

CARLISLE AREA SCHOOL DISTRICT

Carlisle, PA 17013

**HONORS ALGEBRA II**

**GRADES 8-12**

Date of Board Approval: April 17, 2014

# CARLISLE AREA SCHOOL DISTRICT

## PLANNED INSTRUCTION COVER PAGE

<b>TITLE OF COURSE:</b>	Honors Algebra II	<b>SUBJECT:</b>	Mathematics	<b>GRADE LEVEL:</b>	8-12
<b>COURSE LENGTH:</b>	1 year	<b>DURATION:</b>	50 minutes	<b>FREQUENCY:</b>	5 pd/wk
<b>PREREQUISITES:</b>	Algebra I, Honors Geometry	<b>CREDIT:</b>	1	<b>LEVEL:</b>	Acc.

### Course Description/Objectives:

Honors Algebra II deals with the same concepts as Algebra II but in more depth and in a more abstract setting. Students planning to pursue a mathematics or science-related-major should select Honors Algebra II rather than Algebra II. This course may not be selected if Algebra II has been successfully completed. Note: A TI graphing calculator is recommended for home use.

**Text:** Algebra II, McDougall Littell, 2007

**Curriculum Writing Committee:** John Campbell, Kristy Shinn, Kelly Brent

## **COURSE TIMELINE**

### **Unit 1: Equations and Inequalities**

7 days

- Properties of Real Numbers
- Evaluate and Simplify Algebraic Expressions
- Solving Equations and Inequalities
- Solving Absolute Value Equations and Inequalities

### **Unit 2: Linear Equations & Functions**

13 days

- Relations and Functions
- Graphing Equations of Lines
- Writing Equations of Lines
- Direct Variation
- Scatter Plots, Lines of Best Fit and Absolute Value Functions
- Graphing Linear Inequalities in Two Variables

### **Unit 3: Linear Systems & Matrices**

18 days

- Solve Linear Systems by Graphing
- Solve Linear Systems Algebraically
- Graphing Systems of Linear Inequalities
- Solve Systems of Linear Equations in Three Variables
- Matrix Operations

### **Unit 4: Quadratic Functions & Factoring**

28 days

- Graphing Quadratic Functions
- Factoring
- Solving Quadratics through Square Roots and Completing the Square
- Complex Numbers, the Quadratic Formula and the Discriminant
- Graph and Solve Quadratic Inequalities
- Write Quadratic Functions and Models

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

20 days

- Properties of Exponents
- Evaluate, Analyze and Graph Polynomial Functions
- Operations with Polynomials
- Remainder Theorem, Factor Theorem and the Fundamental Theorem of Algebra

- Rational Zeroes
- Writing Polynomial Functions and Models

#### **Unit 6: Rational Exponents & Radical Functions**

20 days

- Nth Roots and Rational Exponents
- Function Operations and Composition
- Inverse Operations
- Graphing Square and Cube Root Functions
- Solve Radical Equations

#### **Unit 7: Exponential & Logarithmic Functions**

18 days

- Graph Exponential Growth and Decay
- Functions Involving 'e'
- Evaluate and Solve Exponential and Logarithmic Functions
- Apply Properties of Logarithms
- Write and Apply Exponential and Power Functions

15 days

#### **Unit 8: Rational Functions**

- Inverse and Joint Variation
- Graph Rational Functions
- Operations with Rational Expressions
- Solve Rational Equations

#### **Unit 9: Quadratic Relations & Conic Sections**

15 days

- Graph and Write Equations of Parabolas
- Graph and Write Equations of Circles
- Graph and Write Equations of Ellipses
- Graph and Write Equations of Hyperbolas
- Translate and Classify Conic Sections
- Solve Quadratic Systems

#### **Unit 10: Trigonometric Ratios and Functions**

10 days

- Trigonometry with Right Triangles
- Angles and Radian Measure
- Trigonometric Functions of Any Angle
- Inverse Trigonometric Functions

