CARLISLE AREA SCHOOL DISTRICT
Carlisle, PA 17013

Honors Pre-Calculus

GRADES 10 - 12

Date of Board Approval: February 19, 2015
# CARLISLE AREA SCHOOL DISTRICT
## PLANNED INSTRUCTION COVER PAGE

<table>
<thead>
<tr>
<th>TITLE OF COURSE:</th>
<th>Honors Pre-Calculus</th>
<th>SUBJECT:</th>
<th>Math</th>
</tr>
</thead>
<tbody>
<tr>
<td>COURSE LENGTH:</td>
<td>School Year</td>
<td>GRADE LEVEL:</td>
<td>10 – 12</td>
</tr>
<tr>
<td>DURATION:</td>
<td>50 minutes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FREQUENCY:</td>
<td>Daily</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PREREQUISITES:</td>
<td>Algebra 1, 2 and Geometry</td>
<td>CREDIT:</td>
<td>1</td>
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<tr>
<td></td>
<td></td>
<td>LEVEL:</td>
<td>Honors</td>
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Course Description/Objectives: Pre-Calculus is a course that extends and builds upon topics covered in Algebra 2 as well as introducing students to trigonometric concepts. By the end of this course, students should be able to solve and graph polynomial, exponential, logarithmic and trigonometric functions. Students will also have an understanding of the unit circle, be able to apply trigonometric identities and solve real world problems using trigonometric relationships.

Text: *Pre-Calculus, 8th Edition*, Ron Larson

Curriculum Writing Committee: Mark Alwine, Micah Shinn, Kelly Brent
COURSE TIME LINE

Unit 1: Functions and Graphs
- Linear Equations
- Parent Functions
- Composite Functions
- Inverse Functions

Unit 2: Polynomial and Rational Functions
- Quadratic Equations
- Solving and Graphing Polynomial Equations
- Rational Functions
- Non-linear Inequalities

Unit 3: Matrices
- Operations
- Inverse and Determinant
- Solving Systems of Equations
- Real World Application

Unit 4: Exponential andLogarithmic Functions
- Properties
- Graphs
- Solving
- Real World Modeling

Unit 5: Trigonometry
- Radian and Degree Measure
- The Unit Circle
- Graphs of Trigonometric Functions
- Inverse Trigonometric Functions
- Real World Modeling
Unit 6: Analytic Trigonometry
- Fundamental Identities
- Solving Trigonometric Equations
- Trigonometric Formulas

6 weeks

Unit 7: Solving Non-Right Triangles
- Law of Sines
- Law of Cosines
- Real World Modeling

2 weeks

Unit 8: Introduction to Limits
- Basic Properties
- Evaluating One- and Two-Sided Limits
- Difference Quotient

2 weeks

TOTAL: 36 weeks
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus  TIME FRAME: 4 weeks
UNIT # 1: Functions and Graphs  GRADE: 10-12

STANDARDS:

PA Common Core Standards

CC.2.2.HS.D.7 • Create and graph equations or inequalities to describe numbers or relationships
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.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

The Standards of Mathematical Practices

1 • Make sense of problems and persevere in solving them
2 • Reason abstractly and quantitatively
4 • Model with mathematics
5 • Use appropriate tools strategically
6 • Attend to precision
**KNOW, UNDERSTAND, DO**

**COURSE:** Honors Pre-Calculus  
**TIME FRAME:** 4 weeks  
**UNIT # 1:** Functions and Graphs  
**GRADE:** 10-12

### UNDERSTANDINGS

In order to use the current technology, the properties and rules of Algebra must be understood.

### COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Test

### KNOW

- Recognize Interval Notation
- Differentiate between Bounded Intervals and Unbounded Intervals
- Understand the term Non-negative
- Simplify Rational Expressions
- Find Domain
- Identify Critical Numbers

### DO

- Factor
- Solve equations
- Solve inequalities
- Graph equations
- Graph inequalities
- Interpret graphs
- Simplify rational expressions
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus  
UNIT # 2: Polynomial and Rational Functions  

TIME FRAME: 4 weeks  
GRADE: 10-12

STANDARDS:

PA Common Core Standards

CC.2.1.HS.F.7  • Apply concepts of complex numbers in polynomial and quadratic equations to solve problems
CC.2.1.HS.D.3  • Extend the knowledge of arithmetic operations and apply to polynomials
CC.2.1.HS.D.4  • Understand the relationship between zeros and factors of polynomials to make generalizations about functions and their graphs
CC.2.1.HS.D.5  • Use polynomial identities to solve problems
CC.2.1.HS.D.6  • Extend the knowledge of rational functions to rewrite in equivalent forms
CC.2.1.HS.C.6  • Interpret functions in terms of the situations they model

The Standards of Mathematical Practices

1  • Make sense of problems and persevere in solving them
2  • Reason abstractly and quantitatively
4  • Model with mathematics
5  • Use appropriate tools strategically
6  • Attend to precision
7  • Look for and make use of structure
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus
UNIT # 2: Polynomial and Rational Functions

TIME FRAME: 4 weeks
GRADE: 10-12

UNDERSTANDINGS
The degree of a polynomial is also the number of complex zeros and it is the maximum number of x-intercepts the polynomial can have.

