DELAWARE VALLEY SCHOOL DISTRICT

PLANNED INSTRUCTION

A PLANNED COURSE FOR:

Honors Pre-calculus

Grade Level:11/12

Date of Board Approval: _____2018_____

DELAWARE VALLEY SCHOOL DISTRICT

Planned Instruction

Title of Planned Instruction: Honors Pre-calculus

Subject Area: Mathematics Grade(s): 11/12

Course Description:

This course follows Honors Algebra 2 with Trigonometry. It is a rigorous course for college bound students and is designed to challenge the students as they investigate functions (polynomial, rational, exponential, trigonometric and logarithmic) in a detailed manner. The course also covers conic sections, complex numbers, sequences, series, probability, and introductory calculus concepts such as limits and rates of change. One of the primary objectives of this course is for students to develop the knowledge and skills necessary to be successful in Advanced Placement Calculus during their senior year. In compliance with the goals of Advanced Placement Calculus, this course emphasizes a multi-representational approach to Pre-calculus, with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally. The connections among these representations also are important. Technology is integrated whenever appropriate to support and challenge the learning of the students. Such technological instruction will be through the use of graphing calculators and/or internet-based learning sites.

Time/Credit for the Course: Full year/1 credit

Curriculum Writing Committee:

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Curriculum Map

1. **Marking Period One - Overview with time range in days: 45**
    - Review and practice data analysis and percentages
    - Introduction to graphs through distance formula, midpoint formula, intercepts and symmetry. Introduction to and analysis of functions and their graphs, properties, and applications: linear, quadratic, absolute value, square root, piece-wise, constant, identity, cubic, cube root, greatest integer, and reciprocal.
    - Review for SAT Reasoning Test

    Marking Period One - Goals:
    Understanding of:
    - Data analysis and percentages
    - Sets of numbers; analyzing and graphing
    - Distance formula, midpoint formula, intercepts, symmetry
    - Writing equations of a circle and graphing circles
    - Defining functions
    - Properties of various functions: linear, quadratic, absolute value, square root, piece-wise, constant, identity, cubic, cube root, greatest integer, and reciprocal functions
    - Graphing techniques of functions: transformations, both by hand and with graphing utility
    - Mathematical models and applications of functions
    - Quadratic functions and their properties
    - Quadratic models
    - Quadratic equations and inequalities

2. **Marking Period Two - Overview with time range in days: 45**
    - In depth analysis, properties, and applications of the following functions and their graphs: polynomial, rational, exponential, and logarithmic.
    - Review for SAT Reasoning Test

    Marking Period Two - Goals:
    Understanding of:
    - Polynomial functions and models
    - Real and complex zeros of polynomial functions
    - Properties of rational functions
    - Graphs of polynomial and rational functions
    - Polynomial and rational equations and inequalities
    - Evaluating and writing composite functions
    - One-to-one functions and their inverses
    - Exponential functions and their properties

- Logarithmic functions and their properties
- Logarithmic and exponential equations
- Applications of exponential and logarithmic equations

3. Marking Period Three - Overview with time range in days: 45

- Introduction to trigonometric terminology, angles, unit circle, radians, degrees, properties and graphs
- In depth analysis of functions and their graphs, properties and applications: trigonometric functions (sine, cosine, tangent, cotangent, cosecant, and secant), inverse trigonometric functions (inverse sine and inverse cosine)
- Trigonometric identities: reciprocal, even-odd, Pythagorean, quotient, sum and difference, double angle identities
- Proving complex trigonometric identities from basic identities
- Solving trigonometric equations
- Review for SAT Reasoning Test and SAT Math Levels 1 and 2 Subject Tests

Marking Period Three - Goals

Understanding of:

- Angles and their measure in radians and degrees
- Trigonometric functions with a Unit Circle approach in degrees and radian measures
- Properties of the trigonometric functions
- Graphs of sine, cosine, tangent, cosecant, cotangent, secant
- Phase shifts with trigonometric functions The inverse sine and cosine functions
- Elementary trigonometric identities: quotient, reciprocal, Pythagorean, even-odd
- Sum and difference formulas
- Double angle formulas
- Finding all solutions of a trigonometric equation
- Trigonometric equation quadratic in form
- Solving trigonometric equations by using identities