- Law of Sines
- Law of Cosines

### **Unit 11: Counting Methods and Probability**

6 days

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

### **Unit 12: Sequences and Series**

4 days

- Define and Use Sequences and Series
- Analyze Arithmetic Sequences and Series
- Analyze Geometric Sequences and Series

**TOTAL:** 174 days

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 7 days

**UNIT #1:** Equations and Inequalities

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- CC.2.1.HS.F.4 • Use units as a way to understand problems and to guide the solution of multi-step problems.
- 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.8 • Apply inverse operations to solve equations or formulas for a given variable.
- CC.2.2.HS.D.9 • Use reasoning to solve equations, and justify the solution method.

### Keystone Algebra II Eligible Content:

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

### Mathematical Practices:

- 1 • Make sense of problems and persevere in solving them.
- 2 • Reason abstractly and quantitatively.
- 3 • Construct viable arguments and critique the reasoning of others.
- 5 • Use appropriate tools strategically.
- 6 • Attend to precision.
- 7 • Look for and make use of structure.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 7 days

**UNIT #1:** Equations and Inequalities

**GRADE:** 8 – 12

## UNDERSTANDINGS

A solution to an equation or inequality is a value that makes the equation or inequality true.

The properties of real numbers justify each step of solving an equation or inequality.

Equations and formulas can be solved for a given variable by using inverse operations.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Test

### KNOW

- Recognize the properties of real numbers.
- Recognize the similarities and differences in solving equations and inequalities.
- Recognize the similarities and differences in solving absolute-value equations and absolute-value inequalities.

### DO

- Distinguish between the properties of real numbers.
- Evaluate and simplify algebraic expressions.
- Determine if a value is a solution to an equation or inequality.
- Solve for a given variable in an equation or formula.
- Solve absolute-value equations and inequalities.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 13 days

**UNIT #2:** Linear Equations and Functions

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- CC.2.1.HS.F.5 • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- 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.D.7 • Create and graph equations or inequalities to describe numbers or relationships.
- CC.2.4.HS.B.3 • Analyze linear models to make interpretations based on the data.

### Keystone Algebra II 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.
- A2.2.1.1.3 • Determine the domain, range, or inverse of a relation.
- A2.2.2.2.1 • Identify or describe the effect of changing parameters within a family of functions (e.g.  $y = x^2$  and  $y = x^2 + 3$ , or  $y = x^2$  and  $y = 3x^2$ ).

### Mathematical Practices:

- 1 • Make sense of problems and persevere in solving them.
- 2 • Reason abstractly and quantitatively.
- 3 • Construct viable arguments and critique the reasoning of others.
- 4 • Model with mathematics.
- 5 • Use appropriate tools strategically.
- 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:** Honors Algebra II

**TIME FRAME:** 13 days

**UNIT #2:** Linear Equations and Functions

**GRADE:** 8 – 12

## UNDERSTANDINGS

Relations and functions can be shown algebraically or graphically.

Changing certain values of an equation will affect its graph.

Any ordered pair on the graph of a line is a solution to its related equation.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Test

### KNOW

- Recognize functions given a relation or graph.
- Differentiate the various forms of a linear equation.
- Recognize the graph of an absolute-value equation.
- Understand how the values of  $a$ ,  $h$ , and  $k$  affect the graph of  $y = a \cdot f(x - h) + k$ .

### DO

- Distinguish between a relation and function.
- Write a linear equation given various pieces of information.
- Graph a linear function given any form.
- Graph absolute-value equations.
- Graph transformations of equations.
- Graph two-variable inequalities.
- Determine if an ordered pair is a solution to an equation or inequality in two variables.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 18 days

**UNIT #3:** Linear Systems and Matrices

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- CC.2.2.HS.D.9      • Use reasoning to solve equations, and justify the solution method.
- CC.2.2.HS.D.10    • Represent, solve and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically.

