Dominican International School

SUBJECT: Calculus

GRADE LEVEL: 12 **SCHOOL YEAR: 2022-23**

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

COURSE DESCRIPTION:

This course aims to introduce the two main branches of calculus: differential calculus and integral calculus. Initially, the course will review the students on pre-calculus concepts. This is important for the study of limits and its properties. Limits will then be used to define the basic definitions of the two main branches of calculus. Applications of the concepts taught will be supplied to give the students an idea of how to recognize or design applications in future experiences.

COURSE OBJECTIVES:

Standard 1 Limits and Continuity
Students understand the concept of limit, find limits of functions at points and at infinity, decide if a function is continuous, and use continuity theorems.

C.1.1 Understand the concept of limit and estimate limits from graphs and tables of values.
C.1.2 Find limits by substitution.
C.1.3 Find limits of sums, differences, products, and quotients.
C.1.4 Find limits of rational functions that are undefined at a point.
C.1.5 Find one-sided limits.
C.1.6 Find limits at infinity.
C.1.7 Decide when a limit is infinite and use limits involving infinity to describe asymptotic behavior.
C.1.8 Find special limits
C.1.9 Understand continuity in terms of limits.
C.1.10 Decide if a function is continuous at a point.
C.1.11 Find the types of discontinuities of a function.
C.1.12 Understand and use the Intermediate Value Theorem on a function over a closed interval.
C.1.13 Understand and apply the Extreme Value Theorem: If f(x) is continuous over a closed interval, then f has a maximum and a minimum on the interval.

Standard 2 Differential Calculus
Students find derivatives of algebraic, trigonometric, logarithmic, and exponential functions. They find derivatives of sums, products, and quotients, and composite and inverse functions. They find derivatives of higher order, and use logarithmic differentiation and the Mean Value Theorem.

C.2.1 Understand the concept of derivative geometrically, numerically, and analytically, and interpret the derivative as a rate of change.
C.2.2 State, understand, and apply the definition of derivative.
C.2.3 Find the derivatives of functions, including algebraic, trigonometric, logarithmic, and exponential functions.
C.2.4 Find the derivatives of sums, products, and quotients.
C.2.5 Find the derivatives of composite functions, using the chain rule.
C.2.6 Find the derivatives of implicitly-defined functions.
C.2.7 Find second derivatives and derivatives of higher order.
C.2.8 Find derivatives using logarithmic differentiation.
C.2.9 Understand and use the relationship between differentiability and continuity.
C.2.10 Understand and apply the Mean Value Theorem.

Standard 3 Applications of Derivatives
Students find slopes and tangents, maximum and minimum points, and points of inflection. They solve optimization problems and find rates of change.

C.3.1 Find the slope of a curve at a point, including points at which there are vertical tangents and no tangents.
C.3.2 Find a tangent line to a curve at a point and a local linear approximation.
C.3.3 Decide where functions are decreasing and increasing. Understand the relationship between the increasing and decreasing behavior of f and the sign of f'.
C.3.4 Find local and absolute maximum and minimum points.
C.3.5 Analyze curves, including concavity.
C.3.6 Find points of inflection of functions. Understand the relationship between the concavity of f and the sign of f''. Understand points of inflection as places where concavity changes.
C.3.7 Use first and second derivatives to help sketch graphs. Compare the corresponding characteristics of the graphs of f, f', and f''.
C.3.8 Solve optimization problems.
C.3.9 Find average and instantaneous rates of change. Understand the instantaneous rate of change as the limit of the average rate of change. Interpret a derivative as a rate of change in applications, including velocity, speed, and acceleration.
C.3.10 Find the velocity and acceleration of a particle moving in a straight line.
C.3.11 Model rates of change, including related rates problems.

Standard 4 Integral Calculus
Students define integrals using Riemann Sums, use the Fundamental Theorem of Calculus to find integrals, and use basic properties of integrals. They integrate by substitution and find approximate integrals.

C.4.1 Use rectangle approximations to find approximate values of integrals.
C.4.2 Calculate the values of Riemann Sums over equal subdivisions using left, right, and midpoint evaluation points.
C.4.3 Interpret a definite integral as a limit of Riemann Sums.
C.4.4 Understand the Fundamental Theorem of Calculus: Interpret a definite integral of the rate of change of a quantity over an interval as the change of the quantity over the interval.
C.4.5 Use the Fundamental Theorem of Calculus to evaluate definite and indefinite integrals and to represent particular antiderivatives. Perform analytical and graphical analysis of functions so defined.
C.4.6 Understand and use these properties of definite integrals.
C.4.7 Understand and use integration by substitution (or change of variable) to find values of integrals.
C.4.8 Understand and use Riemann Sums, the Trapezoidal Rule, and technology to approximate definite integrals of functions represented algebraically, geometrically, and by tables of values.

Standard 5 Applications of Integration
Students find velocity functions and position functions from their derivatives, solve separable differential equations, and use definite integrals to find areas and volumes.

C.5.1 Find specific antiderivatives using initial conditions, including finding velocity functions from acceleration functions, finding position functions from velocity functions, and applications to motion along a line.
C.5.2 Solve separable differential equations and use them in modeling.
C.5.3 Use definite integrals to find the area between a curve and the x-axis, or between two curves.
C.5.4 Use definite integrals to find the average value of a function over a closed interval.
C.5.5 Use definite integrals to find the volume of a solid with known cross-sectional area.
C.5.6 Apply integration to model and solve problems in physics, biology, economics, etc., using the integral as a rate of change to give accumulated change and using the method of setting up an approximating Riemann Sum and representing its limit as a definite integral.