An equation can give you insight as to what the graph will look like.

COMMON ASSESSMENTS/CULMINATING ACTIVITY
Unit Test

KNOW
- Identify Maximum and Minimum
- Understand the Rational Zero Test
- Utilize the Remainder Theorem
- Understand The Fundamental Theorem of Algebra
- Recognize Complex Numbers and the Imaginary Unit
- Identify Complex Conjugates
- Identify Continuous and Discontinuous Functions
- Recognize Slant Asymptotes

DO
- Find the axis of symmetry and vertex of a parabola.
- Find the maximum and minimum value of a quadratic function.
- Divide polynomials.
- Sketch graphs of polynomials.
- Find zeros of polynomials.
- Find the asymptotes of a rational function.
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus
UNIT # 3: Matrices
TIME FRAME: 5 weeks
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.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
CC.2.2.HS.D.10 • Represent, solve, and interpret equations/inequalities and systems of equations/inequalities algebraically and graphically

The Standards of Mathematical Practices

1  • Make sense of problems and persevere in solving them
2  • Reason abstractly and quantitatively
4  • Model with mathematics
5  • Use appropriate tools strategically
6  • Attend to precision
7  • Look for and make use of structure
# KNOW, UNDERSTAND, DO

**COURSE:** Honors Pre-Calculus  
**UNIT # 3:** Matrices  
**TIME FRAME:** 5 weeks  
**GRADE:** 10-12

## UNDERSTANDINGS

Matrices can be used to model many real world problems.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

**Unit Test**

<table>
<thead>
<tr>
<th>KNOW</th>
<th>DO</th>
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</thead>
</table>
| • Convert a system of equations into an augmented matrix  
• Combine two matrices  
• Identify systems of equations with no or infinite solutions | • Write a matrix in reduced and row reduced echelon form  
• Add, subtract and multiply matrices  
• Find the inverse of a matrix  
• Find the determinant of a matrix  
• Determine if three coordinates are collinear  
• Find the area of a triangle given three coordinates |
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus

UNIT # 4: Logarithmic and Exponential Functions and Equations

TIME FRAME: 5 weeks

GRADE: 10-12

STANDARDS:

PA Common Core Standards

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
CC.2.2.HS.C.5 • Construct and compare linear, quadratic, and exponential models to solve problems

The Standards of Mathematical Practices

1 • Make sense of problems and persevere in solving them
2 • Reason abstractly and quantitatively
4 • Model with mathematics
5 • Use appropriate tools strategically
6 • Attend to precision
7 • Look for and make use of structure
# KNOW, UNDERSTAND, DO

**COURSE:** Honors Pre-Calculus  
**TIME FRAME:** 5 weeks  
**UNIT # 4:** Logarithmic and Exponential Functions and Equations  
**GRADE:** 10-12

## UNDERSTANDINGS

Many businesses use logistics growth models to either predict where their company will be years down the road or as an aide to market their products.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

Unit Test

## KNOW

- Use inverse properties
- Evaluate a logarithm
- Identify logarithmic and exponential graphs
- Find domain

## DO

- Calculate a logarithmic expression without the aide of a calculator
- Use logarithms to solve an exponential equation
- Use exponentiation to solve a logarithmic equation
- Expand a logarithm using properties
- Condense multiple logarithms to one logarithm using properties
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus

UNIT # 5: Trigonometry

TIME FRAME: 8 weeks
GRADE: 10-12

STANDARDS:

PA Common Core Standards

CC.2.2.HS.D.7 • Create and graph equations or inequalities to describe numbers or relationships.
CC.2.2.HS.C.4 • Interpret the effects transformations have on functions and find the inverses of functions.
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 the graphs.
CC.2.2.HS.C.9 • Prove the Pythagorean identity and use it to calculate trigonometric ratios.
CC.2.3.HS.A.7 • Apply trigonometric ratios to solve problems involving right triangles.

The Standards of Mathematical Practices

1 • Make sense of problems and persevere in solving them
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# KNOW, UNDERSTAND, DO

**COURSE:** Honors Pre-Calculus  
**UNIT # 5:** Trigonometry  
**TIME FRAME:** 8 weeks  
**GRADE:** 10-12

## UNDERSTANDINGS

Students should understand how to graph, measure and interpret angle measures, in both radians and degrees.  
Students should understand how to convert from one angle measure to the other in order to use the most practical type of angle measure for a given problem.  
Students should understand how to evaluate, graph, and interpret the sine, cosine, tangent, secant, cosecant and cotangent functions.  
Students should understand how to read, interpret and use the Unit Circle to solve trigonometric problems.

