**AP Calculus AB Syllabus 2018 – 2019**

**Curricular Requirements:**

* CR1a. The course is structured around the enduring understandings within Big Idea 1: Limits.
* CR1b. The course is structured around the enduring understandings within Big Idea 2: Derivatives.
* CR1c. The course is structured around the enduring understandings within Big Idea 3: Integrals and the Fundamental Theorem of Calculus.
* CR2a. The course provides opportunities for students to reason with definitions and theorems.
* CR2b. The course provides opportunities for students to connect concepts and processes.
* CR2c. The course provides opportunities for students to implement algebraic/ computational processes.
* CR2d. The course provides opportunities for students to engage with graphical, numerical, analytical, and verbal representations and demonstrate connections among them.
* CR2e. The course provides opportunities for students to build notational fluency.
* CR2f. The course provides opportunities for students to communicate mathematical ideas in words, both orally and in writing.
* CR3a. Students have access to graphing calculators.
* CR3b. Students have opportunities to use calculators to solve problems.
* CR3c. Students have opportunities to use a graphing calculator to explore and interpret calculus concepts.
* CR4. Students and teachers have access to a college-level calculus textbook.

**Mathematical Practices for AP Calculus AB:**

* MPAC 1: Reasoning with definitions and theorems
* MPAC 2: Connecting concepts
* MPAC 3: Implementing algebraic/ computational processes
* MPAC 4: Connecting multiple representations
* MPAC 5: Building notational fluency
* MPAC 6: Communicating

**Prerequisites:**

* Algebra I
* Geometry
* Algebra II
* Precalculus

**Text, Resources and Materials:**

* Calculus of a Single Variable, 10e – Larson, Edwards **[CR4]**
* Graphing Calculator (TI-84) – Students who do not have access to a graphing calculator will be provided one by the district. **[CR3a]**
* One 2” binder
* Filler paper
* Graph paper
* Dividers
* Pencils
* Websites –
  + Calculus of a Single Variable Textbook – Larson/ Edwards
    - https://www.alvinisd.net/cms/lib/TX01001897/Centricity/Domain/5037/Calculus%20of%20a%20Single%20Variable%2010th%20%20Edition.pdf
  + TeachingCalculus.com – Lin McMullin
  + GetaFive.com – (Class code: BNH82VJ)
  + LarsonCalculus.com
  + CalcChat.com (Your textbook is listed as “Calculus 10e”.)
  + Greg Kelly Math (https://sites.google.com/site/gkellymath/home/calculus-powerpoints)
  + https://www.khanacademy.org/math/ap-calculus-ab
  + Google Classroom (code: b1jp7d)

**Course Objectives and Expectations:**

AP Calculus AB is roughly equivalent to a first semester college calculus course devoted to topics in differential and integral calculus, primarily limits, derivatives, integrals, and the Fundamental Theorem of Calculus. AP Calculus is designed to develop mathematical knowledge conceptually, guiding students to connect topics and representations throughout the course and to apply strategies and techniques to accurately solve diverse types of problems.

**Course Outline:**

* Big Idea 1: Limits ( 4 weeks) **[CR1a]**
  + 1.1 A Preview of Calculus
  + 1.2 Finding Limits Graphically and Numerically
  + 1.3 Evaluating Limits Analytically
  + 1.4 Continuity and One-Sided Limits
  + 1.5 Infinite Limits
  + 3.5 Limits at Infinity

**Sample Activities:**

**Points of (dis)continuity:** Students explore limits at discontinuities in four ways: using the table feature on their calculators with decreasing increments, using algebraic techniques to “simplify” the expressions given as formulas, using the graph trace features on their calculators, and using verbal descriptions of functions written in words to create graphs that match the verbal descriptions. Each student will provide a written summary that compares and contrasts jump, removable, and asymptotic discontinuities. They will also share their findings with their classmates showing how the different representations reveal the discontinuities in different ways. **[CR2c], [CR2d], [CR2f], [CR3c]**

**Limits Oral Quiz:** Once students understand limits, they are given an oral quiz that is presented to the entire class. Each student is given a separate problem. Students must describe how to find a limit for the given function (which may be presented algebraically, graphically, or numerically) and explain what the limit means in the context of the problem. **[CR2f]**

