

CARLISLE AREA SCHOOL DISTRICT

Carlisle, PA 17013

**ALGEBRA II**

**GRADES 10-12**

Date of Board Approval: May 15, 2014

**CARLISLE AREA SCHOOL DISTRICT  
PLANNED INSTRUCTION COVER PAGE**

<b>TITLE OF COURSE:</b>	Algebra II	<b>SUBJECT:</b>	Math	<b>GRADE LEVEL:</b>	10-12
<b>COURSE LENGTH:</b>	1 year	<b>DURATION:</b>	50 minutes	<b>FREQUENCY:</b>	M-F
<b>PREREQUISITES:</b>	Algebra I and Geometry	<b>CREDIT:</b>	1 credit	<b>LEVEL:</b>	HS

**Course Description/Objectives:**

Algebra II is designed for students who need to extend the algebraic skills begun in Algebra I or Integrated Math I and II in a more practical and less theoretical setting than in Honors Algebra II. The course studies inequalities, algebraic fractions, fractional and negative exponents, radicals, solving systems of equations, and the complex numbers. Students are introduced to the concept of a function in general and specifically to polynomial, rational, exponential, logarithmic, and trigonometric functions. This course may not be selected if Honors Algebra II has been successfully completed.

**Text:** McDougal Littell Algebra 2, Pennsylvania Edition

**Curriculum Writing Committee:** Jennifer Barnhart, Micah Shinn, Robyn Wolfe, Kelly Brent

## COURSE TIME LINE

<b>Unit 1: Equations and Inequalities</b>	4 weeks
<ul style="list-style-type: none"><li>• <i>Properties of Real Numbers</i></li><li>• <i>Solve/Rewrite Equations</i></li><li>• <i>Solve Linear Inequalities</i></li><li>• <i>Solve Absolute Value Equations/Inequalities</i></li></ul>	
<b>Unit 2: Graphing Linear Equations and Inequalities</b>	4 weeks
<ul style="list-style-type: none"><li>• <i>Relations and Functions</i></li><li>• <i>Graph/Write Equations of Lines</i></li><li>• <i>Scatter Plots and Lines of Best Fit</i></li><li>• <i>Graph Linear Inequalities in Two Variables</i></li></ul>	
<b>Unit 3: Systems of Equations and Inequalities</b>	3.5 weeks
<ul style="list-style-type: none"><li>• <i>Solve Systems of Equations Graphically and Algebraically</i></li><li>• <i>Graph Systems of Linear Inequalities</i></li><li>• <i>Basic Matrix Operations</i></li><li>• <i>Multiply Matrices</i></li></ul>	
<b>Unit 4: Quadratic Functions and Factoring</b>	7 weeks
<ul style="list-style-type: none"><li>• <i>Graph Quadratic Functions</i></li><li>• <i>Solve Quadratic Functions by Factoring</i></li><li>• <i>Solve Quadratic Functions by Finding Square Roots or Completing the Square</i></li><li>• <i>Using the Quadratic Formula</i></li></ul>	
<b>Unit 5: Polynomials</b>	5 weeks
<ul style="list-style-type: none"><li>• <i>Properties of Exponents</i></li><li>• <i>Add, Subtract, and Multiply Polynomials</i></li><li>• <i>Factor and Solve Polynomial Equations</i></li><li>• <i>Apply the Remainder and Factor Theorems</i></li></ul>	

**Unit 6: Rational Exponents and Radical Functions**

5 weeks

- *Use and Apply Properties of Rational Exponents*
- *Function Operations and Composition*
- *Use Inverse Functions*
- *Solve Radical Equations*

**Unit 7: Rational Expressions**

4.5 weeks

- *Model Inverse and Joint Variation*
- *Multiply and Divide Rational Functions*
- *Add and Subtract Rational Expressions*
- *Solve Rational Equations*

**Unit 8: Probability and Introduction to Sequences**

3 weeks

- *Counting Principle and Permutations*
- *Combinations and the Binomial Theorem*
- *Define and Use Probability*
- *Define and Use Sequences and Series*

TOTAL: 36 weeks

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 4 weeks

**UNIT # 1:** Equations and Inequalities

**GRADE:** 10-12

## STANDARDS:

### PA Core Standards:

- CC.2.2.HS.D.1      • Interpret the structure of expressions to represent a quantity in terms of its context.
- CC.2.2.HS.D.2      • Write expressions in equivalent forms to solve problems.

