Dominican International School

SUBJECT: PreCalculus

GRADE LEVEL: 11 **SCHOOL YEAR: 2022-23**

TEACHER: Ms. Yvonne lee **EMAIL: ylee@dishs.tp.edu.tw**

COURSE DESCRIPTION:

Pre-Calculus serves as a transition between algebra and calculus. This course covers many important fundamental concepts that will prepare students for calculus and college-level mathematics. Students are expected to understand, analyze, and utilize basic functions. They are also expected to understand the relationship between exponential functions and logarithm. Trigonometric functions and identities will be included and students are expected to graph and analyze graph and prove identities. Analytic geometry in two dimension and discrete mathematics will also be covered.

COURSE OBJECTIVES:

The course objectives are defined in the Common Core State Standard high school domain.

CCSS: Mathematics

CCSS: HS: Algebra

Seeing Structure in Expressions

HSA-SSE.A. Interpret the structure of expressions.

HSA-SSE.A.1. Interpret expressions that represent a quantity in terms of its context.

HSA-SSE.A.1b. Interpret complicated expressions by viewing one or more of their parts as a single entity.

HSA-SSE.B. Write expressions in equivalent forms to solve problems.

HSA-SSE.B.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

HSA-SSE.B.3c. Use the properties of exponents to transform expressions for exponential functions.

CCSS: HS: Functions

Interpreting Functions

HSF-IF.B. Interpret functions that arise in applications in terms of the context.

HSF-IF.B.4. For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

HSF-IF.C. Analyze functions using different representations.

HSF-IF.C.7. Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

HSF-IF.C.7c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

HSF-IF.C.7d. (+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

HSF-IF.C.7e. Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

HSF-IF.C.8. Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

HSF-IF.C.8b. Use the properties of exponents to interpret expressions for exponential functions.

Linear, Quadratic, and Exponential Models

HSF-LE.A. Construct and compare linear and exponential models and solve problems.

HSF-LE.A.1. Distinguish between situations that can be modeled with linear functions and with exponential functions.

HSF-LE.A.1a. Prove that linear functions grow by equal differences over equal intervals, and that exponential functions grow by equal factors over equal intervals.

HSF-LE.A.1c. Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.

HSF-LE.A.2. Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

HSF-LE.A.3. Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

HSF-LE.A.4. For exponential models, express as a logarithm the solution to $ab^{ct} = d$ where a, c, and d are numbers and the base b is 2, 10, or e; evaluate the logarithm using technology.

HSF-LE.B. Interpret expressions for functions in terms of the situation they model.

HSF-LE.B.5. Interpret the parameters in a linear or exponential function in terms of a context.

Trigonometric Functions

HSF-TF.A. Extend the domain of trigonometric functions using the unit circle.

HSF-TF.A.1. Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.

HSF-TF.A.2. Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

HSF-TF.A.3. (+) Use special triangles to determine geometrically the values of sine, cosine, tangent for p/3, p/4 and p/6, and use the unit circle to express the values of sine, cosines, and tangent for x, p + x, and 2p – x in terms of their values for x, where x is any real number.

HSF-TF.A.4. (+) Use the unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.

HSF-TF.B. Model periodic phenomena with trigonometric functions.

HSF-TF.B.5. Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

HSF-TF.B.6. (+) Understand that restricting a trigonometric function to a domain on which it is always increasing or always decreasing allows its inverse to be constructed.

HSF-TF.B.7. (+) Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.

CCSS: Mathematics

CCSS: HS: Num/Quantity

Vector & Matrix Quantities

HSN-VM.A. Represent and model with vector quantities.

HSN-VM.A.1. (+) Recognize vector quantities as having both magnitude and direction. Represent vector quantities by directed line segments, and use appropriate symbols for vectors and their magnitudes (e.g., v, |v|, ||v||, v).

HSN-VM.A.2. (+) Find the components of a vector by subtracting the coordinates of an initial point from the coordinates of a terminal point.

HSN-VM.A.3. (+) Solve problems involving velocity and other quantities that can be represented by vectors.

