



SUBJECT: Calculus

GRADE LEVEL: 12

TEACHER: Ms. Yvonne Lee

SCHOOL YEAR: 2024-25

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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 for the previous scopes and lessons learned.

Homeworks/Classworks/Seatworks are graded based on the completion and whether it is completed 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 them to turn in the due date. Any Missing, Incomplete, or Late works are counted with a 10% or more penalty with due dates as posted on the Google Classroom. Students MUST submit "Mark as Done" in Google Classroom for each assignment posted. Not submitting "Done" count as Incomplete with 10% penalty. An additional 10% are penalized for each day for late turn-in work.

The student who misses the scheduled Test or Quarterly Exam with legit reason may write a makeup test/exam right after the student returns back to school. 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. Department	<u>10%</u>
Total Grade	100%

ADDITIONAL INFORMATION:

Academic Dishonesty means employing a method or technique or engaging in conduct in an academic endeavor that contravenes the standards of ethical integrity expected at DIS. Academic dishonesty includes but is not limited to, the following:

1. Purposely incorporating the ideas, words of sentences, paragraphs, or parts thereof without appropriate acknowledgment and representing the product as one's own work; and
1. Representing another's intellectual work such as photographs, paintings, drawings, sculpture, or research or the like as one's own, including failure to attribute content to an AI.
2. Employing a tutor, making use of Artificial Intelligence without acknowledgement, getting a parent to write a paper or do an assignment, paying for an essay to be written by someone else and presented as the student's own work.
3. Committing any act that a reasonable person would conclude, when informed of the evidence, to be a dishonest means of obtaining or attempting to obtain credit for academic work.

Any act of academic dishonesty will result in an automatic zero on the entire assignment

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
<p style="text-align: center;">Week 1 Aug 12th to 16th <u>4 Days of Class</u> 12~ First Day / Orientation Day 15~ Opening Mass & Assumption of Our Lady 8:00 15~ Induction of Class, Student Council Officers and DYM</p>	1.1 Functions and Their Graphs
<p style="text-align: center;">Week 2 Aug 19th to 23rd</p>	1.2 Combining Functions; Shifting and Scaling Graph 1.3 Trigonometric Functions
<p style="text-align: center;">Week 3 Aug 26st to 30th 26~Fire drill? 26~Middle and High School Catholic Bridge Program (after assembly) 28~St. Dominic de Guzman Feast Day Celebration</p>	1.4 Graphing with Software 1.5 Exponential Functions
<p style="text-align: center;">Week 4 Sep 2nd to 6th 2~House Ceremony</p>	1.6 Inverse Functions and Logarithms
<p style="text-align: center;">Week 5 Sep 9th to 13th 9~ Mass & Birthday Mother Mary & VIP Induction</p>	Chapter 1 Test 2.1 Rates of Change and Tangent Lines to Curves
<p style="text-align: center;">Week 6 Sep 16th to 20th <u>1 Day of Class</u> 17~Moon Festival 18-20~ Teacher's Conference</p>	2.2 Limit of a Function and Limit Laws
<p style="text-align: center;">Week 7 Sep 23rd to 27th 24-26~Pre-Exam Days</p>	2.3 The Precise Definition of a Limit
<p style="text-align: center;">Week 8 Sep 30th to Oct 4th</p>	2.4 One-Sided Limits 2.5 Continuity
<p style="text-align: center;">Week 9 Oct 7th to 11th <u>1 Day of Class</u> 7~Launching - Rosary Month and Bullying Prevention Day 8-9 ~Q1 Exams 10~Double Ten 11~Record Day</p>	Quarter Exam

