Course Syllabus	
Franklin High School	**2019-2020**
Course Title: PreCalculus	Grade Level(s): 9 - 12

Prerequisites:
Successful completion of Advanced Algebra 3-4

Course description:
Explores relations and functions graphically, numerically, symbolically, and verbally. Examines
exponential, logarithmic, polynomial, and rational functions. Investigates applications from a variety of perspectives. Course explores trigonometric functions algebraically, numerically, symbolically, and graphically. Content will be explored with and without the use of a graphing calculator.

Students will be assessed on topics that are covered in the Math 111 and Math 112 course content and outcomes guidelines listed on the PCC website. They include functions, exponential functions and equations, logarithmic functions and equations, polynomial functions, rational functions, periodic functions, right triangle trigonometry, transformations of trigonometric functions, trigonometric equations, trigonometric expressions/identities, oblique triangle trigonometry, polar coordinates, vectors, and parametric equations.

Standards:
Based on PCC's Course Content and Outcome Guides
Semester 1:

1. Explore and analyze functions represented in a variety of forms (numerically, symbolically, verbally and graphically).
    1. Given a function in any form, identify and express understanding of the domain and range, the horizontal intercept(s), the vertical intercept, the asymptotes as appropriate, and the end behavior.
    2. Given a function represented graphically, identify and express an understanding of the local and absolute extrema and the approximate intervals over which the function is increasing or decreasing and concave up or concave down as appropriate.
    3. Construct and express understanding of new functions from functions represented in any form.
        1. Construct and express understanding of a sum, difference, product or quotient of two given functions.
        2. Construct and express understanding of a composition of two given functions.
        3. Construct and express understanding of the inverse of a given function.
        4. Investigate and express understanding of the new functions in context of applications.

4. Investigate families of functions in any form within the context of transformations.
    1. Shift, reflect and/or stretch a given function horizontally or vertically.
    2. Investigate and express understanding of given transformations in context of applications.
    3. Investigate and express understanding of the symmetry of even and odd functions.

2. Explore and analyze exponential functions represented in a variety of forms (numerically, symbolically, verbally and graphically) in context of applications.
    1. Given an exponential function that is represented graphically, numerically or symbolically, express it in the other two forms.
    2. Write the symbolic form of exponential functions represented in various forms.
        1. Given two points from an exponential function, generate a model symbolically.
        2. Given initial value and growth rate, generate a model symbolically.
        3. Given a table of values, determine if the model is linear or exponential and generate an appropriate model symbolically.
        4. Given the graph of the function, generate a model symbolically.
    3. Solve exponential equations symbolically, distinguishing between exact and approximate solutions.
    4. Investigate different forms of exponential functions
    5. Solve a variety of applied problems involving exponential functions (such as radioactive decay, bacteria growth, population growth, and compound interest). All variables in applications shall be appropriately defined with units.
3. Explore and analyze logarithmic functions represented in a variety of forms (numerically, symbolically, verbally and graphically) in context of applications.
    1. Express logarithmic functions, using a variety of bases in addition to ee and 10, as inverse functions of exponential functions represented in various forms.
    2. Given a logarithmic function that is represented graphically, numerically or symbolically, the student should be able to express it in the other two forms.
    3. Using properties of logarithms, including change of base, simplify logarithmic expressions and solve logarithmic equations graphically and symbolically, distinguishing between exact and approximate solutions.
    4. Solve a variety of applied problems involving logarithmic functions (such as intensity of sound, earthquake intensity, and determining acidity of a solution by its pH). All variables in applications shall be appropriately defined with units.

4. Explore and analyze polynomial functions represented in a variety of forms

(numerically, symbolically, verbally and graphically) in context of applications.

1. Investigate the end-behavior of power functions.
2. Given a polynomial function that is represented graphically, represent it symbolically
3. Given a polynomial function in factored form, graph it by hand.
4. Distinguish the relationship between zeros, roots, solutions and the horizontal-intercepts of a polynomial function.
5. Find and estimate zeros of a polynomial that is represented in a variety of forms.
    1. Distinguish between exact and approximate solutions, including complex solutions.
6. Sketch a polynomial function given the roots of the function, and the corresponding multiplicity of each root.
7. Solve a variety of applied problems involving polynomial functions. All variables in applications shall be appropriately defined with units.

5. Explore and analyze rational functions represented in a variety of forms (numerically, symbolically, verbally and graphically) in context of applications.
    1. Given a rational function that is represented graphically, represent it symbolically.
    2. Given a rational function in factored form, graph it by hand.
    3. Find horizontal asymptotes, vertical asymptotes, and holes of rational functions.
    4. Recognize oblique asymptotes graphically.
    5. Understand the concept of limits in the context of asymptotes.
    6. Solve a variety of applied problems involving rational functions. All variables in applications shall be appropriately defined with units.