### Keystone Algebra II Eligible Content:

- None in Algebra II

### Mathematical Practices:

- 1      • Make sense of problems and persevere in solving them.
- 2      • Reason abstractly and quantitatively.
- 3      • Construct viable arguments and critique the reasoning of others.
- 4      • Model with mathematics.
- 5      • Use appropriate tools strategically.
- 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:** Honors Algebra II

**TIME FRAME:** 18 days

**UNIT #3:** Linear Systems and Matrices

**GRADE:** 8 – 12

## UNDERSTANDINGS

Systems of linear equations can be solved by many different methods.

Systems of linear equations can have one solution, no solution or many solutions, and can be represented through equations or by a graph.

A solution to a system of linear equations must be true for all equations.

A solution to a system of linear inequalities is represented by a shaded intersected region on a graph.

Matrices can be added, subtracted or multiplied; they can also be used to solve a system of equations.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Systems of Equations Book Project, Chapter Test

### KNOW

- Recognize that the number of solutions a system has is equivalent to the number of intersections on its related graph.
- Name the dimensions of a matrix.
- Recognize whether or not two matrices can be multiplied together.

### DO

- Define a system of equations using the terms “inconsistent”, “consistent”, “dependent” and/or “independent.”
- Decide which method is most efficient in solving a system of equations.
- Determine if an ordered pair is a solution to a system of inequalities both graphically and algebraically.
- Solve a system of three variables.
- Add, subtract and multiply two matrices together.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 28 days

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

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- |               |  |
|---------------|--|
| CC.2.1.HS.F.6 | • Extend the knowledge of arithmetic operations and apply to complex numbers.                                      |
| CC.2.1.HS.F.7 | • Apply concepts of complex numbers in polynomial identities and quadratic equations to solve problems.            |
| 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.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.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.7 | • Create and graph equations or inequalities to describe numbers or relationships.                                 |

### Keystone Algebra II Eligible Content:

- |            |   |
|------------|---|
| A2.1.1.1.1 | • Simplify/write square roots in terms of $i$ .   |
| A2.1.1.1.2 | • Simplify/evaluate expressions involving powers of $i$ .                                       |
| A2.1.1.2.1 | • Add and subtract complex numbers.   |
| A2.1.1.2.2 | • Multiply and divide complex numbers.  |
| 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). |
| A2.1.3.2.2 | • Use algebraic processes to solve a formula for a given variable.                              |

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 28 days

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

**GRADE:** 8 – 12

- A2.2.1.1.4 • Identify and/or determine the characteristics of an exponential, quadratic, or polynomial function.
- A2.2.2.1.1 • Create, interpret, and/or use the equation, graph, or table of a polynomial function (including quadratics).
- A2.2.2.2.1 • Identify or describe the effect of changing parameters within a family of functions (eg.  $y = x^2$  and  $y = x^2 + 3$ ).
- A2.2.3.1.1 • Draw, identify, find, interpret, and/or write an equation for a regression model (lines and curves of best fit) for a scatter plot.
- A2.2.3.1.2 • Make predictions using the equations or graphs of regression models (lines and curves of best fit) of scatter plots.

## Mathematical Practices:

- 1 • Make sense of problems and persevere in solving them.
- 2 • Reason abstractly and quantitatively.
- 3 • Construct viable arguments and critique the reasoning of others.
- 4 • Model with mathematics.
- 5 • Use appropriate tools strategically.
- 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:** Honors Algebra II

**TIME FRAME:** 28 days

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

**GRADE:** 8 – 12

## UNDERSTANDINGS

Quadratic expressions are in the form of  $ax^2 + bx + c$ .

The graph of a quadratic function is called a parabola.

Quadratic equations can be solved by factoring, completing the square, or by the Quadratic Formula.

The solutions to a quadratic equation can be real or imaginary (complex).

