Dover-Sherborn High School
Mathematics Curriculum
Pre-Calculus CP 1

A. DESCRIPTION

This course is an extension of Algebra II with the emphasis in Trigonometry and introductory calculus topics. All major areas covered in Algebra II are reinforced at a greater depth with additional applications aided by the use of the graphing calculator. The course is designed to encompass all those topics necessary to be successful in a college calculus course.

B. OBJECTIVES

The students will be able to:

1. use slopes of lines to write and graph linear equations in two variables.
2. analyze graphs of functions according to characteristics such as domain, range and continuity.
3. identify transformations of functions.
4. find arithmetic combinations and compositions of functions.
5. find inverse functions.
6. use long division, synthetic division and rational zeros to sketch and analyze graphs of polynomial functions.
7. determine the domain and asymptotes of rational functions and sketch their graphs.
8. recognize, evaluate and graph exponential and logarithmic functions.
9. use properties of logarithms, to solve exponential and logarithmic equations.
10. evaluate trigonometric functions, use fundamental trigonometric identities, sketch graphs of trigonometric functions and evaluate inverse trigonometric functions.
11. use trigonometric identities and formulas to solve, evaluate, simplify, and verify trigonometric expressions.
12. write the standard form of the equation of a parabola

C. OUTLINE

1. Functions and Their Graphs [F.IF.1]; [F.IF.2]; [F.IF.3]; [F.IF.4]; [F.IF.7d]; [F.IF.7a]; [F.IF.7b]; [F.IF.7c]; [F.BF.1c]; [F.BF.4]; [F.BF.4a]; [F.BF.4b]
    a. graphs of equations
    b. linear equations in two variables
    c. functions
    d. analyzing graphs of functions
    e. a library of functions
    f. shifting, reflecting, and stretching graphs
    g. combinations of functions
    h. inverse functions
    i. mathematical modeling and variation

2. Trigonometry [F.TF.1]; [F.TF.2]; [F.TF.3]; [F.TF.4]; [G.SRT.6]; [G.SRT.7]; [G.SRT.8]; [F.TF.5]; [F.TF.6]; [F.TF.1]
   a. radian and degree measure
   b. trigonometric functions: the unit circle
   c. right triangle trigonometry
   d. trigonometric functions of any angle
   e. graphs of sine and cosine functions
   f. graphs of other trigonometric functions
   g. inverse trigonometric functions
   h. applications and models
3. Analytic Trigonometry[F.TF.8]; [F.TF.9];
   a. using fundamental identities
   b. verifying trigonometric identities
   c. solving trigonometric equations
   d. multiple – angle and product-to-sum formulas
4. Additional Topics in Trigonometry [G.SRT.10]; [G.SRT.11]
   a. law of sines
   b. law of cosines
5. Polynomial and Rational Functions [A.APR.2]; [A.APR.3]; [N.CN.1]; [N.CN.2]; [N.CN.3]
   a. quadratic functions
   b. polynomial functions of higher degree
   c. polynomial and synthetic division
   d. zeros of polynomial functions
   e. complex numbers
   f. rational functions
   g. non-linear inequalities
6. Exponential and Logarithmic Functions [F.IF.7e]
   a. exponential functions and their graphs
   b. logarithmic functions and their graphs
   c. properties of logarithms
   d. exponential and logarithmic functions and models
7. Systems of Equations and Inequalities[A.CED.2]; [A.CED.3]; [A.REI.5]; [A.REI.6]; [A.REI.8]; [A.REI.9]; [A.REI.11]; [A.REI.12]
   a. Linear and Nonlinear Systems of Equations
   b. Multivariable Linear Systems
   c. Systems of Inequalities
   d. Linear Programming
8. Sequences, Series, and Probability [A.SSE.4]; [F.BF.1a]; [F.BF.2]; [F.LE.2]
   a. Sequences and Series
   b. Arithmetic Sequences and Partial Sums
   c. Geometric Sequence and Series