Semester 2:

1. Develop an understanding of angles in different systems of measure.
    1. Understand the definition of an angle in standard position and identify the initial and terminal rays.
    2. Express the measure of an angle in degrees, degrees-minutes-seconds (DMS), and radians.
        1. Convert between the angle-measures listed.
    3. Sketch an angle of any given measure in standard position and identify the related or reference angle and coterminal angles.
    4. Find the length of an arc on the circumference of a circle using the definition of an angle in radian measure.
2. Explore and analyze periodic functions.
    1. Determine if a function is periodic.
    2. Determine the period of a periodic function.
    3. Determine the amplitude and midline of a periodic function where applicable.
    4. Define the sine and cosine functions in terms of the unit circle.
    5. Determine the period, midline, and amplitude of the sine and cosine

functions.
6. Define the tangent function in terms of the sine and cosine functions and determine its period.
7. Define the reciprocal trigonometric functions.

3. Develop an understanding of right triangle trigonometry using both radians and degrees.
    1. Define the six trigonometric functions of an acute angle in terms of the sides of a right triangle.
    2. Solve right triangles:
        1. Given two sides.
        2. A side and a non-right angle of the triangle.
    3. Evaluate the exact values of the six trigonometric functions using $30^\circ-60^\circ-90^\circ$ $30^\circ-60^\circ-90^\circ$ and $45^\circ-45^\circ-90^\circ$ $45^\circ-45^\circ-90^\circ$ triangles.
    4. Solve applied problems involving right triangles.
4. Explore and analyze transformations of trigonometric functions.
    1. Investigate trigonometric functions within the context of transformations represented graphically, symbolically, numerically and verbally.
        1. Shift, reflect and stretch a given trigonometric function horizontally and vertically.
        2. Given graphs of sinusoidal functions, identify the phase shift, horizontal shift, amplitude, period and midline and write an equation for the function.
        3. Given equations of sinusoidal functions, identify the phase shift, horizontal shift, amplitude, period and midline and draw the graph.
        4. Investigate and express understanding of given transformations in the context of applications.
    2. Fit sinusoidal functions to data.
        1. Fit sinusoidal functions to data analytically using the concepts of horizontal shift, amplitude, period and midline.
        2. Investigate and express understanding of the models in the context of applications.
5. Develop an understanding and skill in solving trigonometric equations symbolically and graphically in real world settings.
    1. Simplify an expression using the fundamental identities (Pythagorean, reciprocal).
    2. Recognize and apply identities including the cofunction, sum and differences, double and half angle, product to sum identities.
    3. Define the inverse trigonometric functions.
        1. Understand the domain and range restrictions.
        2. Understand how to use the inverse functions to find all solutions to a trigonometric equation.
    4. Find the general solution of a trigonometric equation symbolically and graphically, using exact values where appropriate.
    5. Find the solutions of trigonometric equations given domain constraints,

using exact values where appropriate.
6. Algebraically verify trigonometric identities.
7. Distinguish between trigonometric identities which are always true and trigonometric equations which may or may not have solutions.
8. Solve applied problems using trigonometry.

6. Develop an understanding and skill in solving problems using the Law of Cosines and the Law of Sines.
    1. Solve given triangles using the Law of Sines as appropriate; identify and solve the ambiguous case.
    2. Solve given triangles using the Law of Cosines as appropriate.
    3. Solve applications involving oblique triangles.
7. Develop an understanding and skill in the use of polar coordinates, vectors and parametric equations and explore their use in real world settings.
    1. Polar Coordinates.
        1. Plot points and simple graphs in polar coordinates.
        2. Perform conversions between rectangular and polar coordinates.
        3. If time permits, explore rose curves, lemniscates and limiçons using technology.
    2. Vectors.
        1. Define a vector using magnitude and direction.
        2. Represent a vector in various forms,
           e.g., $\vec{w}$ =3î +4ĵ =⟨3,4⟩w→=3ı^+4ȷ^=⟨3,4⟩.
        3. Apply vector operations of scalar multiplication, addition, and subtraction graphically and symbolically.
        4. Create unit vector in same direction as a given vector.
        5. Compute the dot product of two vectors.
            1. Understand the significance of the sign of the dot product as it applies to the orientation of the vectors.
            2. Find the angle between two vectors using the dot product.
        6. Investigate at least two of the following applications.
            - Tension in cables.
            - Work.
            - Component forces on objects.
            - Navigation.
            - Velocity vectors.
            - Other appropriate applied problems.
    2. Parametric Equations.
        1. Use parametric equations to describe horizontal and vertical components of motion over time.
        2. Apply parametric equations to problems involving circular and elliptical motion, and/or parabolic trajectories.
        3. Write parameterizations of circles and ellipses.
    3. Implicit Equations.
        1. Use circles and ellipses as examples of implicitly defined equations.