4. **Marking Period Four – Overview with time range in days: 45**
    - Applications of Trigonometric functions through the use of the Law of Sines, Law of Cosines, Heron's formula, and Right Triangle Trigonometry
    - Understanding the properties of circles.
    - Recognizing the four conic sections: circle, parabola, ellipse, hyperbola
    - Systems of equations, inequalities, non-linear equations
    - Sequences and series
    - Sigma Notation
    - Multiplication Principle of Counting, Permutations, and Combinations
    - Review for SAT Reasoning Test and SAT Math Levels 1 and 2 Subject Tests
    - Cumulative Assessment

Marking Period Four - Goals:
Understanding of:

- Applications involving right triangle trigonometry
- The Law of Sines
- The Law of Cosines
- Heron's Formula and the area of a triangle using trigonometry
- Polar Coordinates: Converting to and from Rectangular Coordinates
- Conic Sections: Equations and Graphs
- Introduction to Parametric Equations
- Systems of equations with 2 or 3 variables by substitution or elimination
- Systems of inequalities
- Systems of nonlinear equations
- Arithmetic and geometric sequences and series
- Summation Notation
- Combinatorics
- Probability: Mutually exclusive events, conditional probability, independent events, and geometric probability

Curriculum Plan

Unit 1: Functions and Their Graphs

Marking Period: 1

Standard(s): PA Core State Standards for Mathematics
http://static.pdesas.org/content/documents/PA%20Core%20Standards%20Mathematics%20PreK-12%20March%202014.pdf

Standards Addressed:

CC.2.4.8.B.1	CC.2.1.HS.D.2	CC.2.1.HS.D.10	CC.2.3.HS.A.1
CC.2.4.HS.B.1	CC.2.1.HS.D.3	CC.2.2.HS.C.1	CC.2.3.HS.A.11
CC.2.4.HS.B.2	CC.2.1.HS.D.4	CC.2.2.HS.C.2	CC.2.4.HS.B.1
CC.2.4.HS.B.3	CC.2.1.HS.D.7	CC.2.2.HS.C.3	CC.2.4.HS.B.2
CC.2.1.HS.F.3	CC.2.1.HS.D.8	CC.2.2.HS.C.4	CC.2.4.HS.B.3
CC.2.1.HS.D.1	CC.2.1.HS.D.9	CC.2.2.HS.C.5	

Big Idea # 1: Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms.

Essential Question:

- How can you extend algebraic properties and processes to linear, quadratic, absolute value, square root, piece-wise, constant, identity, cubic, cube root, and reciprocal and then apply them to solve real world problems?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to linear, quadratic, and polynomial expressions and equations, and apply them to solve real world problems.
- Represent a quadratic function in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the solution of the associated quadratic equation to each representation.

Big Idea #2: Families of functions exhibit properties and behaviors that can be recognized across representations. Functions can be transformed, combined, and composed to create new functions in mathematical and real world situations.

Essential Question:

- How do linear, quadratic, absolute value, square root, piece-wise, constant, identity, cubic, cube root, reciprocal, and their graphs and/or tables help us interpret events that occur in the world around us?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to quadratic, and polynomial expressions and equations, and apply them to solve real world problems.
- Represent quadratic and polynomial functions in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the solution of the associated quadratic equation to each representation.

Big Idea #3: Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range), and the relationship is recognizable across representations.

Essential Question:

- How do you explain the benefits of multiple methods of representing linear, quadratic, absolute value, square root, piece-wise, constant, identity, cubic, cube root, and reciprocal function (tables, graphs, equations, and contextual situations)?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to quadratic and polynomial expressions and equations, and apply them to solve real world problems.
- Represent a quadratic function in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the solution of the associated quadratic equation to each representation.

Big Idea #4: Mathematical relations and functions can be modeled through multiple representations and analyzed to raise and answer questions.

Essential Question:

- How can data be organized and represented to provide insight into the relationship between quantities?
- How does the type of data influence the choice of display?

Concept:

- Data
- Percentages

Competencies:

- Recognize and evaluate random processes underlying statistical experiments.