### Standards of Mathematical Practices:

1. Make sense of problems and persevere in solving them.
4. Model with mathematics.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 4 weeks

**UNIT # 1:** Equations and Inequalities

**GRADE:** 10-12

## UNDERSTANDINGS

Inverse operations and properties are used to solve equations and inequalities.

The procedures for solving inequalities and equations are the same EXCEPT when multiplying or dividing by a negative number.

Real world situations can be modeled using equations or inequalities.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Exam

### KNOW

- Classify numbers as natural, whole, integer, rational, irrational, and real.
- Identify the properties being used in a sequence of mathematical statements (identity, inverse, distributive, associative, commutative, closure).
- Distinguish between simplifying expressions, evaluating expressions, and solving equations.

### DO

- Locate real numbers on a number line.
- Order real numbers from least to greatest.
- Simplify and evaluate expressions using order of operations, definitions of operations, and properties.
- Rewrite equations/formulas for a specified variable.
- Solve linear and absolute value equations/inequalities.
- Graph linear and absolute value inequalities in one variable
- Determine when a solution is extraneous.
- Determine when a real world situation should be modeled by an equation or inequality.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 4 weeks

**UNIT # 2:** Graphing Linear Equations and Inequalities

**GRADE:** 10-12

## STANDARDS:

### PA Core Standards:

- CC.2.2.HS.C.1 • Use the concept and notation of functions to interpret and apply them in terms of their context.
- CC.2.2.HS.D.7 • Create and graph equations or inequalities to describe numbers or relationships.
- CC.2.2.HS.D.8 • Apply inverse operations to solve equations or formulas for a given variable.
- CC.2.2.HS.D.10 • Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

### Keystone Eligible Content:

- A2.1.3.2.2 • Use algebraic processes to solve a formula for a given variable (e.g., solve  $d = rt$  for  $r$ ).
- A2.2.1.1.3 • Determine the domain, range, or inverse of a relation.

### Standards of Mathematical Practices:

1. Make sense of problems and persevere in solving them.
4. Model with mathematics.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 4 weeks

**UNIT # 2:** Graphing Linear Equations and Inequalities

**GRADE:** 10-12

## UNDERSTANDINGS

A function is a relation where each input (element of the domain) produces a unique output (element of the range).

Every solution to a linear equation is represented by an ordered pair on its graph, and when substituted into the equation, will make a true statement.

Real world data rarely plots a perfectly straight line, so we create a line of best fit to make predictions.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Exam

### KNOW

- Identify the domain and range of a relation.
- Recognize when a relation is also a function.
- Read equations written in function notation.
- Distinguish between linear and non-linear functions.
- Determine which form is most useful for writing the equation of a line based on the given information: slope-intercept form, point-slope form, or standard form.
- Determine when a set of data varies directly.
- Distinguish between positive and negative correlation and the strength of the correlation in a scatter plot.
- Determine the transformations (translation, reflection, stretch/shrink) of an absolute value graph as compared to the parent graph given the equation or graph.