2nd QUARTER – TENTATIVE COURSE CONTENT

<i>(NB: Depending on time and interest, the teacher may delete and/or add other selections.)</i>	
Week / Date	Topic / Projects / Assessments
Week 1 (10) Oct 14th to 18th <i>14~ Second Quarter Begins</i>	2.6 Limits Involving Infinity; Asymptotes of Graphs
Week 2 (11) Oct 21st to 25th <i>25 – Book Fair</i> <i>25- Masquerade Night</i>	3.1 Tangent Lines and the Derivative at a Point 3.2 The Derivative as a Function
Week 3 (12) Oct 28th to Nov 1st <i>1-All Saint's Day Mass</i>	3.3 Differentiation Rules 3.4 The Derivative as a Rate of Change
Week 4 (13) Nov 4th to Nov 8th	3.5 Derivatives of Trigonometric Functions
Week 5 (14) Nov 11th to 15th	3.6 The Chain Rule
Week 6 (15) Nov 18th to 22nd <i>22-Gr.12 Q2 Exam</i> <i>22 - YSC Contest</i>	3.7 Implicit Differentiation
Week 7 (16) Nov 25th to 29th <i>25-Gr.12 Q2 Exam</i> <i>26-28~Pre-Exam Day</i>	3.8 Derivatives of Inverse Functions and Logarithms
Week 8 (17) Dec 2nd to Dec 6th <u>6~Half Day</u> <i>Foundation Day Celebrations</i>	Quarter Exam 3.9 Inverse Trigonometric Functions Desmos Project
Week 9 (18) Dec 9th to 13th <u>3 Days of Class</u> <i>12-13 ~Q2 Exams</i>	Desmos Project
Dec 16th to Jan 3rd	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 (19) Jan 6th to 10th <u>4 Days of Class</u> 6~Record Day 7~Third Quarter Begins 10 ~ New Year Mass	4.1 Extreme Value of Functions on Closed Intervals
Week 2 (20) Jan 13th to 17th	4.2 The Mean Value Theorem
Week 3 (21) Jan 20th to 24th	4.3 Monotonic Functions and the First Derivative Test
Jan 27th to Jan 31st	Chinese New Year
Week 4 (22) Feb 3rd to 7th	4.4 Concavity and Curve Sketching
Week 5 (23) Feb 10th to 14th 1-14~Catholic Week	4.4 Concavity and Curve Sketching
Week 6 (24) Feb 17th to 21st	4.6 Applied Optimization
Week 7 (25) Feb 24th to 28th <u>4 Days of Class</u> 24~Lenten Mass? 25-27 ~ Pre-Exam Days 24-27~IOWA Assessments 28 ~ Memorial Day Holiday	4.7 Newton's Method
Week 8 (26) March 3rd to 7th 5~ Ash Wednesday	4.8 Antiderivatives
Week 9 (27) March 10th to 14th <u>4 Days of Class</u> 14 – 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 (28) March 17th 21st <u>4 Days of Class</u> 17 – Q3 Exams 18~ Fourth Quarter Begins 18~ Fire Drill? 19~ Feast of St. Joseph	5.1 Area and Estimating with Finite Sums
Week 2 (29) March 24th to 28th	5.2 Sigma Notation and Limits of Finite Sums
Week 3 (30) March 31st to April 4th <u>4 Days of Class</u> 4~Tomb Sweeping	5.2 Sigma Notation and Limits of Finite Sums
Week 4 (31) Apr 7th to 11th	5.3 The Definite Integral
April 14th to April 18th	Easter Break
Week 5 (32) Apr 21st to 25th 23~Easter Mass 21-25 ~ AP Mock Exams 26~Spring Fair	5.4 The Fundamental Theorem of Calculus
Week 6 (33) Apr 28th to May 2nd 4/29-5/1~ Pre-Exam Days 1-2~ Final Exams (K, 5, 8, 12 only)	5.6 Definite Integral Substitutions and the Area Between Curves
Week 7 (34) May 5th to 9th 5-9~ Final Exams (K, 5, 8, 12 only) 5-9 ~ AP Exams	Quarter Exam
Week 8 (35) May 12th to 16th <u>4 Days of Class</u> 14-15~ Q4 Exam 16~ Record Day 12-16 ~ AP Exams	Graduation Preparation
Week 9 (36) May 19th to 23rd	Graduation Preparation
Week 10 (37) May 26th to 30th <u>4 Days of Class</u>	