* Big Idea 2: Derivatives ( 10 weeks) **[CR1b]**
  + 2.1 The Derivative and the Tangent Line Problem
  + 2.2 Basic Differentiation Rules and Rates of Change
  + 2.3 Product and Quotient Rules and Higher-Order Derivatives
  + 2.4 The Chain Rule
  + 2.5 Implicit Differentiation
  + 2.6 Related Rates
  + 3.1 Extrema on an Interval
  + 3.2 Rolle’s Theorem and the Mean Value Theorem **[CR1b]**
  + 3.3 Increasing and Decreasing Functions and the First Derivative Test
  + 3.4 Concavity and the Second Derivative Test
  + 3.6 A Summary of Curve Sketching
  + 3.7 Optimization Problems
  + 3.9 Differentials
  + 5.1 The Natural Logarithmic Function: Differentiation
  + 5.3 Inverse Functions
  + 5.4 Exponential Functions: Differentiation and Integration
  + 5.5 Bases Other than *e* and Applications
  + 5.6 Inverse Trigonometric Functions: Differentiation

**Sample Activities:**

**Derivative at a Point, A:** Students use a worksheet to explore the derivative function using the limit definition of the derivative at a point. For several points, students compute the difference quotient algebraically using the definition and use a table and/ or graph on their calculators to evaluate the limits and interpret their results in terms of the definition to decide if the derivative does or does not exist at each point. The original function and its derivative values are plotted on two graphs with the same horizontal axes. Students trade papers and validate each other’s answers. **[CR2a]**

**Derivative at a Point, B:** Students explore the derivative function using tangent lines at a point. Students are given a graph of some function *f* on equal-size grid paper. At several points, students draw tangent lines and use their slopes to estimate the derivative. Students plot the derivative values on the same set of aces. Graphs may include discontinuous and non-differentiable points. Results are presented to the class.

**Derivative at a Point, C:** Students use Desmos to create a slider showing a function and its derivative. The graph shows the tangent line sliding along the curve as its slope values are plotted. Polynomial, rational, exponential, logarithmic, trigonometric, and inverse trigonometric functions are used as the parent function.

**Search for *f:*** Using the graph of the derivative *f’(x),* students determine key features of *f(x)* (such as increasing/ decreasing intervals, local extrema, points of inflection, and concavity intervals) and create a graph of *f(x).* They exchange *f(x)* graphs with a classmate and make a graph of *f’(x)* to match their new *f(x).* Students meet together to check *f’(x)* graphs and resolve any differences. **[CR2b]**

**Continuous and Differentiable Examples:** Students are asked to create examples (or state that no such example exists) of a function that is continuous but not differentiable, a function that is differentiable but not continuous, a function that is neither differentiable nor continuous, and a function that is both differentiable and continuous. They share answers.

* Big Idea 3: Integrals and the Fundamental Theorem of Calculus ( 10 weeks) **[CR1c]**
  + 4.1 Antiderivatives and Indefinite Integration
  + 4.2 Area
  + 4.3 Riemann Sums and Definite Integrals
  + 4.4 The Fundamental Theorem of Calculus
    - The First Fundamental Theorem of Calculus
      * If is continuous on then the function defined by is an antiderivative of That is, for
    - The Second Fundamental Theorem of Calculus
      * If is continuous on then where is any antiderivative of
  + 4.5 Integration by Substitution
  + 4.6 Numerical Integration
  + 5.2 The Natural Logarithmic Function: Integration
  + 5.4 Exponential Functions: Differentiation and Integration
  + 5.5 Bases Other than *e* and Applications
  + 5.7 Inverse Trigonometric Functions: Integration
  + 7.1 Area of a Region Between Two Curves
  + 7.2 Volume: The Disk Method

**Sample Activities:**

**Reimann Sums to Definite Integrals:** Students write an expression for approximation of the area between the horizontal axis and the graph of *f(x)* for a particular function given as a formula on a specified interval as a left, right, and midpoint Riemann sum using *n* subdivisions. They then use a Desmos graph with slider to explore sums. The file superimposes rectangular areas on the graph of *f(x),* showing the sum value. The software allows for left, right, and midpoint sums. The slider increases the number of partitions to explore precision. Finally, students write limits of their Riemann sums as *n* goes to infinity, then identify each as a definite integral, and use the Fundamental Theorem of Calculus to evaluate the integral. **[CR2e]­­**

**Honeycomb Volume:** Students find the volume of paper party decorations. Students trace the decoration, measure the outline to construct a data table, and use regression to determine the curve(s) of best fit for their object. They write integrals to represent the volume of their objects as solids of revolution and compute the volumes on their calculators. Pairs will assess the reasonableness of answers and compare results with another pair. **[CR3b]**