D. TEXT

Precalculus, Larson / Hostetler 7th Edition 2007.
ISBN-10: 0-618-64344-3

E. RESOURCE MATERIALS
1. graphical calculators
2. HM Testing Software
3. worksheet prepared by teachers

Course Title: Pre-calculus Level 1/CP Grade: 11

Unit: Functions and Their Graphs

Month Presented: September Unit Length (in weeks): 2

Essential Question(s):

1. Can I identify important characteristics of a function such as its domain, range, continuity, boundedness, extrema, symmetry, and asymptotes?
   - Can I identify and make accurate sketches of the ten basic functions?
   - Can I combine functions algebraically and find the composition of two functions?
   - Can I find the inverse of a function both algebraically and graphically?
   - Can I verify the inverse of a function?
   - Can I perform graphical transformations of a function based on its equation?

Learning Objectives:

- Give the domain and range of a function based on its equation or graph.
- Identify continuous functions and give the type of continuity.
- Identify intervals on which a function is increasing or decreasing.
- Describe a function as being bounded above or bounded below.
- Give the local and absolute extrema for a given function.
- Describe the symmetry of a given function based on its equation or graph.
- Identify vertical and horizontal asymptotes based on its equation or graph.
- Sketch the ten basic functions.
- Combine functions algebraically.
- Find the composition of functions
- Find the inverse of a function algebraically and graphically.
- Verify inverse functions.
- Perform translations, reflections, stretches and shrinks of a function based on its equation.

Instructional Strategies & Activities:

- Note taking.
- Guided exploration.
- Cooperative learning/group work.
- Competitive Review Games.

Materials Utilized:

- Textbook.
- Teacher generated notes and homework worksheets.

Assessment Strategies:

- Discussion/Daily class performance.
- Openers/Warm-Ups.
- Daily homework/Error analysis.
- Tests and quizzes.
- Reflection and Self-Assessment

Course Title: Pre-Calculus Level 1/CP Grade: 11

Unit: Trigonometry

Month Presented: October-November Unit Length (in weeks): 7

Essential Question(s):

- Can I draw an angle with a given degree measure and identify two or more angles as being co-terminal?
- Can I convert to and from decimal degrees to degrees, minutes, and seconds?
- Can I convert to and from degrees to radians?
- Can I solve right triangles for all side lengths and angle measures using the six trigonometric functions?
- Given the coordinates of a point on the terminal side of an angle measure in the coordinate plane, can I find the six trigonometric functions for that angle?
- Can I use reference angles to find trig functions of acute and obtuse angles?
- Can I solve right triangles for all missing angles and sides?
- Can I find the measure of an angle given the value of one of its trigonometric functions?
- Can I give an example of a periodic function?
- Can I determine the symmetry of a graph?
- Can I graph the six trigonometric functions and give their amplitudes, periods, phase shifts, and vertical shifts?
- Can I solve applied problems involving simple harmonic motion?
- Can I use angles of elevation and depression to solve applied right triangle trig problems?

Learning Objectives:

- Identify coterminal angles
- Convert from decimal degrees to degrees, minutes, seconds and vice versa
- Convert from degrees to radians and vice versa
- Use the six trigonometric functions to solving right triangles
- Solve applied problems using right triangle trigonometry
- Define six trig functions in terms of x, y, and r
- Given a point on the terminal side of an angle, find values for the six trig functions by forming a reference triangle
- Use one trig function to find the other five
- Know signs of trig functions – which functions are positive in which quadrants?
- Find trig functions for quadrantal angles
- Understand reference angles and how to use them.
    - Use reference angles of 45°, 30°, 60° to find values for trig functions of non-acute (obtuse) angles

- Find decimal approximations for the values of the six trigonometric functions for all angles
- Find the measure of an angle given the value of one of its trigonometric functions
- Define periodic functions
- Determine the symmetry of the graph
- Know the properties of the sine and cosine functions
- Graph the sine and cosine functions
- Find the amplitude and period of a trigonometric function from its equation
- Graph sine and cosine functions with various amplitudes and periods
- Find the phase shift and vertical shift of sine and cosine functions from their equations
- Graph sine and cosine functions with various phase shifts and vertical shifts
- Determine the properties of the tangent and cotangent functions
- Graph the tangent and cotangent functions
- Determine the properties of the secant and cosecant functions
- Graph the secant and cosecant functions
- Solve problems involving simple harmonic motion
- Solve right triangles, given the measures of one angle and one side or the measures of two sides
- Define and use angles of elevation and depression and use this knowledge to solve applied problems.