Overview: This unit connects algebra and geometry using the rectangular coordinate system and applies it to graph equations in two variables. The unit encompasses what a function is, how to graph functions, properties of functions, and how functions are used in applications.

Goals: Students will be able to

- Identify and classify functions
- Plot relations in the coordinate plane
- Evaluate distance and midpoint using formulas
- Apply mathematical models to real world events

Objectives: Students will be able to

- Identify and analyze properties of real numbers (DOK Level Three)
- Use set notation to determine unions, intersections, complements, and subsets of given sets (DOK Level Two)
- Use the distance and midpoint formula (DOK Level One)
- Graph equations by plotting points (DOK Level Two)
- Find intercepts from a graph and an equation (DOK Level One)
- Test an equation for symmetry with respect to the x-axis, the y-axis, and the origin (DOK Level Three)
- Solving equations using a graphing utility (DOK Level Two)
- Calculate and interpret the slope of a line (DOK Level One)
- Graph lines given a point and the slope (DOK Level Two)
- Find the equation of a vertical and a horizontal line (DOK Level One)
- Use the point-slope form of a line (DOK Level One)
- Determine the equation of a line given two points (DOK Level Two)

- Write the equation of a line in slope-intercept form (DOK Level Two)
- Identify the slope and y-intercept of a line from its equation (DOK Level One)
- Graph lines written in general form using intercepts (DOK Level Two)
- Write the equation of a secant line to a graph (DOK Level Two)
- Draw the line tangent to a graph and determine its equation (DOK Level Three)
- Identify the point on a line that is closest to a given point and determine its coordinates (DOK Level Three)
- Formulate equations of parallel and perpendicular lines (DOK Level Three)
- Write the equation of a circle in various forms (DOK Level Two)
- Graph a circle in various forms by completing the square (DOK Level One)
- Determine whether a relation represents a function (DOK Level Three)
- Calculate the value of a function (DOK Level One)
- List the domain and the range of a function (DOK Level Two)
- Perform operations on functions (DOK Level Three)
- Identify the graph of a function (DOK Level One)
- Obtain information from or about the graph of a function (DOK Level Three)
- Determine and identify even and odd functions (DOK Level Two)
- Use a graph to determine where a function is increasing, decreasing, or constant (DOK Level Two)
- Use a graph to locate local maxima and local minima (DOK Level Two)
- Find the average rate of change of a function (DOK Level Two)
- Explain the difference between average rate of change and instantaneous rate of change (DOK Level Two)
- Graph the following functions: linear, quadratic, absolute value, square root, piece-wise, constant, identity, cubic, cube root, greatest integer, and reciprocal (DOK Level Three)
- Graph functions using transformations (DOK Level Three)
- Analyze non-routine transformations of graphs, such as absolute value and/or reciprocal of a given function (DOK Level Four)
- Identify the vertex and axis of symmetry of a quadratic function (DOK Level Two)
- Graph a quadratic function using its vertex, axis of symmetry, and intercepts using various forms (DOK Level Three)
- Build and analyze functions and models (DOK Level Four)
- Solve inequalities involving a quadratic function algebraically and graphically (DOK Level Three)
- Apply the greatest integer function to real-world examples (DOK Level Four)

- Understand and use the relationship between percent change and growth factor. (DOK Level Three)
- Choose an appropriate graphical representation for a given data set. (DOK Level Two)
- Analyze and interpret numerical data distributions. (DOK Level Three)

Unit 2: Polynomial and Rational Functions

Marking Period: 2

Standard(s): PA Core State Standards for Mathematics
http://static.pdesas.org/content/documents/PA%20Core%20Standards%20Mathematics%20PreK-12%20March%202014.pdf

Standards Addressed:

CC.2.1.HS.F.1	CC.2.1.HS.D.1	CC.2.1.HS.D.6	CC.2.1.HS.D.10
CC.2.1.HS.F.3	CC.2.1.HS.D.2	CC.2.1.HS.D.7	CC.2.2.HS.C.1
CC.2.1.HS.F.6	CC.2.1.HS.D.3	CC.2.1.HS.D.8	CC.2.2.HS.C.2
CC.2.1.HS.F.7	CC.2.1.HS.D.4	CC.2.1.HS.D.9	CC.2.2.HS.C.3

Big Idea # 1: Relations and functions are mathematical relationships that can be represented and analyzed using words, tables, graphs, and equations.