HSN-VM.B. Perform operations on vectors.

HSN-VM.B.4. (+) Add and subtract vectors.

HSN-VM.B.4a. Add vectors end-to-end, component-wise, and by the parallelogram rule. Understand that the magnitude of a sum of two vectors is typically not the sum of the magnitudes.

HSN-VM.B.4b. Given two vectors in magnitude and direction form, determine the magnitude and direction of their sum.

HSN-VM.B.4c. Understand vector subtraction v – w as v + (–w), where –w is the additive inverse of w, with the same magnitude as w and pointing in the opposite direction. Represent vector subtraction graphically by connecting the tips in the appropriate order, and perform vector subtraction component-wise.

HSN-VM.B.5. (+) Multiply a vector by a scalar.

HSN-VM.B.5a. Represent scalar multiplication graphically by scaling vectors and possibly reversing their direction; perform scalar multiplication component-wise, e.g., as c(v?, v?) = (cv?, cv?).

HSN-VM.C. Perform operations on matrices and use matrices in applications.

HSN-VM.C.6. (+) Use matrices to represent and manipulate data, e.g., to represent payoffs or incidence relationships in a network.

HSN-VM.C.7. (+) Multiply matrices by scalars to produce new matrices, e.g., as when all of the payoffs in a game are doubled.

HSN-VM.C.8. (+) Add, subtract, and multiply matrices of appropriate dimensions.

HSN-VM.C.9. (+) Understand that, unlike multiplication of numbers, matrix multiplication for square matrices is not a commutative operation, but still satisfies the associative and distributive properties.

HSN-VM.C.10. (+) Understand that the zero and identity matrices play a role in matrix addition and multiplication similar to the role of 0 and 1 in the real numbers. The determinant of a square matrix is nonzero if and only if the matrix has a multiplicative inverse.

CCSS: HS: Functions

Trigonometric Functions

HSF-TF.C. Prove and apply trigonometric identities.

HSF-TF.C.8. Prove the Pythagorean identity $\sin^2(x) + \cos^2(x) = 1$ and use it to calculate trigonometric ratios.

HSF-TF.C.9. (+) Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.

CCSS: HS: Geometry

Similarity, Right Triangles, & Trigonometry

HSG-SRT.C. Define trigonometric ratios and solve problems involving right triangles

HSG-SRT.C.6. Understand that by similarity, side ratios in right triangles are properties of the angles in the triangle, leading to definitions of trigonometric ratios for acute angles.

HSG-SRT.C.7. Explain and use the relationship between the sine and cosine of complementary angles.

HSG-SRT.C.8. Use trigonometric ratios and the Pythagorean Theorem to solve right triangles in applied problems.

HSG-SRT.D. Apply trigonometry to general triangles

HSG-SRT.D.10. (+) Prove the Laws of Sines and Cosines and use them to solve problems.

HSG-SRT.D.11. (+) Understand and apply the Law of Sines and the Law of Cosines to find unknown measurements in right and non-right triangles (e.g., surveying problems, resultant forces).

Expressing Geometric Properties with Equations

HSG-GPE.A. Translate between the geometric description and the equation for a conic section

HSG-GPE.A.2. Derive the equation of a parabola given a focus and directrix.

HSG-GPE.A.3. (+) Derive the equations of ellipses and hyperbolas given two foci for the ellipse, and two directrices of a hyperbola.

CCSS: HS: Stats/Probabilities

Using Probability to Make Decisions

HSS-MD.A. Calculate expected values and use them to solve problems

HSS-MD.A.1. (+) Define a random variable for a quantity of interest by assigning a numerical value to each event in a sample space; graph the corresponding probability distribution using the same graphical displays as for data distributions.

HSS-MD.A.2. (+) Calculate the expected value of a random variable; interpret it as the mean of the probability distribution.

HSS-MD.A.3. (+) Develop a probability distribution for a random variable defined for a sample space in which theoretical probabilities can be calculated; find the expected value.

HSS-MD.A.4. (+) Develop a probability distribution for a random variable defined for a sample space in which probabilities are assigned empirically; find the expected value.