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 – Hass, Heil and Weir. Thomas' Calculus: Early Transcendentals, Single Variable 14th ed. 2018.
- Ti-nspireCX Graphing calculator
- Khan Academy

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:

(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 Functions and Their Graphs
Week 2 **Aug 15th to 19th** *Opening Mass*	1.2 Combining Functions; Shifting and Scaling Graph 1.3 Trigonometric Functions
Week 3 **Aug 22nd to 26th**	1.4 Graphing with Software 1.5 Exponential Functions
Week 4 **Aug 29th to Sep 2nd**	1.6 Inverse Functions and Logarithms
Week 5 **Sep 5th to 9th** **4 Days of Class** *8~ Mass &Birthday Mother Mary* *9th – Moon Festival*	Chapter 1 Test 2.1 Rates of Change and Tangent Lines to Curves
Week 6 **Sep 12th to 16th** FYI – Pre-Exam Days	2.2 Limit of a Function and Limit Laws 2.3 The Precise Definition of a Limit
Week 7 **Sep 19th to 23rd**	2.4 One-Sided Limits
Week 8 **Sep 26th to 30th** **2 Days of Class** *28-30 ~Teacher's Conference*	2.5 Continuity
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*	2.6 Limits Involving Infinity; Asymptotes of Graphs
Week 2 (11) **Oct 17th to 21st**	3.1 Tangent Lines and the Derivative at a Point 3.2 The Derivative as a Function
Week 3 (12) **Oct 24th to 28th** *25-27 – Book Fair* *28- Masquerade Night* *TBA-Holy Rosary Mass*	3.3 Differentiation Rules 3.4 The Derivative as a Rate of Change
Week 4 (13) **Oct 31st to Nov 4th** *1-All Saint's Day Mass*	3.5 Derivatives of Trigonometric Functions 3.6 The Chain Rule
Week 5 (14) **Nov 7th to 11th**	3.7 Implicit Differentiation

Week 6 (15) **Nov 14th to 18th**	3.8 Derivatives of Inverse Functions and Logarithms
Week 7 (16) **Nov 21st to 25th** *25 - YSC Contest* *25-Gr.12 Q2 Exam*	3.9 Inverse Trigonometric Functions
Week 8 (17) **Nov 28th to Dec 2nd** FYI – Pre-Exam Days *28-Gr.12 Q2 Exam*	Quarter Exam Desmos Project
Week 9 (18) **Dec 5th to 9th** 8 - Foundation Day Celebrations	Desmos Project
Week 10 (19) **Dec 12th to 16th** **3 Days of Class** *15-16 ~Q2 Exams*	Desmos Project
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**	3.10 Related Rates
Week 2 (21) **Jan 9th to 13th**	3.11 Linearization and Differentials
Week 3 (22) **Jan 16th to 20th**	4.1 Extreme Value of Functions on Closed Intervals 4.2 The Mean Value Theorem
Jan 23rd to 27th	**Chinese New Year**
Week 4 (23) **Jan 30th to Feb 3rd**	4.3 Monotonic Functions and the First Derivative Test 4.4 Concavity and Curve Sketching
Week 5 (24) **Feb 6th to 10th**	4.5 Indeterminate Forms and L'Hopital's Rule
Week 6 (25) **Feb 13th to 17th**	4.6 Applied Optimization
Week 7 (26) **Feb 20th to 24th** *20-24 ~IOWA* *22 ~ Ash Wednesday Mass* *21-23 ~ Pre-Exam Days*	4.7 Newton's Method
Week 8 (27) **Feb 27th to March3rd** **3 Days of Class** 27-28 ~ 228 Memorial Day Holiday	4.8 Antiderivatives
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*	5.1 Area and Estimating with Finite Sums
Week 2 (30) **March 20th to 24th** *20 ~ Fire Drill*	5.2 Sigma Notation and Limits of Finite Sums
Week 3 (31) **March 27th to 31st**	5.3 The Definite Integral
Apr 3rd to 14th	**Easter Break**
Week 4 (33) **Apr 17th to 21st**	5.4 The Fundamental Theorem of Calculus
Week 5 (34) **Apr 24th to 28th** 24-28 ~ AP Mock Exams	5.5 Indefinite Integrals and the Substitution Method
Week 6 (35) **May 1st to 5th** *2-4~ Pre-Exam* *1-5~ Final Exams (K, 5, 8, 12 only)* *1-5 ~ AP Exams*	5.6 Definite Integral Substitutions and the Area Between Curves
Week 7 (36) **May 8th to 12th** *8-12~ Final Exams(K, 5, 8, 12 only)* *1-5 ~ AP Exams*	Quarter Exam
Week 8 (37) **May 15th to 19th** **3 Days of Class** *18-19~ Q4 Exams*	Graduation Preparation
Week 9 (38) **May 22nd to 26th** **4 Days of Class** *22~ Record Day* *23-26 ~ Student Clearance*	Graduation Preparation
Week 10 (39) **May 29th to June 2nd** **4 Days of Class** *1 ~ Students Last Day* *2~ Teachers/Staff Meeting*	