Syllabus for AP Calculus AB
Mr. Kikuchi

Contact Information:
Room: D201
Email: gary_kikuchi@notes.k12.hi.us

I. Course Objective: Calculus can be divided into two main branches, Differential Calculus (DC) and Integral Calculus (IC). Prior to studying the two branches, we have another concept called Limits that serves as a gateway into the two branches. Therefore, we will study these three major ideas in this course. Moreover, we will learn the connection between the two branches when we cover the Fundamental Theorem of Calculus (FTC). Intuitively, DC centers on finding the instantaneous rate of change (such as velocity) and its application to solving problems while IC centers on the finding the total (such as total area and volume) and its application to solving problems.

To master the two branches successfully, students must be able to work with 4 different functional representations, and see the connections that exist among the 4 representations. The four representations are:
- **G**raphical;
- **N**umerical (e.g. tables);
- **A**lgebraic/**A**nalytical;
- **W**ritten (also verbal).

We can use the acronym **GNAW** to stand for the 4 representations, and the first goal is to master the use of all 4 representation to do analysis, be able to convert one representation to another as needed, and be able to decide which representation is the best one to use to analyze any given calculus problem.

Additionally, the College Board requires that all students:
• Understand the meaning of the derivative in terms of a rate of change and local linear approximation, and be able to use derivatives to solve a variety of problems.
• Understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of change, and be able to use integrals to solve a variety of problems.
• Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus.
• Be able to communicate mathematics and explain solutions to problems both verbally and in written sentences.
• Be able to model a written description of a physical situation with a function, a differential equation, or an integral.
• Be able to use technology to help solve problems, experiment, interpret results, and support conclusions.
• Be able to determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement.

• Develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment.

II. Textbook: Finney, Ross L., Franklin D. Demana, Bert K. Waits, and Daniel Kennedy. *Calculus—Graphical, Numerical, Algebraic-AP Edition* 5th ed, 2016. Pearson Education. While we will also use various other supplementary sources for this class, Finney *et al*'s textbook will remain our main source of information in addition to the videos.

III. Technology Requirement:
We will use a ***Texas Instruments 84 Plus graphing calculator*** in class regularly. I recommend you obtain a graphing calculator of your own to use during the AP Exam. We have a set of ***TI-84 Plus calculators*** for classroom use. We will use the calculator in a variety of ways as a tool to illustrate ideas and topics. The following are some examples of how the calculator will be used:
• Conduct discovery and exploration including both concepts and application.
• Graph functions within arbitrary windows.
• Use the TABLE feature to observe the value of a function closer and closer to a given value of x from both the left and right in order to understand limits.
• Approximate the derivative at a point and approximate the value of a definite integral using numerical methods.
• Check to see if a function is differentiable at a point by using local linearity
• Analyze and interpret results.
• Justify and explain graphs and equations.

IV. Classroom Rules:

I expect the students to:
• Arrive on time and be in their assigned seat;
• Put away their electronic devices during class (phones, headphones, games, etc);
• Be prepared to be on task and have all supplies ready;
• Participate actively and take good notes;
• Use all classroom equipment with care and keep the room clean—put trash in trash cans;
• Support and respect each other—no swearing, put-downs and inappropriate behavior;
• Ask permission to leave the room for any reason;
• Give their best effort and keep an open mind.

Students can expect me to:
• Respect the students and give them support;
• Listen to the students and answer all questions;
• Offer help to learn the necessary material;
• Honor the students' opinions;

- Be patient and be fair;
- Making learning interesting and apply the concepts to the real world;
- Create a safe learning environment in class.

In addition, I expect the parents/guardians to be an active participant in helping the students learn. Parents, please check Jupiter Grades regularly to keep track of what I require students to do at home and the grade your child is earning. Please do contact me if you have any questions or suggestions.

V. Grading Information and Policy:

Letter grades are given using the following grading scale:

87 % and above	A
Below 87% to 77%	B
Below 77% to 67%	C
Below 67% to 57%	D
Below 57%	F

Homework and class notices will also be posted on Jupiter Grades, so if you miss school, please make sure to check there to complete any homework or project and to catch up on class work.

Make-up of Missed Work/Test Information: For an **excused** absence, a student may retake a missed exam upon return. In other cases, I will determine whether a student will be allowed to retake an exam or not, based on the student's previous effort and attendance record. Missed homework/classwork due to an excused absence will be due the day after the student returns without any penalty. Any work turned in the following day without an approved excuse will get half credit; work later than one day will be counted as a zero.