Essential Question:

- How can you extend algebraic properties and processes to quadratic, exponential and polynomial expressions and equations and then apply them to solve real world problems?

Concept:

- Polynomial functions and equations

Competencies:

- Extend algebraic properties and processes to quadratic, and polynomial expressions and equations, and apply them to solve real world problems.
- Represent a polynomial or rational function in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the solution of the associated polynomial or rational equation to each representation.

Big Idea #2: Families of functions exhibit properties and behaviors that can be recognized across representations. Functions can be transformed, combined, and composed to create new functions in mathematical and real world situations.

Essential Question:

- How do you explain the benefits of multiple methods of representing polynomial and rational functions (tables, graphs, equations, and contextual situations)?

Concept:

- Polynomial functions and equations

Competencies:

- Represent a polynomial or rational function in multiple ways, including table, graphs, equations, and contextual situations, and make connections among representations; relate the solution of the associated polynomial or rational equation to each representation.

Overview: This unit looks at two general classes of functions: polynomial functions and rational functions, and examines their properties.

Goals: Students will be able to

- Identify and classify a polynomial function
- Investigate and interpret the graph of a polynomial function
- Identify a rational function
- Investigate and interpret the graph of a rational function
- Apply mathematical models to real world events

Objectives: Students will be able to

- Identify polynomial functions and their degree (DOK Level One)
- Graph polynomial functions using transformations (DOK Level Two)
- Identify the real zeros of a polynomial function and their multiplicity (DOK Level One)
- Identify and describe the shape of the graph of a polynomial function near its x-intercepts (DOK Level Two)
- Formulate a sign pattern graph to represent where the graph of a polynomial function is above/below the x-axis
- Graph a polynomial function given its sign pattern graph (DOK Level Two)
- Analyze the graph of a polynomial function (DOK Level Four)
- Find the domain of a rational function (DOK Level One)
- Find the vertical and horizontal asymptotes of a rational function (DOK Level Two)
- Analyze the graph of a rational function (DOK Level Four)
- Graph rational functions given their sign pattern graph and other information such as vertical/horizontal asymptotes and intercepts (DOK Level Three)
- Interpret limit notation in the context of the features of graphs of rational functions (DOK Level Two)
- Determine the end-behavior of graphs of rational functions by investigating the limits as x goes to infinity (DOK Level Three)
- Evaluate one-sided limits as x approaches a vertical asymptote (DOK Level Three)
- Solve polynomial inequalities (DOK Level Two)
- Formulate a sign pattern graph to represent where the graph of a rational function is above/below the x-axis
- Solve rational inequalities (DOK Level Two)
- Assess the remainder and factor theorems (DOK Level Three)

- Use the rational zeros theorem to list the potential rational zeros of a polynomial (DOK Level Two)
- Find the real and complex zeros of a polynomial function (DOK Level Three)
- Solve polynomial equations (DOK Level Two)
- Apply the conjugate pairs theorem (DOK Level Four)
- Construct a polynomial function with specified zeros (DOK Level Three)
- Explain and apply the Intermediate Value Theorem (DOK Level Three)

Unit 3: Exponential and Logarithmic Functions

Marking Period: 3

Standard(s): PA Core State Standards for Mathematics
http://static.pdesas.org/content/documents/PA%20Core%20Standards%20Mathematics%20PreK-12%20March%202014.pdf

Standards Addressed:

CC.2.1.HS.F.1	CC.2.1.HS.D.7	CC.2.2.HS.C.1	CC.2.2.HS.C.5
CC.2.1.HS.F.3	CC.2.1.HS.D.8	CC.2.2.HS.C.2	CC.2.2.HS.C.6
CC.2.1.HS.D.1	CC.2.1.HS.D.9	CC.2.2.HS.C.3	CC.2.4.HS.B.2
CC.2.1.HS.D.2	CC.2.1.HS.D.10	CC.2.2.HS.C.4	

Big Idea # 1: Relations and functions are mathematical relationships that can be represented and analyzed using words, tables, graphs, and equations.