The real solutions to a quadratic function (roots) are the x-intercepts on the related graph.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Quadratic Project, Chapter Tests

### KNOW

- Recognize factoring patterns (such as Difference of Squares and Perfect Square Trinomials).
- Recognize how the values of a, h, and k affect the graph of  $y = a(x - h)^2 + k$ .
- Identify the formulas for Standard Form, Vertex Form, and Intercept Form of a Quadratic Function.
- Identify parts of a radical expression.
- Understand the purpose of radical and complex conjugates.
- Recognize the Quadratic Formula and the Discriminant.

### DO

- Identify the Axis of Symmetry and Vertex in a quadratic equation in any form.
- Determine the minimum or maximum value of a parabola
- Factor quadratic expressions.
- Simplify radical expressions.
- Add, subtract, multiply and divide complex numbers.
- Solve quadratic equations by factoring, completing the square and/or the quadratic formula.
- Determine the number and type of solutions a quadratic has by evaluating the value of the discriminant.
- Graph and analyze quadratic inequalities in one and two variables.
- Write equations of quadratics in Vertex, Intercept or Standard Form
- Create and use a quadratic regression model.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 20 days

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

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- |               |   |
|---------------|---|
| CC.2.1.HS.F.1 | • Apply and extend the properties of exponents to solve problems with rational exponents.   |
| CC.2.1.HS.F.5 | • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.                                 |
| CC.2.1.HS.F.7 | • Apply concepts of complex numbers in polynomial identities and quadratic equations to solve problems.                           |
| 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.3 | • Write functions or sequences that model relationships between two quantities.   |
| 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 zeroes and factors of polynomials to make generalizations about functions and their graphs. |
| CC.2.2.HS.D.5 | • Use polynomial identities to solve problems.  |

### Keystone Algebra II 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.   |
| A2.1.2.1.3 | • Simplify/evaluate expressions involving multiplying with exponents, powers of powers, and powers of products.   |
| A2.2.1.1.4 | • Identify and/or determine the characteristics of an exponential, quadratic or polynomial function (e.g., intervals of increase/decrease, intercepts, zeroes, and asymptotes). |
| A2.2.2.1.1 | • Create, interpret, and/or use the equation, graph, or table of a polynomial function.   |
| A2.2.2.1.3 | • Determine, use, and/or interpret minimum and maximum values over a specified interval of a graph of a polynomial, exponential or logarithmic function.                        |

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 20 days

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

**GRADE:** 8 – 12

- A2.2.2.1.4      • Translate a polynomial, exponential, or logarithmic function from one representation of a function to another (graph, table and equation).
- A2.2.2.2.1      • Identify or describe the effect of changing parameters within a family of functions (eg.  $y = x^2$  and  $y = x^2 + 3$ ).
- A2.2.3.1.1      • Draw, identify, find, interpret, and/or write an equation for a regression model (lines and curves of best fit) for a scatter plot.
- A2.2.3.1.2      • Make predictions using the equations or graphs of regression models (lines and curves of best fit) of scatter plots.

## Mathematical Practices:

- 1      • Make sense of problems and persevere in solving them.
- 2      • Reason abstractly and quantitatively.
- 3      • Construct viable arguments and critique the reasoning of others.
- 4      • Model with mathematics.
- 5      • Use appropriate tools strategically.
- 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:** Honors Algebra II

**TIME FRAME:** 20 days

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

**GRADE:** 8 – 12

## UNDERSTANDINGS

Polynomial Functions must only have whole number exponents.

The real solutions (roots) of a polynomial function are the x-intercepts on the related graph.

The highest degree (exponent) of a polynomial function tells us how many solutions the function has, whether they are real or complex.

Using Synthetic Division or Polynomial Long Division can assist in finding solutions to polynomial functions.

Solutions that are complex must come in conjugate pairs.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Test (and/or Mid-Term Exam)

### KNOW

- Recognize the different properties of exponents.
- Recognize the difference between a polynomial and algebraic expression.
- Identify Sum and Difference of Cubes.
- Recognize the formula for cubing a binomial.
- Understand Descartes' Rule of Signs and its purpose.