Quarter Grades: Quarter grades are weighted as follows: Quizzes/Tests (70%) and classwork/homework/notes (30%).
Semester Grades: Semester grade is the mean of the two quarter grades.
Year Grade: Year grade is the mean of the two semester grades.
NOTE: Since this an **AP** Calculus course, all students in our class are expected to take the AP Calculus exam. However, your AP Exam result will have **no** impact on your course grade.

VI. Required Supplies:

Composition book for note-taking	Graphing calculator*
Eraser	Pencils
Pens	Graphing Paper
Ruler	Folder Paper
Folder/Binder	

*A graphing calculator is crucial to success in this class. If you cannot afford one, one can be assigned for the year on request, but if you lose it, you will receive an obligation form, which may quote a price much higher than what you could have bought yourself

because we are required to use only DOE-approved vendors. You will need a graphing calculator for the AP exam, and you should learn all its functions BEFORE you take the exam.

AP Calculus AB Course Outline

This schedule leaves 4–6 weeks for flexibility with teaching and learning time management.

Unit 1: Preparation for Calculus (1-2 days, coverage done by summer work)

Order and inequalities—solving inequalities
Lines - slope as a rate of change, parallel and perpendicular lines, and equations.
Functions and graphs—functions, domain and range, families of functions and transformations, piecewise functions, and composition of functions
Trigonometric functions—graphs of basic trigonometric functions, domain and range, inverse trigonometric functions, and applications

Unit 2: Limits and Continuity (3.5 weeks)

A. Rates of change
B. Limits at a point
      1. Properties of limits
      2. Two-sided
      3. One-sided
C. Limits involving infinity
      1. Asymptotic behavior
      2. End behavior
      3. Properties of limits
      4. Visualizing limits
D. Continuity
      1. Continuous functions
      2. Discontinuous functions
      a. Removable discontinuity
      b. Jump discontinuity
      c. Infinite discontinuity
E. Instantaneous rates of change

Unit 3: The Derivative (4 weeks)

A. Definition of the derivative
B. Differentiability
      1. Local linearity
      2. Numeric derivatives using the calculator
      3. Differentiability and continuity
C. Derivatives of algebraic functions
D. Derivative rules when combining functions
E. Applications to velocity and acceleration
F. Derivatives of trigonometric functions

G. The chain rule
H. Implicit derivatives
      1. Differential method
      2. y' method
I. Derivatives of inverse trigonometric functions
J. Derivatives of logarithmic and exponential functions
K. L'Hospital's Rule (added this year, see chapter 9.2 pp. 452-460)

Unit 4: Applications of the Derivative (3 weeks)

A. Extreme values
      1. Local (relative) extrema
      2. Global (absolute) extrema
B. Using the derivative
      1. Mean value theorem
      2. Rolle's theorem
      3. Increasing and decreasing functions
C. Analysis of graphs using the first and second derivatives
      1. Critical values
      2. First derivative test for extrema
      3. Concavity and points of inflection
      4. Second derivative test for extrema
D. Optimization problems
E. Linearization models
F. Related rates

Unit 5: The Definite Integral (3 weeks)

A. Approximating areas
      1. Riemann sums
      2. Trapezoidal rule
      3. Definite integrals
B. The Fundamental Theorem of Calculus (part 1)
C. Definite integrals and antiderivatives
      1. The Average Value Theorem
D. The Fundamental Theorem of Calculus (part 2)

Unit 6: Differential Equations and Mathematical Modeling (3-4 weeks)

A. Antiderivatives
B. Integration using u-substitution
C. Separable differential equations
      1. Growth and decay
      2. Slope fields
      3. General differential equations

Unit 7: Applications of Definite Integrals (3 weeks)

A. Summing rates of change
B. Particle motion
C. Areas in the plane
D. Volumes
       1. Volumes of solids with known cross sections.
       2. Volumes of solids of revolution
              a. Disk method
              b. Shell method
              c. Washer method

Unit 8:
Review for AP test (4-6 weeks)

Parents/Guardian and Student: Please read through the entire syllabus and sign the section below, and return the last page to me. Thank you!

We, the undersigned, have read through the entire syllabus and understand the conditions stated in it.

Student Name   **Parents/Guardian Name(s)**

_____   _____

                                                              _____

Student Signature   **Parents/Guardian Signature(s)**

_____   _____

                                                              _____

Student email address   **Parents/Guardian email address**

_____   _____

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Student phone number   **Parents/Guardian phone number**

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If you have any questions or concerns about this syllabus, please email me or write them on the back of this page after you cut it out. I promise to respond!