Essential Question:

- What are the advantages/disadvantages of the various methods to represent exponential and logarithmic functions (table, graph, equation) and how do we choose the most appropriate representation?

Concept:

- Exponential and logarithmic functions and equations

Competencies:

- Extend algebraic properties and processes to quadratic, exponential, and polynomial expressions and equations, and apply them to solve real world problems.
- Represent exponential and logarithmic functions in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the growth/decay rate of the associated exponential and logarithmic equation to each representation.

Big Idea #2: Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range), and the relationship is recognizable across representations.

Essential Question:

- What are the advantages/disadvantages of the various methods to represent exponential and logarithmic functions (table, graph, equation) and how do we choose the most appropriate representation?

Concept:

- Exponential and logarithmic functions and equations

Competencies:

- Extend algebraic properties and processes to quadratic, exponential, logarithmic, and polynomial expressions and equations, and apply them to solve real world problems.
- Represent exponential and logarithmic functions in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the growth/decay rate of the associated exponential equation to each representation.

Overview: This unit investigates two general classes of functions: exponential functions and logarithmic functions, and it examines their properties.

Goals: Students will be able to

- Identify and classify an exponential function
- Investigate the graph of an exponential function
- Identify a logarithmic function
- Investigate the graph of a logarithmic function
- Apply mathematical models to real world events

Objectives: Students will be able to

- Form a composite function (DOK Level One)
- Find the domain of a composite function (DOK Level One)
- Determine whether a function is one-to-one (DOK Level One)
- Determine the inverse of a function defined by a map on or a set of ordered pairs (DOK Level One)
- Obtain the graph of the inverse function from the graph of a function (DOK Level Two)
- Find the inverse of a function defined by an equation (DOK Level Two)
- Evaluate exponential functions (DOK Level Two)
- Graph exponential functions (DOK Level Two)
- Evaluate limits involving exponential functions (DOK Level Two)
- Define the number e (DOK Level One)
- Compare linear and exponential models (DOK Three)
- Solve exponential equations (DOK Level Three)
- Change exponential expressions to logarithmic expressions and logarithmic expressions to exponential expressions (DOK Level Two)
- Evaluate logarithmic expressions (DOK Level Two)
- Determine the domain of a logarithmic function (DOK Level Two)
- Graph logarithmic functions (DOK Level Two)

- Solve logarithmic equations (DOK Level Three)
- Work with the properties of logarithms (DOK Level Three)
- Write a logarithmic expression as a sum or difference of logarithms (DOK Level Three)
- Write a logarithmic expression as a single logarithm (DOK Level Three)
- Evaluate logarithms whose base is neither 10 nor e (DOK Level Three)
- Graph a logarithmic function whose base is neither 10 nor e (DOK Level Three)
- Analyze financial modeling problems (DOK Level Four)
- Analyze exponential growth and decay models (DOK Level Four)
- Explain logistic models (DOK Level Four)

Unit 4: Trigonometric Functions

Marking Period: 4

Standard(s): PA Core State Standards for Mathematics
http://static.pdesas.org/content/documents/PA%20Core%20Standards%20Mathematics%20PreK-12%20March%202014.pdf

Standards Addressed:

CC.2.1.HS.F.1	CC.2.1.HS.D.5	CC.2.2.HS.C.3	CC.2.2.HS.C.9
CC.2.1.HS.F.3	CC.2.1.HS.D.9	CC.2.2.HS.C.4	CC.2.3.HS.A.1
CC.2.1.HS.D.1	CC.2.2.HS.C.1	CC.2.2.HS.C.7	CC.2.3.HS.A.7
CC.2.1.HS.D.2	CC.2.2.HS.C.2	CC.2.2.HS.C.8	CC.2.3.HS.A.10

Big Idea # 1: Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms.

Essential Question:

- How can you extend algebraic properties and processes to trigonometric functions and then apply them to solve real world problems?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to trigonometric expressions and equations, and apply them to solve real world problems.
- Represent trigonometric functions in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations.
- Represent a trigonometric function in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the solution of the associated trigonometric equation to each representation.