### DO

- Factor polynomials of a higher degree than two by such methods as finding a GCF, factoring by grouping, or quadratic form.
- Simplify expressions with exponents using properties.
- Use polynomial long division or synthetic division to find solutions.
- Use Descartes' Rule of Signs in order to describe how many real zeroes there are in a polynomial function.
- Write a polynomial function given the zeroes, whether rational, irrational or complex.
- Create and use a polynomial regression model.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 20 days

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

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- CC.2.1.HS.D.2 • Write expressions in equivalent forms to solve problems.
- CC.2.1.HS.F.1 • Apply and extend the properties of exponents to solve problems with rational exponents.
- 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.C.3 • Write functions or sequences that model relationships between two quantities.
- CC.2.2.HS.C.4 • Interpret the effects transformations have on functions, and find the inverses of functions.
- CC.2.2.HS.C.6 • Interpret functions in terms of the situations they model.

### Keystone Algebra II Eligible Content:

- A2.1.2.1.2 • Simplify/evaluate expressions involving positive and negative exponents and/or roots.
- A2.1.2.1.3 • Simplify/evaluate expressions multiplying with exponents, powers of powers, and powers of products (limit to rational exponents).
- A3.1.3.1.2 • Solve equations involving rational and/or radical expressions.
- A2.2.1.1.3 • Determine the domain, range, or inverse of a relation.
- A2.2.2.2.1 • Identify or describe the effect of changing parameters within a family of functions (eg.  $y = x^2$  and  $y = x^2 + 3$ ).

### Mathematical Practices:

- 1 • Make sense of problems and persevere in solving them.
- 2 • Reason abstractly and quantitatively.
- 3 • Construct viable arguments and critique the reasoning of others.
- 4 • Model with mathematics.
- 5 • Use appropriate tools strategically.
- 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:** Honors Algebra II

**TIME FRAME:** 20 days

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

**GRADE:** 8 – 12

## UNDERSTANDINGS

Expressions containing rational exponents are related to radical expressions.

The order in which a composition of functions is evaluated is important.

It can be determined if two functions are inverses of each other by finding their compositions.

Not all solutions to equations involving radical or rational expressions will “check” in the original equation.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Test

### KNOW

- Recognize the properties of exponents and apply them to rational exponents.
- Understand the order in which you perform a composition of functions is crucial.
- Identify the steps of finding the inverse of a function.
- Recognize the graphs of square root and cube root functions.
- Recognize how the values of  $a$ ,  $h$ , and  $k$  affect the graphs of square root and cube root functions.

### DO

- Convert between radical form and rational form.
- Simplify expressions involving radicals or rational exponents.
- Perform a composition of two or more functions.
- Calculate the inverse of a function.
- Determine if two functions are inverses by using composition of functions.
- Determine the domain and range of a square root or cube root function.
- Determine if a solution is extraneous.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 18 days

**UNIT #7:** Exponential and Logarithmic Functions

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- |               |  |
|---------------|--|
| CC.2.1.HS.F.5 | • Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.                  |
| 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.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.D.8 | • Apply inverse operations to solve equations or formulas for a given variable.                                    |

