric sequences and series.
- Find the nth term and the sum of the first n terms of arithmetic and geometric sequences and series.
- Find the arithmetic and geometric mean between two terms.
- Use mathematical induction to prove statements about natural numbers.
- Find entries in Pascals triangle.
- Use the binomial theorem to expand binomials to the nth power.

Assessment Strategies:

Students will:

- Written tests
- Teacher observation
- Oral presentations and written reports
- Quizzes
- Homework

Instructional Strategies:

Students will:

1. Lecture
2. Discussion
3. Cooperative learning
4. Student presentations (both individual and in groups)
5. Written essays
6. Research projects
7. Simulations and games

8. Worksheets, study guides and other reproducible materials
9. Interdisciplinary projects
10. Computer assisted instruction
11. Supervised individual work

Instructional Materials:
Bellman, Bragg, Charles, Hall, Handlin, and Kennedy, Algebra 2, Boston, MA: Pearson/Prentice Hall 2009