2. Develop an understanding and skill in solving problems involving operations on complex numbers.
    1. Define a complex number and perform conversions between, and arithmetic operations on, rectangular and polar forms.
    2. If time permits, use Euler's formula to find an nth root of a complex number algebraically.
3. Use technology to enhance the understanding of concepts in the course.
    1. Select the appropriate mode for degrees and radians on the calculator.
    2. Conversion of fractions of a degree to minutes and seconds.
    3. Graphing parametric equations.
    4. Graphing polar equations.
    5. Graph trigonometric equations in radian and degree modes in appropriate windows.
    6. Solve trigonometric equations graphically.

Schedule of topics/units covered:
A more detailed summary can be found on my website as the year progresses.
www.mathisart11235.com/precalculus
Semester 1:
Unit 1 – Functions
Unit 2 – Polynomials and Rational Functions
Unit 3 – Exponential and Logarithmic Functions

Semester 2:
Unit 1 – Angles and Periodic Functions
Unit 2 – Analytic Trigonometry
Unit 3 – Applications of Trigonometry
Unit 4 – Polar Coordinates and Vectors
Unit 5 – Parametric Equations

Differentiation/accessibility strategies and supports (TAG, ELL, SpEd, other):

Our new textbook is a great starting point for students who want to exceed the course requirements in this class. The book contains supplemental topics and provides great examples on application problems in each section. For students who are new to a textbook in math, I provide teacher-made notes and have the key to the notes scanned and available on my website after each class period.

Class time is time for feedback, group work, investigations, and demonstrating understanding. During this time the habits of interaction that will be encouraged and modeled include:
-Time to think independently before working collaboratively
-Time to explain your reasoning

-Demonstrating how to listen to understand in groups
-Exploring multiple pathways to solve problems
-Time to explore and compare logic in our ideas and thinking
-Time to critique and debate mathematically

Students will be given 15 minutes to revise work after all individual tests (not the final exam). This will occur during class time the class period following the test day. Students who miss this class need to make revisions within two school days of the revision period.

Final proficiencies:

Students must demonstrate understanding of the following topics:
Semester 1:
Unit 1 – Functions
Unit 2 – Polynomials and Rational Functions
Unit 3 – Exponential and Logarithmic Functions

Semester 2:
Unit 1 – Angles and Periodic Functions
Unit 2 – Analytic Trigonometry
Unit 3 – Applications of Trigonometry
Unit 4 – Polar Coordinates and Vectors
Unit 5 – Parametric Equations

Demonstrating understanding is generally defined as passing the individual tests with a C or better, and passing the final exam with a C or better.

Assessment (pre/post)/evaluation/grading policy:

90-100% - A
80-89.9% - B
70-79.9% - C
60-69.9% - D
0-59.9% - F

Overall Grade Breakdown:
1% - Daily Quizzes
4% - Homework
10% - Group Tests
60% - Individual Tests
25% - Final Exam

Formative assessments are given daily in the form of daily quizzes. I will grade them and return them for review the following class period. They are 1% of the overall grade and used to provide students with feedback. This process helps students understand the grading practices that will be used on the unit tests and final. Daily quizzes are collaborative and open note.

Group tests are taken without the use of any notes. They make up 10% of the overall grade. No retakes or revisions. Students will be able to work collaboratively during class. Missing a group test also needs to be made up within two school days. Cell phones always prohibited.

Individual tests are taken without the use of any notes. Students will be given 15 minutes to revise work after all individual tests (not the final exam). This will occur during class time the class period following the test day. Students who miss this class need to make revisions within two school days of the revision period. No Retakes on individual tests. This will make up 60% of the overall grade. Cell phones always prohibited.

A Final exam is taken without the use of any notes. No retakes and no revisions. Cell phones always prohibited. This will make up 25% of the overall grade.

Homework completion will make up 4% of the overall grade. Homework is considered complete if each question is copied down, including graphs and instructions, and each problem is attempted. Homework is due the class period following its assigned date.

Behavioral expectations:

Students are expected to be in class on time and participate in all activities. In general, a student who follows the Franklin STRONG acronym as posted in the room, will be demonstrating great behavior.

Safety issues and requirements:

N/A