### Keystone Algebra II Eligible Content:

- |            |   |
|------------|---|
| A2.1.2.1.4 | • Simplify or evaluate expressions involving logarithms and exponents.  |
| A2.1.3.1.3 | • Write and/or solve a simple exponential or logarithmic equation (including common and natural logarithms).  |
| A2.1.3.1.4 | • Write, solve and/or apply linear or exponential growth or decay (including problem situations).   |
| A2.2.1.1.4 | • Identify and/or determine the characteristics of an exponential, quadratic, or polynomial function (e.g. intervals of increase/decrease, intercepts, zeroes, and asymptotes). |
| A2.2.2.1.2 | • Create, interpret and/or use the equation, graph, or table of an exponential or logarithmic function (including common and natural logarithms).                               |
| A2.2.2.1.3 | • Determine, use, and/or interpret minimum and maximum values over a specified interval of a graph of a polynomial, exponential or logarithmic function.                        |
| A2.2.2.1.4 | • Translate a polynomial, exponential, or logarithmic function from one representation of a function to another (graph, table and equation).                                    |
| A2.2.2.2.1 | • Identify or describe the effect of changing parameters within a family of functions (eg. $y = x^2$ and $y = x^2 + 3$ ).   |
| A2.2.3.1.1 | • Draw, identify, find, interpret, and/or write an equation for a regression model (lines and curves of best fit) for a scatter plot.   |

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 18 days

**UNIT #7:** Exponential and Logarithmic Functions

**GRADE:** 8 – 12

A2.2.3.1.2      • Make predictions using the equations or graphs of regression models (lines and curves of best fit) of scatter plots.

## Mathematical Practices:

- 1      • Make sense of problems and persevere in solving them.
- 2      • Reason abstractly and quantitatively.
- 3      • Construct viable arguments and critique the reasoning of others.
- 4      • Model with mathematics.
- 5      • Use appropriate tools strategically.
- 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:** Honors Algebra II

**TIME FRAME:** 18 days

**UNIT #7:** Exponential and Logarithmic Functions

**GRADE:** 8 – 12

## UNDERSTANDINGS

The characteristics of exponential functions can help analyze real-world problems involving growth and decay.

Exponential expressions are related to logarithmic expressions.

Logarithms are able to be converted between different bases.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Test

### KNOW

- Recognize the difference between exponential growth and decay in an equation and graph.
- Identify what the “a” and “b” values represent in an exponential function.
- Understand the purpose of the natural base “e.”
- Understand the purpose of an asymptote.
- Understand why a solution to an equation may be extraneous.

### DO

- Graph exponential growth and decay functions.
- Apply and analyze “a” and “b” values in exponential growth and decay problems.
- Use the natural base “e” in calculations and equations.
- Convert between exponential and logarithmic form.
- Convert logarithms between various bases, including base “e.”
- Solve logarithmic and exponential equations.
- Determine if an answer to an equation is extraneous.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 15 days

**UNIT #8:** Rational Functions

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- 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.D.6 • Extend the knowledge of rational functions to rewrite in equivalent forms.
- CC.2.2.HS.D.9 • Use reasoning to solve equations, and justify the solution method.

### Keystone Algebra II Eligible Content:

- A2.1.2.2.2 • Simplify rational algebraic expressions.
- A2.1.3.2.1 • Determine how a change in one variable relates to a change in a second variable.

### Mathematical Practices:

- 1 • Make sense of problems and persevere in solving them.
- 2 • Reason abstractly and quantitatively.
- 3 • Construct viable arguments and critique the reasoning of others.
- 4 • Model with mathematics.
- 5 • Use appropriate tools strategically.
- 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:** Honors Algebra II

**TIME FRAME:** 15 days

**UNIT #8:** Rational Functions

**GRADE:** 8 – 12

## UNDERSTANDINGS

Rational expressions are fractions with variable expressions in them.

The graphs of rational expressions will tend to have at least one asymptote, which is a line that the graph gets close to, but never touches.

Rational expressions can be added, subtracted, multiplied or divided, and the steps are similar to those when working with regular fractions.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Test

### KNOW

- Recognize the differences between direct, inverse and joint variation.
- Recognize the graph a rational function and the use of an asymptote.
- Recognize when a rational function has an asymptote and what type it is.
- Identify the steps for solving a rational equation.

### DO

- Calculate using direct, inverse and joint variation.
- Graph a rational function.
- Find and graph all asymptotes, whether they are vertical, horizontal or slant (oblique).
- Add, subtract, multiply and divide rational expressions.
- Solve equations involving rational expressions.
- Determine if solutions to rational equations are extraneous.



# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 15 days

**UNIT #9:** Quadratic Relations and Conic Sections

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- CC.2.1.HS.F.4 • Use units as a way to understand problems and to guide the solution of multi-step problems.
- 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.D.2 • Write expressions in equivalent forms to solve problems.
- CC.2.3.HS.A.10 • Translate between the geometric description and the equation for a conic section.

### Keystone Algebra II Eligible Content:

- A2.1.3.2.2 • Use algebraic processes to solve a formula for a given variable.
- A2.2.2.2.1 • Identify or describe the effect of changing parameters within a family of functions (eg.  $y = x^2$  and  $y = x^2 + 3$ ).

### Mathematical Practices:

- 1 • Make sense of problems and persevere in solving them.
- 2 • Reason abstractly and quantitatively.
- 3 • Construct viable arguments and critique the reasoning of others.
- 4 • Model with mathematics.
- 5 • Use appropriate tools strategically.
- 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:** Honors Algebra II

**TIME FRAME:** 15 days

**UNIT #9:** Quadratic Relations and Conic Sections

**GRADE:** 8 – 12

## UNDERSTANDINGS

Conic sections (parabolas, circles, ellipses and hyperbolas) are seen in real-life situations.

Each graph of a conic can be derived from cutting a cross-section of a cone.

Each of the conics has the property that certain parts of its graph are equidistant from critical points on the graph.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Conics Book Project, Chapter Test

### KNOW

- Recall the Distance and Midpoint Formulas.
- Recognize the difference between the graphs and equations for a parabola, circle, ellipse and hyperbola.
- Recognize all vocabulary for each of the 4 conics and to which conic it belongs.
- Recall the process of Completing the Square.
- Recognize if an ordered pair is a solution to a system of equations.

### DO

- Graph the equations for a parabola, circle, ellipse and hyperbola given a center/vertex of (0,0) as well as a translated equation.
- Identify all major parts of each of the four conics.
- Write the equations for a parabola, circle, ellipse and hyperbola given various pieces of information about that particular conic.
- Solve systems of equations involving a line and conic or two conics.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 10 days

**UNIT #10:** Trigonometric Ratios and Functions

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- |               |   |
|---------------|---|
| CC.2.2.HS.C.7 | • Apply radian measure of an angle and the unit circle to analyze the trigonometric functions.      |
| CC.2.2.HS.C.8 | • Choose trigonometric functions to model periodic phenomena and describe the properties of graphs. |
| CC.2.2.HS.C.9 | • Prove the Pythagorean identity and use it to calculate trigonometric ratios.                      |
| CC.2.3.HS.A.3 | • Verify and apply geometric theorems as they relate to geometric figures.                          |
| CC.2.3.HS.A.7 | • Apply trigonometric ratios to solve problems involving right triangles.                           |

### Mathematical Practices:

- |   |  |
|---|--|
| 1 | • Make sense of problems and persevere in solving them.            |
| 2 | • Reason abstractly and quantitatively.                            |
| 3 | • Construct viable arguments and critique the reasoning of others. |
| 4 | • Model with mathematics.  |
| 5 | • Use appropriate tools strategically.                             |
| 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:** Honors Algebra II

**TIME FRAME:** 10 days

**UNIT #10:** Trigonometric Ratios and Functions

**GRADE:** 8 – 12

## UNDERSTANDINGS

Trigonometry, meaning “triangle measure”, is a very important tool used in real-life situations.

The side lengths or angle measures of a right triangle can be found using the mnemonic device SOH-CAH-TOA.

The side lengths or angle measures of any triangle can be found, provided that the information given follows the ASA, AAS, SAS, or SSS Laws.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Quiz/Test

### KNOW

- Identify the basic six trigonometric ratios (sine, cosine, tangent, cosecant, secant, cotangent).
- Recognize the difference between degree measure and radian measure.
- Recognize the construction of the Unit Circle.
- Understand the different cases when solving using the Law of Sines or Law of Cosines.
- Recognize Heron’s Formula and its purpose.