Instructional Strategies & Activities:

- Note taking.
- Guided exploration.
- Cooperative learning/group work.
- Competitive Review Games.

Materials Utilized:

- Textbook
- Teacher generated notes and homework worksheets

Assessment Strategies:

- Discussion/Daily class performance
- Openers/Warm-Ups
- Daily homework/Error analysis
- Tests and quizzes
- Reflection and Self-Assessment

Course Title: Pre-Calculus Level 1/CP Grade: 11

Unit: Analytic Trigonometry

Month Presented: November - December Unit Length (in weeks): 5

Essential Question(s):

- Can I prove the reciprocal, ratio, and Pythagorean identities and use these identities to prove other identities?

Learning Objectives:

- Use formulas for the cosine of a sum or difference of two angle measures
- Use formulas for the sine of a sum or difference of two angle measures
- Use formulas for the tangent of a sum of difference of two angle measures
- Use double and half angle identities to solve for various angle measures
- Use the sum, difference, double, and half-angle identities to solve applied problems as well as to prove other identities.
- Understand and prove the reciprocal, ratio, Pythagorean, and odd-even identities
- Use the fundamental identities to write equivalent trigonometric expressions
- Use the fundamental identities to prove other identities

Instructional Strategies & Activities:

- Note taking
- Guided exploration
- Cooperative learning/group work
- Competitive Review Games

Materials Utilized:

- Textbook
- Teacher generated notes and homework worksheets

Assessment Strategies:

- Discussion/Daily class performance
- Openers/Warm-Ups
- Daily homework/Error analysis
- Tests and quizzes
- Reflection and Self-Assessment

Course Title: Pre-Calculus Level 1/CP Grade: 11

Unit: Additional Topics in Trigonometry

Month Presented: December - January Unit Length (in weeks): 2

Essential Question(s):

- Can I solve any oblique triangle using the law of sines, the law of sines ambiguous case or the law of cosines?
- Can I find the area of any oblique triangle using trigonometry?

Learning Objectives:

- Use the law of sines to solve triangles when the measures of two angles and one side are known.
- Use the ambiguous case of the law of sines to solve a triangle when the measures of two sides and an angle opposite one of them are given
- Use the law of cosines to solve triangles when the measures of two sides and the included angle or the measures of three sides are given
- Find the area of a triangle when the measures of two sides and the included angle are known.
- Use the law of sines to find the area of a triangle when the measures of one side and two angles are known
- Find the area of a triangle when the lengths of three sides are known
- Use Heron's formula to find the length of an altitude of a triangle when the lengths of the three sides are known

Instructional Strategies & Activities:

- Note taking
- Guided exploration
- Cooperative learning/group work
- Competitive Review Games

Materials Utilized:

- Textbook
- Teacher generated notes and homework worksheets

Assessment Strategies:

- Discussion/Daily class performance
- Openers/Warm-Ups
- Daily homework/Error analysis
- Tests and quizzes
- Reflection and Self-Assessment

Course Title: Pre-calculus Level 1/CP Grade: 11

Unit: Polynomial and Rational Functions

Month Presented: January - February Unit Length (in weeks): 5

Essential Question(s):

- Can I identify the different types of polynomial functions?
- Can I graph quadratic functions written in standard form, vertex form, and intercept form?
- Can I divide two polynomials using long division and synthetic division?
- Can I find the rational zeros of a polynomial function based on its equation?

Learning Objectives:

- Identify the different types of polynomial functions
- Graph quadratic functions written in standard form, vertex form, and intercept form.
- Divide two polynomials using long division and synthetic division
- Find the rational zeros of a polynomial function based on its equation

Instructional Strategies & Activities:

- Note taking.
- Guided exploration.
- Cooperative learning/group work.
- Competitive Review Games

Materials Utilized:

- Textbook.
- Teacher generated notes and homework worksheets.