### DO

- Represent a relation as a list of ordered pairs, in a table, in a graph, and in a mapping diagram.
- Find the slope of a line given two points on the line, the graph of the line, and the equation of the line in any form.
- Use slope and y-intercepts to classify lines as parallel, perpendicular, coinciding, or intersecting.
- Graph linear equations in any form.
- Write linear equations in any form.
- Model real world data using direct variation.
- Determine the best-fitting line for a linear model.
- Graph absolute value equations.
- Graph linear inequalities and absolute value inequalities in two variables.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 3.5 weeks

**UNIT # 3:** Systems of Equations and Inequalities

**GRADE:** 10-12

## STANDARDS:

### PA Core Standards:

- CC.2.2.HS.D.10
- Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.
  - Use reasoning to solve equations, and justify the solution method..

### Standards of Mathematical Practices:

1. Make sense of problems and persevere in solving them.
4. Model with mathematics.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 3.5 weeks

**UNIT # 3:** Systems of Equations and Inequalities

**GRADE:** 10-12

## UNDERSTANDINGS

The solution of a system of linear equations is the point of intersection of the lines on the graph; when that ordered pair is substituted back in to the original equations, it will make all of the equations true.

Systems of linear equations can have no solution, one solution, or infinitely many solutions.

There are many applications of linear systems of equations and inequalities used in real life.

Matrices are an efficient way to organize and process large amounts of data, especially using technology.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Exam

### KNOW

- Classify systems of linear equations as consistent and independent, consistent and dependent, or inconsistent.
- Recognize which method is most efficient for solving a given system of linear equations: graphing, substitution, or elimination.
- Differentiate between scalar multiplication and matrix multiplication.

### DO

- Solve a system of linear equations by graphing, substitution, and elimination.
- Graph systems of linear inequalities.
- Graph systems that include absolute value inequalities.
- Write and solve systems of equations or inequalities to solve real-world problems.
- Add and subtract matrices.
- Multiply matrices by a scalar.
- Multiply two matrices.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 7 weeks

**UNIT # 4:** Quadratic Functions and Factoring

**GRADE:** 10-12

## STANDARDS:

### PA Common Core Standards:

- CC.2.2.HS.D.2 • Write expressions in equivalent forms to solve problems.
- CC.2.2.HS.D.3 • Extend the knowledge of arithmetic operations and apply to polynomials.
- CC.2.2.HS.D.4 • Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.
- CC.2.2.HS.C.2 • Graph and analyze functions, and use their properties to make connections between the different representations.
- CC.2.2.HS.C.4 • Interpret the effects transformations have on functions, and find the inverses of functions.
- CC.2.2.HS.C.5 • Construct and compare linear, quadratic, and exponential models to solve problems.
- CC.2.2.HS.C.6 • Interpret functions in terms of the situations they model.

### Keystone Eligible Content:

- A2.1.2.2.1 • Factor algebraic expressions, including difference of squares and trinomials.
- A2.1.3.1.1 • Write and/or solve quadratic equations (including factoring and using the quadratic formula).

### Standards of Mathematical Practices:

1. Make sense of problems and persevere in solving them.
4. Model with mathematics.
6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

COURSE: Algebra II

TIME FRAME: 7 weeks

UNIT # 4: Quadratic Functions and Factoring

GRADE: 10-12

## UNDERSTANDINGS

Quadratic functions can be written in several forms that are helpful for generating the graph of the function.

Quadratic functions can be solved using various methods, all of which will produce the same solution.

Quadratic functions can have various numbers and types of solutions, which provide you with information about the graph of the function.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Exam

### KNOW

- Identify the vertex of a quadratic function in standard form, vertex form, and intercept form.
- Identify the axis of symmetry of a quadratic function in standard form, vertex form, and intercept form.
- List points that lie on the graph of a quadratic function in standard form and vertex form.
- State the direction of opening of the graph of a quadratic function in standard form, vertex form, and intercept form.
- Identify the x-intercepts of a quadratic function in intercept form.
- Identify the greatest common factor of a polynomial.
- Recall how to factor trinomials and a binomial that is the difference of two perfect squares.
- Recall how to perform operations with square roots
- Define a complex number.
- Recognize the solution(s) to a quadratic function represents the x-intercept(s) of the function.