Big Idea #2: Families of functions exhibit properties and behaviors that can be recognized across representations. Functions can be transformed, combined, and composed to create new functions in mathematical and real world situations.

Essential Question:

- How do trigonometric functions and their graphs and/or tables help us interpret events that occur in the world around us?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to trigonometric expressions and equations, and apply them to solve real world problems.
- Represent trigonometric functions in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations.
- Represent a trigonometric function in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the solution of the associated trigonometric equation to each representation.

Big Idea #3: Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range), and the relationship is recognizable across representations.

Essential Question:

- How do you explain the benefits of multiple methods of representing trigonometric functions (tables, graphs, equations, and contextual situations)?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to trigonometric expressions and equations, and apply them to solve real world problems.
- Represent trigonometric functions in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations.
- Represent a trigonometric function in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations; relate the solution of the associated trigonometric equation to each representation.

Overview: This unit investigates trigonometric functions and examines their properties.

Goals: Students will be able to

- Identify and classify a trigonometric function
- Investigate the graph of a trigonometric function
- Identify an inverse trigonometric function
- Investigate the graph of an inverse trigonometric function

- Apply mathematical models to real world events
- Investigate the fundamental identities of the trigonometric functions

Objectives: Students will be able to

- Convert between decimals and degrees, minutes, seconds forms for angles (DOK Level Two)
- Find the arc length of a circle (DOK Level Two)
- Convert from degrees to radians and radians to degrees (DOK Level One)
- Find the area of a sector of a circle (DOK Level Two)
- Find the exact values of the trigonometric functions using a point on the unit circle (DOK Level Two)
- Find the exact values of the trigonometric functions of the quadrantal angles (DOK Level Two)
- Find the exact values of the exact values of the trigonometric functions for integer multiples of $\frac{\pi}{6}=30°, \frac{\pi}{4}=45°,$ and $\frac{\pi}{3}=60°.$ (DOK Level Two)
- Use a calculator to approximate the value of the trigonometric functions (DOK Level One)
- Use circle of radius r to evaluate the trigonometric functions (DOK Level Three)
- Determine the domain and range of the trigonometric functions (DOK Level Two)
- Determine the period of the trigonometric functions (DOK Level Two)
- Determine the signs of the trigonometric functions in a given quadrant (DOK Level One)
- Find the values of the trigonometric functions using fundamental identities (DOK Level Three)
- Find the exact values of the trigonometric functions of an angle given one of the functions and the quadrant of the angle (DOK Level Three)
- Use even-odd properties to find the exact values of the trigonometric functions (DOK Level Three)
- Graph functions in the form of $y=A\cos(\omega x)$ and $y=A\sin(\omega x)$ using transformations (DOK Level Four)
- Determine the amplitude and period of sinusoidal functions (DOK Level Two)
- Graph sinusoidal functions using key points (DOK Level Three)
- Find an equation for a sinusoidal graph (DOK Level Three)
- Graph sinusoidal functions of the form $y=\sin A(\omega x-\phi)+B$ (DOK Level Four)
- Find a sinusoidal function from data (DOK Level Three)
- Apply trigonometric functions to real world problems (DOK Level Four)
- Find the exact value of inverse sine, cosine and tangent functions (DOK Level Three)

- Find an approximate value of inverse sine, cosine and tangent functions (DOK Level One)
- Use properties of inverse functions to find exact values of certain composite functions (DOK Level Four)
- Find the inverse function of a trigonometric functions (DOK Level Three)
- Solve equations using inverse trigonometric functions (DOK Level Three)
- Write a trigonometric expression as an algebraic expression (DOK Level Three)
- Use algebra to simplify trigonometric expressions (DOK Level Three)
- Establish fundamental trigonometric identities (DOK Level Four)
- Use sum and difference formulas to find exact values and establish identities (DOK Level Three)
- Solve equations involving a single trigonometric function (DOK Level Three)
- Solve trigonometric equations quadratic in form and linear in sine and cosine (DOK Level Three)
- Solve trigonometric equations using identities (DOK Level Four)
- Find the value of trigonometric functions of an acute angle using right triangles (DOK Level Three)
- Use the complementary angle theorem (DOK Level Two)
- Solve right triangles (DOK Level Three)
- Solve applied problems using right triangles (DOK Level Four)
- Solve SAA, ASA, and SSA Triangles using the Law of Sines (DOK Level Three)
- Solve ASA and SSS Triangles using the Law of Cosines (DOK Level Three)
- Use the Law of Sines and the Law of Cosines to solve applied problems (DOK Level Three)
- Find the area of SSS Triangles using Heron’s Formula (DOK Level Two)
- Find the area of SAS Triangles using the lengths of two sides and the sine of the included angle (DOK Level Two)