HSS-MD.B. Use probability to evaluate outcomes of decisions

HSS-MD.B.5a. Find the expected payoff for a game of chance.

HSS-MD.B.5b. Evaluate and compare strategies on the basis of expected values.

Mathematical Practice

MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.

MP.1. Make sense of problems and persevere in solving them.

MP.2. Reason abstractly and quantitatively.

MP.4. Model with mathematics.

MP.5. Use appropriate tools strategically.

PRIMARY TEXTBOOK & OTHER RESOURCES:

Students are responsible for coming to class prepared with all the required supplies. Laptops or equivalent devices are permitted for some activities based on Teacher's instructions.

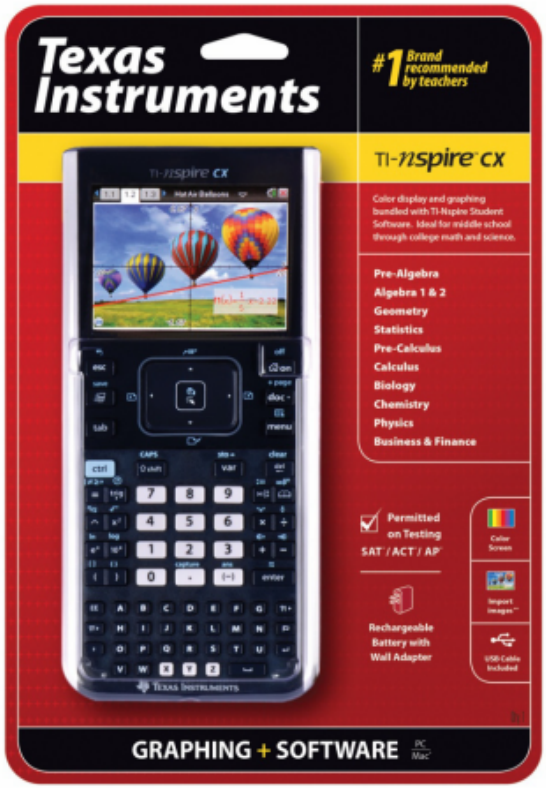
- Textbook – Ron Larson, Paul Battaglia. PreCalculus with Limits: A Graphing Approach 8th ed. 2020.
- Ti-nspireCX Graphing calculator
- Khan Academy

Ti-*n*spire *CX* Calculator I/II (non-CAS) is a required supply at the Dominican International School-Taipei for the classes:

9-Math (2nd semester)
10-Math
11-Math
12-Math
9-Biology
10-Chemistry/Earth Science
11-Physics

AP Calculus AB
AP Calculus BC
AP Biology
AP Chemistry
AP Physics
AP Statistics

Do **NOT** buy the Ti-*n*spire CAS model, Ti-84+, Ti-89, Ti-92, or other models!!! Some of the class instructions may be based on understanding how to use the Ti-*n*spire *CX* Calculator. Not having the required calculator could affect the student academic understanding (and grades). Not having the required calculator when the Teacher instructs is equivalent to not being prepared for class, which may count off in the Deportment grade. Tests and Exams may allow only the use of the **Ti-nspire *CX*** calculator.

Ti –*n*spire *CX* (non-CAS model) DIS approved	Ti –*n*spire CAS or Ti-*n*spire**CX** CAS model are NOT DIS approved and NOT Permitted on the ACT
	

ASSESSMENT:

Tests and Quarterly Exams are scheduled and announced in advance. Pop Quizzes are unannounced and can be given at any time during the class so the students must come to class prepared. ALL Tests, Exams and Quizzes may be cumulative so students are responsible for staying prepared of the previous scopes and lessons learned.