Assessment Strategies:

- Discussion/Daily class performance.
- Openers/Warm-Ups.
- Daily homework/Error analysis.
- Tests and quizzes.
- Reflection and Self-Assessment

Course Title: Pre-calculus Level 1/CP Grade: 11

Unit: Limits

Month Presented: March Unit Length (in weeks): 2

Essential Question(s):
- Can I identify what a limit is visually?
- Can I calculate limits to infinity?
- Can I calculate as x approaches a number?

Learning Objectives:
- Interpret limits visually
- Calculate limits of various functions

Instructional Strategies & Activities:
- Note taking.
- Guided exploration.
- Cooperative learning/group work.
- Competitive Review Games

Materials Utilized:
- Textbook.
- Teacher generated notes and homework worksheets.

Assessment Strategies:
- Discussion/Daily class performance.
- Openers/Warm-Ups.
- Daily homework/Error analysis.
- Tests and quizzes.
- Reflection and Self-Assessment

Course Title: Pre-Calculus Level 1/CP Grade: 11

Unit: Exponential & Logarithmic Functions

Month Presented: March - April Unit Length (in weeks): 4

Essential Question (s):

- Can I use the properties of logarithms to expand logarithms and write as a single logarithm?
- Can I solve logarithmic equations?
- Can I graph logarithmic functions and their inverses?
- Can I solve applied problems using logarithms?

Learning Objectives:

- Know all properties of logarithms.
- Use the properties of logarithms to expand a logarithm or write as a single logarithm.
- Solve logarithmic equations and check all solutions.
- Graph logarithmic functions and their inverses by hand.
- Solve applied problems involving compound interest using logarithms or natural logarithms.

Instructional Strategies & Activities:

- Note taking
- Guided exploration
- Cooperative learning/group work
- Competitive Review Games

Materials Utilized:

- Textbook
- Teacher generated notes and homework worksheets

Assessment Strategies:

- Discussion/Daily class performance
- Openers/Warm-Ups
- Daily homework/Error analysis
- Tests and quizzes
- Reflection and Self-Assessment

Course Title: Pre-Calculus Level 1/CP Grade: 11

Unit: Systems of Equations and Inequalities

Month Presented: May Unit Length (in weeks): 3

Essential Question (s):
- Can I solve a system of equations in two or three vairables
- Can I solve an system of linear inequalities
- Can I write a system of equations/inequalities based on a word problem
- Can I write a system of equations/inequalities based on a given graph

Learning Objectives:
- Graph a system of linear equations
- Graph a system of linear inequalities

Instructional Strategies & Activities:
- Note taking
- Guided exploration
- Cooperative learning/group work
- Competitive Review Games

Materials Utilized:
- Textbook
- Teacher generated notes and homework worksheets

Assessment Strategies:
- Discussion/Daily class performance
- Openers/Warm-Ups
- Daily homework/Error analysis
- Tests and quizzes
- Reflection and Self-Assessment

Course Title: Pre-Calculus Level 1/CP Grade: 11

Unit: Binomial Theorem, Counting, Probability

Month Presented: June Unit Length (in weeks): 2

Essential Question (s):

- Can I use the binomial theorem to determine the coefficients of a polynomial
- Can I use different techniques (combinations & permutations) to count things in varied situations
- Can I calculate probabilities.

Learning Objectives:

- Find coefficients of polynomials using the binomial theorem
- Find an indicated term of a polynomial
- Count things using combinations & permutations
- Apply the rules of counting and probability to solve real world problems.

Instructional Strategies & Activities:

- Note taking
- Guided exploration
- Cooperative learning/group work
- Competitive Review Games

Materials Utilized:

- Textbook
- Teacher generated notes and homework worksheets

Assessment Strategies:

- Discussion/Daily class performance
- Openers/Warm-Ups
- Daily homework/Error analysis
- Tests and quizzes
- Reflection and Self-Assessment