Unit 5: Analytic Geometry (Conics) **Marking Period:** 4

Systems of Equations & Systems of Inequalities
Matrices (Extension)

Standard(s): PA Core State Standards for Mathematics
http://static.pdesas.org/content/documents/PA%20Core%20Standards%20Mathematics%20PreK-12%20March%202014.pdf

Standards Addressed:

CC.2.1.HS.F.3	CC.2.1.HS.D.5	CC.2.1.HS.D.10	CC.2.2.HS.C.4
CC.2.1.HS.D.1	CC.2.1.HS.D.7	CC.2.2.HS.C.1	CC.2.3.HS.A.1
CC.2.1.HS.D.2	CC.2.1.HS.D.8	CC.2.2.HS.C.2	CC.2.3.HS.A.10
CC.2.1.HS.D.3	CC.2.1.HS.D.9	CC.2.2.HS.C.3	

Big Idea # 1: Numbers, measures, expressions, equations, and inequalities can represent mathematical situations and structures in many equivalent forms.

Essential Question:

- How can you extend algebraic properties and processes to conic sections, systems of equations and systems of inequalities and then apply them to solve real world problems?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to equations and inequalities and apply them to solve real world problems.
- Represent conic sections, systems of equations, and systems of inequalities in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations.

Big Idea #2: Families of functions exhibit properties and behaviors that can be recognized across representations. Functions can be transformed, combined, and composed to create new functions in mathematical and real world situations.

Essential Question:

- How do conic sections and their graphs and/or tables help us interpret events that occur in the world around us?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to conic sections and apply them to solve real world problems.
- Represent conic sections in multiple ways, including tables, graphs, equations, and contextual situations, and make connections among representations.

Big Idea #3: Mathematical functions are relationships that assign each member of one set (domain) to a unique member of another set (range), and the relationship is recognizable across representations.

Essential Question:

- How do you explain the benefits of multiple methods of representing systems of equations and systems of inequalities (tables, graphs, equations, and contextual situations)?

Concept:

- Algebraic properties, processes and representations

Competencies:

- Extend algebraic properties and processes to inequalities and equations, and apply them to solve real world problems.

Overview: This unit investigates the four different conic sections and examines their properties. It also will explore systems of linear and nonlinear equations and inequalities.

Goals: Students will be able to

- Identify and classify the four conic sections
- Investigate the graphs of conic sections
- Solve systems of equations and inequalities by substitution, elimination, matrices, and graphing methods
- Perform operations on matrices

Objectives: Students will be able to

- Recall the names of the four conics. (DOK Level One)
- Identify the equations in standard form for each of the four conics. (DOK Level One)
- Analyze parabolas with vertex at both the origin and the point (h, k). (DOK Level Three)
- Analyze ellipses with vertex at both the origin and the point (h, k). (DOK Level Four)
- Analyze hyperbolas with vertex at both the origin and the point (h, k). (DOK Level Four)
- Analyze circles with vertex at both the origin and the point (h, k). (DOK Level Four)