Homeworks/Classworks/Seatworks are graded based on completion and completing by the due dates. Students are responsible for checking the assignments' due dates posted on Google Classroom. Students are expected to be prepared to turn-in any work by the due date class time even if the Teacher did not instruct to turn-in t the due date. Any Missing, Incomplete or Late works are counted with 10% or more penalty with due dates as posted on the Google Classroom. Students MUST submit "Mark as Done" in Google Classroom for each assignments posted. Not submitting "Done" count as Incomplete with 10% penalty. Additional 10% are penalized for each day for late turn-in work. Actual work turn-in may be after the original due date, in which any incomplete work is well late. No late work is accepted 2 days after the due dates posted. Students who are absent are responsible for keeping up with the class by doing the work as assigned on Google Classroom.

Students who miss the scheduled Test or Quarterly Exam must make-up the exam on return at the earliest. If the student does not make-up the exam at the earliest on return, then penalty may be deducted from the final exam score. The make-up test/exam may be different and more challenging than the originally scheduled test/exam. The student grades are assigned as the following:

1. Tests and Pop Quizzes	30%
2. Homework/Classwork/Seatwork /Projects	30%
3. Quarterly Exam	30%
4. Deportment	10%
Total Grade	100%

ADDITIONAL INFORMATION:

1st QUARTER – TENTATIVE COURSE CONTENT

(NB: Depending on time and interest, the teacher may delete and/or add other selections.)	
Week / Date	Topic / Projects / Assessments
Week 1 **Aug 10th to 12th** **3 Days of Class** *10~ First Day / Orientation Day*	1.1 Lines in the Plane
Week 2 **Aug 15th to 19th** *Opening Mass*	1.2 Functions 1.3 Graphs of Functions 1.4 Shifting, Reflecting, and Stretching Graphs
Week 3 **Aug 22nd to 26th**	1.5 Combinations of Functions 1.6 Inverse Functions 1.7 Linear Models and Scatter Plots
Week 4 **Aug 29th to Sep 2nd**	Chapter 1 Test 2.1 Quadratic Functions 2.2 Polynomial Functions of Higher Degree
Week 5 **Sep 5th to 9th** **4 Days of Class** *8~ Mass &Birthday Mother Mary* *9th – Moon Festival*	2.3 Real Zeros of Polynomial Functions 2.4 Complex Numbers
Week 6 **Sep 12th to 16th** FYI – Pre-Exam Days	2.5 The Fundamental Theorem of Algebra 2.6 Rational Functions and Asymptotes
Week 7 **Sep 19th to 23rd**	2.7 Graphs of Rational Functions 2.8 Quadratic Models
Week 8 **Sep 26th to 30th** **2 Days of Class** *28-30 ~Teacher's Conference*	4.1 Radian and Degree Measure
Week 9 **Oct 3rd to 7th** **3 Days of Class** *6-7 ~Q1 Exams*	**Quarter Exam**

2nd QUARTER – TENTATIVE COURSE CONTENT

(NB: Depending on time and interest, the teacher may delete and/or add other selections.)

Week / Date	Topic / Projects / Assessments
Week 1 (10) **Oct 10th to 14th** **4 Days of Class** *10 – Double 10 Holiday*	4.2 Trigonometric Functions: The Unit Circle
Week 2 (11) **Oct 17th to 21st**	4.3 Right Triangle Trigonometry 4.4 Trigonometric Functions of Any Angle
Week 3 (12) **Oct 24th to 28th** *25-27 – Book Fair* *28- Masquerade Night* *TBA-Holy Rosary Mass*	4.5 Graphs of Sine and Cosine Functions 4.6 Graphs of Other Trigonometric Functions
Week 4 (13) **Oct 31st to Nov 4th** *1-All Saint's Day Mass*	4.7 Inverse Trigonometric Functions 4.8 Applications and Models
Week 5 (14) **Nov 7th to 11th**	5.1 Using Fundamental Identities 5.2 Verifying Trigonometric Identities
Week 6 (15) **Nov 14th to 18th**	5.3 Solving Trigonometric Equations 5.4 Sum and Difference Formulas
Week 7 (16) **Nov 21st to 25th** *25 - YSC Contest* *25-Gr.12 Q2 Exam*	5.5 Multiple-Agle and Product-to-Sum Formulas Chapter 5 Test
Week 8 (17) **Nov 28th to Dec 2nd** FYI – Pre-Exam Days *28-Gr.12 Q2 Exam*	6.1 Law of Sines 6.2 Law of Cosines
Week 9 (18) **Dec 5th to 9th** 8 - Foundation Day Celebrations	6.3 Vector in the Plane 6.4 Vectors and Dot Products
Week 10 (19) **Dec 12th to 16th** **3 Days of Class** *15-16 ~Q2 Exams*	**Quarter Exam**
Dec 19th to Jan 2nd	**Christmas Break**