## COMMON ASSESSMENTS/CULMINATING ACTIVITY

At the teacher’s discretion, the unit will conclude with either the use of a Unit Exam or the use of a Unit Project.

## KNOW

- Identify angle unit type  
- Measure angles in degrees  
- Define the six trigonometric functions for right triangles  
- Define the inverse trigonometric functions

## DO

- Solve problems that require the use of either degrees or radians.  
- Convert between degrees and radians, in both directions.  
- Use the Unit Circle to solve trigonometric problems.  
- Graph the six trigonometric functions, with and without transformations.  
- Solve and graph problems that use the inverse trigonometric functions.
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus
UNIT # 6: Analytic Trigonometry

TIME FRAME: 6 weeks
GRADE: 10-12

STANDARDS:

PA Common Core Standards

CC.2.2.HS.C.7 • Apply radian measure of an angle and the unit circle to analyze the trigonometric functions.

CC.2.3.HS.A.7 • Apply trigonometric ratios to solve problems involving right triangles.

The Standards of Mathematical Practices

1 • Make sense of problems and persevere in solving them
2 • Reason abstractly and quantitatively
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4 • Use appropriate tools strategically
5 • Attend to precision
7 • Look for and make use of structure
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus
UNIT # 6: Analytic Trigonometry
TIME FRAME: 6 weeks
GRADE: 10-12

UNDERSTANDINGS

Students will understand how to solve problems that require the use of the fundamental trigonometric identities.

Students will understand how verify trigonometric identities using the fundamental trigonometric identities.

Students will understand how to solve trigonometric equations.

Students will understand how to solve problems using trigonometric formulas.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

At the teacher’s discretion, the unit will conclude with either the use of a Unit Exam or the use of a Unit Project.

KNOW

• Identify and use appropriate trigonometric identities
• Solve trigonometric equations for a given variable
• Apply appropriate trigonometric formulas

DO

• Solve problems that use the fundamental trigonometric identities.
• Verify trigonometric identities.
• Solve a trigonometric equation for x.
• Solve problems involving the use of trigonometric formulas.
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus
UNIT # 7: Solving non-Right Triangles

TIME FRAME: 2 weeks
GRADE: 10-12

STANDARDS:

PA Common 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

The Standards of Mathematical Practices

1 ● Make sense of problems and persevere in solving them
2 ● Reason abstractly and quantitatively
4 ● Model with mathematics
5 ● Use appropriate tools strategically
6 ● Attend to precision
7 ● Look for and make use of structure
**KNOW, UNDERSTAND, DO**

<table>
<thead>
<tr>
<th>COURSE:</th>
<th>Honors Pre-Calculus</th>
<th>TIME FRAME:</th>
<th>2 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>UNIT # 7:</td>
<td>Solving non-Right Triangles</td>
<td>GRADE:</td>
<td>10-12</td>
</tr>
</tbody>
</table>

**UNDERSTANDINGS**

Triangles come in all forms and measures, not just the special right triangles.

**COMMON ASSESSMENTS/CULMINATING ACTIVITY**

Chapter Quiz

<table>
<thead>
<tr>
<th>KNOW</th>
<th>DO</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Understand 2-triangle scenarios</td>
<td>• Solve any triangle for the missing sides and/or angles</td>
</tr>
<tr>
<td>• Identify the correct law based on given information</td>
<td>• Apply the Law of Sines</td>
</tr>
<tr>
<td>• Recognize no solution angles/measurements</td>
<td>• Apply the Law of Cosines</td>
</tr>
<tr>
<td></td>
<td>• Model real world problems involving triangles</td>
</tr>
</tbody>
</table>
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus

UNIT # 8: Introduction to Limits

TIME FRAME: 2 weeks

GRADE: 10-12

STANDARDS:

PA Common Core Standards

- CC.2.2.HS.D.9 Use reasoning to solve equations and justify the solution method
- 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.6 Interpret functions in terms of the situations they model

The Standards of Mathematical Practices

1. Make sense of problems and persevere in solving them
2. Reason abstractly and quantitatively
4. Model with mathematics
5. Use appropriate tools strategically
6. Attend to precision
7. Look for and make use of structure
KNOW, UNDERSTAND, DO

COURSE: Honors Pre-Calculus
UNIT # 8: Introduction to Limits

TIME FRAME: 2 weeks
GRADE: 10-12

UNDERSTANDINGS

The slope of the tangent line can be evaluated as a limit.

COMMON ASSESSMENTS/CULMINATING ACTIVITY

Chapter Quiz

KNOW

- Understand Limit Properties
- Evaluate a limit
- Define slope

DO

- Find the limit of a function using intuition
- Calculate the limit of a function
- Apply the properties of limits to find a limit
- Find a limit graphically and with numerical evidence
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)