### DO

- Graph a quadratic function in standard form, vertex form, and intercept form.
- Solve a quadratic function by factoring.
- Solve a quadratic function by finding square roots.
- Perform operations with complex numbers.
- Solving a quadratic function by completing the square.
- Predict the number and type of solutions a quadratic function will have using the discriminant.
- Solve a quadratic function using the quadratic formula.
- Graph a quadratic inequality.
- Solve a quadratic inequality algebraically.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 5 weeks

**UNIT # 5:** Polynomials and Polynomial Functions

**GRADE:** 10-12

## STANDARDS:

### PA Core Standards:

CC.2.2.HS.D.2 • Write expressions in equivalent forms to solve problems.

CC.2.2.HS.D.3 • Extend the knowledge of arithmetic operations and apply to polynomials.

CC.2.2.HS.D.4 • Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs.

### Keystone Eligible Content:

A2.1.2.1.2 • Simplify/evaluate expressions involving positive and negative exponents and/or roots (may contain all types of real numbers – exponents should not exceed power of 10).

A2.1.2.1.3 • Simplify/evaluate expressions involving multiplying with exponents, powers of powers, and powers or products. Note: Limit to rational exponents.

### Standards of Mathematical Practices:

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 5 weeks

**UNIT # 5:** Polynomials and Polynomial Functions

**GRADE:** 10-12

## UNDERSTANDINGS

Understanding exponents and their properties is essential to simplifying algebraic expressions and performing operations on polynomials.

Polynomials are algebraic expressions with whole number exponents only.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Exam

### KNOW

- Recall properties of integer exponents.
- Identify the degree of a polynomial.

### DO

- Apply the properties of exponents to simplify expressions.
- Add, subtract, and multiply polynomials.
- Divide polynomials using long division.
- Divide polynomials using synthetic division.
- Factor by grouping.
- Factor the sum and difference of two cubes.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 5 weeks

**UNIT # 6:** Rational Exponents and Radical Functions

**GRADE:** 10-12

## STANDARDS:

### PA Core:

CC.2.1.HS.F.1 • Apply and extend the properties of exponents to solve problems with rational exponents.

CC.2.2.HS.D.8 • Apply inverse operations to solve equations or formulas for a given variable.

### Keystone Eligible Content:

A2.1.2.1.1 • Use exponential expressions to represent rational numbers.

A2.1.2.1.2 • Simplify/evaluate expressions involving positive and negative exponents and/or roots (may contain all types of real numbers – exponents should not exceed power of 10).

A2.1.2.1.3 • Simplify/evaluate expressions involving multiplying with exponents, powers or powers, and powers of products.

A2.1.3.1.2 • Solve equations involving rational and/or radical expressions.

A2.1.3.2.2 • Use algebraic processes to solve a formula for a given variable.

### Standards of Mathematical Practices:

6. Attend to precision.

7. Look for and make use of structure.

8. Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 5 weeks

**UNIT # 6:** Rational Exponents and Radical Functions

**GRADE:** 10-12

## UNDERSTANDINGS

The only difference between radical form and rational exponent form is notation.

All functions have an inverse, but not all inverses are functions.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Exam

### KNOW

- Define the relationship between radical form and rational exponent form.
- Define function composition notation.

### DO

- Simplify expressions and both radical and rational forms.
- Perform function operations.
- Perform function compositions.
- Determine the inverse of a function and if the inverse is also a function.
- Solve radical equations and check for extraneous roots.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 4.5 weeks

**UNIT # 7:** Rational Expressions

**GRADE:** 10-12

## STANDARDS:

### PA Core:

- CC.2.2.HS.D.1 • Interpret the structure of expressions to represent a quantity in terms of its context.
- CC.2.2.HS.D.2 • Write expressions in equivalent forms to solve problems.
- CC.2.2.HS.D.3 • Extend the knowledge of arithmetic operations and apply to polynomials.
- CC.2.2.HS.D.5 • Use polynomial identities to solve problems.
- CC.2.2.HS.D.6 • Extend the knowledge of rational functions to rewrite in equivalent forms.