3rd QUARTER – TENTATIVE COURSE CONTENT

(NB: Depending on time and interest, the teacher may delete and/or add other selections.)

Week / Date	Topic / Projects / Assessments
Week 1 (20) **Jan 5 to 6th** **2 Days of Class**	3.1 Exponential Functions and Their Graphs
Week 2 (21) **Jan 9th to 13th**	3.2 Logarithmic functions and their Graphs 3.3 Properties of Logarithms
Week 3 (22) **Jan 16th to 20th**	3.4 Solving Exponential and Logarithmic Equations 3.5 Exponential and Logarithmic Models
Jan 23rd to 27th	**Chinese New Year**
Week 4 (23) **Jan 30th to Feb 3rd**	3.6 Nonlinear Models Chapter 3 Test
Week 5 (24) **Feb 6th to 10th**	7.1 Solving Systems of Equations 7.2 Systems of Linear Equations in Two Variables
Week 6 (25) **Feb 13th to 17th**	7.3 Multivariable Linear Systems 7.4 Matrices and Systems of Equations
Week 7 (26) **Feb 20th to 24th** *20-24 ~IOWA* *22 ~ Ash Wednesday Mass* *21-23 ~ Pre-Exam Days*	7.5 Operations with Matrices 7.6 The Inverse of Square Matrix
Week 8 (27) **Feb 27th to March3rd** **3 Days of Class** 27-28 ~ 228 Memorial Day Holiday	7.7 The Determinant of a Square Matrix 7.8 Applications of Matrices and Determinants
Week 9 (28) **March 6th to 10th** **4 Days of Class** *11 – Q3 Exams*	Quarter Exam

4th QUARTER – TENTATIVE COURSE CONTENT

(NB: Depending on time and interest, the teacher may delete and/or add other selections.)

Week / Date	Topic / Projects / Assessments
Week 1 (29) **March 13th to 17th** **4 Days of Class** *13 – Q3 Exams* *14~ Q4 Begins*	8.1 Sequences and Series 8.2 Arithmetic Sequences and Partial Sums
Week 2 (30) **March 20th to 24th** *20 ~ Fire Drill*	8.3 Geometric Sequences and Series 8.4 The Binomial Theorem
Week 3 (31) **March 27th to 31st**	8.5 Counting Principles 8.6 Probability
Apr 3rd to 14th	**Easter Break**
Week 4 (33) **Apr 17th to 21st**	Chapter 8 Test 9.1 Circles and Parabolas
Week 5 (34) **Apr 24th to 28th** 24-28 ~ AP Mock Exams	9.2 Ellipses 9.3 Hyperbola and Rotation of conics
Week 6 (35) **May 1st to 5th** *2-4~ Pre-Exam* *1-5~ Final Exams (K, 5, 8, 12 only)* *1-5 ~ AP Exams*	9.4 Parametric Equations 9.5 Polar Coordinates
Week 7 (36) **May 8th to 12th** *8-12~ Final Exams(K, 5, 8, 12 only)* *1-5 ~ AP Exams*	9.6 Graphs of Polar Equations 9.7 Polar Equations of Conics
Week 8 (37) **May 15th to 19th** **3 Days of Class** *18-19~ Q4 Exams*	Quarter Exam
Week 9 (38) **May 22nd to 26th** **4 Days of Class** *22~ Record Day* *23-26 ~ Student Clearance*	School Activities
Week 10 (39) **May 29th to June 2nd** **4 Days of Class** *1 ~ Students Last Day* *2~ Teachers/Staff Meeting*	School Activities