**Solids of Revolution:** Students will bring a small object from home that is a solid of revolution. Students will measure their objects to create a graph whose rotation about the *x-*axis would produce their object. Then, they use regression and multiple integrals to compute their object’s theoretical volume. Students will then use displacement to determine the actual volume. **[CR3b]**

* Differential Equations and Limits Revisited ( 3 weeks)
* 6.1 Slope Fields and Euler’s Method
* 6.2 Differential Equations: Growth and Decay
* 6.3 Separation of Variables and the Logistic Equation
* 6.4 First-Order Linear Differential Equations
* 8.1 Basic Integration Rules
* 8.7 Indeterminate Forms and L’Hospital’s Rule

**Sample Activities:**

**Slope Field Card Sort:** Sets of cards include 10 differential equations represented symbolically, as a slope field, and by a verbal description. Students match the cards to bring together all three representations.

**AP Exam:** (Tuesday, May 14, 2019)

* Section I – Multiple-Choice:
  + Part A (No Calculator)
    - 30 questions
    - 60 minutes
  + Part B (Calculator Required)
    - 15 questions
    - 45 minutes
  + Part I Summary:
    - 45 questions
    - 1 hour, 45 minutes
    - 50% of total exam score
* Section II – Free Response
  + Part A (Calculator Required)
    - 2 questions
    - 30 minutes
  + Part B (No Calculator)
    - 4 questions
    - 60 minutes
  + Part II Summary:
    - 6 questions
    - 1 hour, 30 minutes
    - 50% of total exam score
* AP score of 5 is equivalent to the average score among college students earning grades of A in the college course. Similarly, AP Exam scores of 4 are equivalent to college grades of A-, B+, and B. AP Exam scores of 3 are equivalent to college grades of B-, C+, and C.
* Throughout the course, students are required to present solutions to homework problems both orally and on the board to the rest of the class. On at least one question on each quiz and test, students are explicitly instructed to include clearly written justifications in complete sentences for their solutions. They will also do this in class and on homework problems. **[CR2f]**

**AP Exam Review:**

Review for the AP test is ongoing throughout the year. Past multiple-choice and free response problems are regularly used for in-class warmups, class work, homework, quizzes, tests, etc. Problem sets from the textbook (AP style questions) are used throughout each chapter. Students work through several practice exams throughout the year, with additional nighttime reviews as the exam approaches. Past AP practice tests are analyzed to determine individual areas for deeper study.

**Academic Honesty:**

Collaborate responsibly and submit your own work. I value collaboration and encourage you to form study groups because it can facilitate learning, but it is essential that everyone learn the material. Collaboration has little value if each group member works only a few problems and just copies the rest. It is better to make an honest attempt at every problem and then compare and discuss your results. Academic honesty should be maintained at all times.

**Binder:**

Notes should be kept in chronological order and should include – date and section number, all definitions, examples, class work and homework from every class. You can leave notes neatly at home after each big unit (we will use them again at the end of the year for the AP Exam review).

**More about Homework:**

Completion of daily homework is essential for success in this course. Therefore, homework will get much attention by me throughout the year. Periodically you will present your homework solutions to the class using the Elmo document reader. It should be neat, organized and easy for all to follow.

**Attendance, Class Participation and Effort:**

It is extremely important to attend class daily and to put forth consistent effort. You are expected to actively participate, stay engaged, and discuss ideas.

Everyone is encouraged to form a study group for additional support. I am available periods 4, 5, and 6, and before or after school. Please email me when you are coming, so I can make sure I am available. Do not let yourself get behind; come see me as soon as you are even the smallest bit confused!

**It is YOUR responsibility to submit assignments on time.**

Missed or Late Work:

1. No late homework will be accepted, except in case of absence (see below).
2. All quizzes and tests that are missed due to absence must be made up within a reasonable time period, which must be discussed with me upon return to class.

Absences:

If you are absent from class, it is your responsibility to get all the notes from a classmate. All handouts will be set-aside for you in the absentee folder. It is your responsibility to hand in homework assignments immediately upon your return. I will not ask you for your assignments. Work assigned on the day you miss is due the day after you return.

**Grading:**

Grading will be done on a points system. For example, tests will usually be worth 100 points. An in-class assignment may be worth 20 points. Homework may be worth 5 points. (These are all examples and can be changed). Your marking period grade will be calculated by dividing the total earned points by the total possible points.

For example: If you earned 406 points out of 432 possible total points for the marking period, your final marking period grade would be 406/ 432 = 0.9398 = 94%

Grades are posted usually within a few days. Grades should be checked frequently to ensure that your assignments are up-to-date.