- Write the standard form for the equation of a circle. (DOK Level Two)
- Graph a circle. (DOK Level Two)
- Construct the general form for the equation of a circle. (DOK Level Two)
- Solve systems of linear and nonlinear equations by elimination and substitution. (DOK Level Two)
- Identify Inconsistent systems of equations containing two and three variables. (DOK Level One)
- Solve Systems of three equations containing three variables. (DOK Level Two)
- Express the solution of systems of dependent equations containing two and three variables. (DOK Level Two)
- Graph an inequality. (DOK Level Two)
- Graph a system of inequalities. (DOK Level Two)
- Write the augmented matrix of a system of linear equations. (DOK Level Two)
- Write the system of equations from the augmented matrix. (DOK Level Two)
- Perform row reductions on a matrix by hand and by using a graphing calculator. (DOK Level Three)
- Solve a system of linear equations using matrices by hand and by using a graphing calculator. (DOK Level Three)
- Evaluate both 2×2 and 3×3 determinants by hand and by using a graphing calculator. (DOK Level Three)
- Find the sum and difference of two matrices by hand and by using a graphing calculator. (DOK Level Two)
- Find scalar multiples of a matrix by hand and by using a graphing calculator. (DOK Level Two)
- Find the product of two matrices by hand and by using a graphing calculator. (DOK Level Three)
- Construct the inverse of a matrix by hand and by using a graphing calculator. (DOK Level Three)
- Formulate the solution of a system of linear equations using an inverse matrix. (DOK Level Three)
- Explore topics that are emphasized on the Math Level II SAT Subject Test such as: sequences, series, sigma notation, parametric equations, polar equations, factorials, combinations, permutations, and simple probability

Core Activities and Corresponding Instructional Methods:

- Integrate academic and content specific vocabulary
    - Direct instruction and practice.
    - Lead a classroom discussion that prompts students to compare and contrast.
    - Guided practice: Include step-by-step written explanation of solutions to open-ended questions.
    - Build background knowledge by utilizing a graphing utility and TI-SmartView to support solutions to questions and problems.
- Analyze functions
    - Direct instruction by using visual demonstration.
    - Classroom discussion by using content specific vocabulary.
    - Guided practice on identifying the content specific vocabulary.
    - Graphing utility (TI-SmartView).
- Identify properties of and graph functions
    - Direct instruction and classroom discussion about properties supported by visual aids on the SmartBoard.
    - Guided practice: Include step-by-step written explanation of the behavior of a graph
    - Graphing utility (TI-SmartView).
- Analyze examples of applications of functions
    - Classroom discussion and guided practice on building models from analyzing data in a real world situation.
    - Develop both a verbal and/or written logical argument to support conclusions about behaviors of graphs.
    - Determine appropriate window to view the graph of any given function.
    - Graphing utility (TI-SmartView).

Assessments:

Diagnostic:

- PSAT & SAT
- Algebra II & Trigonometry Cumulative Assessment

Formative:

- Teacher observation and questioning
- Homework preparation
- Graded homework
- Quizzes

- Chapter tests

Summative: Common Assessments for each Unit

Extensions:

- Worksheets prepared from Kuta software (DOK Levels Three and Four)
- SAT practice questions from College Board and Khan Academy
- Textbook applications and extensions

Correctives:

- Remediation practice worksheets prepared from Kuta software
- Collaborative team developed worksheets
- More extensive direct instruction

Materials and Resources:

- Print text
- Kuta software
- Graphing utility
- TI SmartView software
- Collaborative teacher developed SAT question bank
- Smart Notebook Gallery Essentials
- College Board web site and Khan Academy web site

Primary Textbook(s) Used for this Course of Instruction

Name of Textbook: Sullivan & Sullivan Precalculus Enhanced with Graphing Utilities 7th Edition

Textbook ISBN #: 0-13-430837-9

Textbook Publisher &Year of Publication: Pearson, 2017

Curriculum Textbook is utilized in (title of course): Precalculus

DELAWARE VALLEY SCHOOL DISTRICT

Checklist to Complete and Submit with Curriculum:

_____ A hard copy of the curriculum using The template entitled "Planned Instruction," available on the district website

_____ Hard copies of all supplemental resources not available electronically

_____ The primary textbook form(s)

_____ The appropriate payment form, in compliance with the maximum curriculum writing hours noted on the first page of this document

_____ A USB/Flash Drive containing a single file that will print the curriculum in its intended sequence from beginning to end and all supplemental resources that are available in electronic format.

Each principal and/or department chair has a schedule of First and Second Readers/Reviewers. Each Reader/Reviewer must sign & date below.

First Reader/Reviewer Printed Name_____

First Reader/Reviewer Signature_____ Date_____

Second Reader/Reviewer Printed Name_____

Second Reader/Reviewer Signature _____ Date_____