### DO

- Solve right triangles using basic trigonometric ratios.
- Evaluate any angle measure using the basic trigonometric ratios.
- Convert between degree measure and radian measure.
- Find the area of a sector or measure of an arc length.
- Solve a triangle using Law of Sines and/or Cosines.
- Find the area of any triangle using Heron’s Formula.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 6 days

**UNIT #11:** Counting Methods and Probability

**GRADE:** 8 – 12

## STANDARDS:

### PA Core Standards:

- CC.2.1.HS.F.3 • Apply quantitative reasoning to choose and interpret units and scales in formulas, graphs, and data displays.
- 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.5 • Make inferences and justify conclusions based on sample surveys, experiments, and observational studies.
- CC.2.4.HS.B.6 • Use the concepts of independence and conditional probability to interpret data.
- CC.2.4.HS.B.7 • Apply the rules of probability to compute probabilities of compound events in a uniform probability model.

### Keystone Algebra II Eligible Content:

- 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.

### Mathematical Practices:

- 1 • Make sense of problems and persevere in solving them.
- 2 • Reason abstractly and quantitatively.
- 3 • Construct viable arguments and critique the reasoning of others.
- 4 • Model with mathematics.
- 5 • Use appropriate tools strategically.
- 8 • Look for and express regularity in repeated reasoning.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 6 days

**UNIT #11:** Counting Methods and Probability

**GRADE:** 8 – 12

## UNDERSTANDINGS

Understanding probability is very crucial in many aspects of today's society.

The difference between a permutation or a combination is that order matters in a permutation.

Theoretical probability is what should happen in an experiment, whereas experimental probability is what actually happens in the experiment.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Quiz

### KNOW

- Identify the formulas for permutations and combinations.
- Recognize the difference between a permutation and combination.
- Understand the importance and uses of Pascal's Triangle as it relates to probability.
- Recognize the difference between experimental and theoretical probability.
- Recognize the difference between probability and odds.
- Recognize the difference between independent and dependent events.

### DO

- Calculate a permutation or combination.
- Expand a binomial using Pascal's Triangle and the Binomial Theorem.
- Calculate and convert between probability and odds.
- Calculate experimental and theoretical probability of an event.

# KNOW, UNDERSTAND, DO

**COURSE:** Honors Algebra II

**TIME FRAME:** 4 days

**UNIT #12:** Sequences and Series

**GRADE:** 8 – 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.C.3      • Write functions or sequences that model relationships between two quantities.

### Keystone Algebra II Eligible Content:

- A2.2.1.1.2      • Identify and/or extend a pattern as either an arithmetic or geometric sequence.

### Mathematical Practices:

- 1      • Make sense of problems and persevere in solving them.
- 2      • Reason abstractly and quantitatively.
- 3      • Construct viable arguments and critique the reasoning of others.
- 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:** Honors Algebra II

**TIME FRAME:** 4 days

**UNIT #12:** Sequences and Series

**GRADE:** 8 – 12

## UNDERSTANDINGS

An arithmetic sequence is a sequence in which a common difference (found by adding or subtracting) is found in between each term of the sequence.

A geometric sequence is a sequence in which a common ratio (found by multiplying or dividing) is found between each term of the sequence.

A series can be written in summation (sigma) notation as a shortcut to writing the sum of the entire sequence.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Quiz

### KNOW

- Understand the difference between a sequence and series.
- Recognize the difference between an arithmetic sequence and geometric sequence.
- Understand what summation (sigma) notation is.
- Recognize the difference between a common difference and common ratio.

### DO

- Find terms of a sequence.
- Write a sequence in summation (sigma) notation.
- Determine if a sequence is arithmetic, geometric, or neither.
- Find the common difference or common ratio of a sequence.



### **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)