### Keystone Eligible Content:

- A2.1.2.2.1 • Factor algebraic expressions, including difference of squares and trinomials.
- A2.1.2.2.2 • Simplify rational algebraic expressions.
- A.2.1.3.1.2 • Solve equations involving rational and/or radical expressions.

### Standards of Mathematical Practices:

6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 4.5 weeks

**UNIT # 7:** Rational Expressions

**GRADE:** 10-12

## UNDERSTANDINGS

Performing operations with rational expressions follows the same process as performing operations with rational numbers.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Exam

### KNOW

- Define what it means for two variables to be inversely proportional.

### DO

- Solve problems involving inverse variation.
- Add, subtract, multiply, and divide rational expressions.
- Solve rational equations.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 3 weeks

**UNIT # 8:** Probability & Intro. to Sequences

**GRADE:** 10-12

## STANDARDS:

### PA Core:

- CC.2.4.HS.B.2 • Summarize, represent, and interpret data on two categorical and quantitative variables.
- CC.2.4.HS.B.4 • Recognize and evaluate random processes underlying statistical experiments.
- CC.2.4.HS.B.6 • Use the concepts of independence and conditional probability to interpret data.
- CC.2.2.HS.C.3 • Write functions or sequences that model relationships between two quantities.

### Keystone Eligible Content:

- A2.2.1.1.1 • Analyze a set of data for the existence of a pattern and represent the pattern with a rule algebraically and/or graphically.
- A2.2.3.2.1 • Use combinations, permutations, and the fundamental counting principle to solve problems involving probability.
- A2.2.3.2.2 • Use odds to find probability and/or use probability to find odds.
- A2.2.3.2.3 • Use probability for independent, dependent, or compound events to predict outcomes.

### Standards of Mathematical Practices:

6. Attend to precision.
7. Look for and make use of structure.
8. Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

**COURSE:** Algebra II

**TIME FRAME:** 3 weeks

**UNIT # 8:** Probability & Intro. to Sequences

**GRADE:** 10-12

## UNDERSTANDINGS

Probability, permutations, and combinations are quantities that describe the number of times or ways events can occur within a particular situation.

A sequence is an algebraic method for representing a pattern.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Exam

### KNOW

- Define sequence notation.
- State the formula for permutations of  $n$  objects taken  $r$  at a time.
- State the formula for combinations of  $n$  objects taken  $r$  at a time.
- Define theoretical probability.

### DO

- Calculate the number of ways to select objects.
- Calculate the number of ways to order objects.
- Find the probability of independent events.
- Generate a sequence given its definition.

## **Adaptations/Modifications for Students with I.E.P.s**

Adaptations or modifications to this planned course will allow exceptional students to earn credits toward graduation or develop skills necessary to make a transition from the school environment to community life and employment. The I.E.P. team has determined that modifications to this planned course will meet the student's I.E.P. needs.

Adaptations/Modifications may include but are not limited to:

### **INSTRUCTION CONTENT**

- Modification of instructional content and/or instructional approaches
- Modification or deletion of some of the essential elements

### **SETTING**

- Preferential seating

### **METHODS**

- Additional clarification of content
- Occasional need for one to one instruction
- Minor adjustments or pacing according to the student's rate of mastery
- Written work is difficult, use verbal/oral approaches
- Modifications of assignments/testing
- Reasonable extensions of time for task/project completion
- Assignment sheet/notebook
- Modified/adjusted mastery rates
- Modified/adjusted grading criteria
- Retesting opportunities

### **MATERIALS**

- Supplemental texts and materials
- Large print materials for visually impaired students
- Outlines and/or study sheets
- Carbonless notebook paper
- Manipulative learning materials
- Alternatives to writing (tape recorder/calculator)