# AP Calculus AB Syllabus

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**\*\*\* VIRTUAL LEARNING DURING COVID-19\*\*\***

Parents and students,

We live in very uncertain times, and there have been and still will be some uncertainty about what comes next. I want to assure you, regardless of any unforeseeable changes, my classroom will operate almost completely the same whether you’re in person or online. However, for the beginning of this year, here are some new things that you may not have done before with virtual learning.

1. The first 3 weeks will be a period of “figuring it out.” If links don’t work, uploading assignments fails, or any other type of issue arises as a result of technology, I assure you it will be handled as quickly as possible and there will not be consequences. We are here to make sure the beginning of online instruction goes as smoothly as possible. Please do not hesitate to send me an email with any and all issues and I will do my best to help at my soonest availability.
2. Expect to be uploading basically everything to Canvas. If the work is to be done in class, students will receive time at the end of the virtual learning period to upload any notes, quizzes, or worksheets. Homework will be due at MIDNIGHT the same night. You WILL NOT be able to upload homework right before class starts. This is to prevent you from trying to do my homework in someone else’s class.
3. My virtual classroom rules follow the same rules that are listed below (within reason), but with these additions:
	1. Students must stay logged onto the virtual meeting for the ENTIRE time of the meeting period. There is no excuse to leave early, plus you cannot log in to the meeting more than once.
	2. Students will keep themselves on mute with their video ON unless given permission to ask a question. I should be able to see your face, as you will be able to see mine unless I am using the whiteboard function for the lesson.
	3. Students will be prepared to take notes with the day’s notes PRINTED out. If a student does not have access to a printer, the student may take notes on notebook paper while viewing the PDF on a laptop or phone. The student will keep ALL of their completed notes in a folder.*\*Keep in mind that if you only have one device, you will be using it for virtual learning and will need to either borrow someone’s device or find a printer for the lesson notes.\**
	4. From the student Code of Conduct, “A student shall not use a telecommunications device, including a cellular telephone, or other electronic device in violation of district and campus rules.” It is a Campus rule that students should not use a cell phone during instruction. This rule remains the same and will be strictly enforced. During any online testing, you will need to put your phone in the camera frame so that is visible to me and out of your immediate reach.

**\*\*\*NOTE: THIS COURSE IS NOT:\*\*\***

**Self-Paced**

**Easier than face to face**

**Independent study**

### Text:

*\*NOTE\* This textbook is NOT required. Pages that are necessary to the course will be scanned and uploaded to Canvas.*

Calculus: Graphical, Numerical, Algebraic: 5th edition

Finney, Demana, Waits, Kennedy, Broussard

### Overview:

The AP Calculus AB Course Description encompasses all topics and subtopics, as identified in the AP College Board Calculus Topic Outline and Course Description, including but not limited to:

* Students working with functions, graphs and limits, inclusive of working with functions numerically, graphically, analytically, and when represented verbally.
* Students working with derivatives.
* Students working with integrals.
* Students mastering their explanations of solutions to problems and the rationale for problem-solving strategies and reasonable solutions, using complete, written sentences as well as oral explanations/arguments.
* Students mastering the use of graphing calculators for solving problems, experimenting with problem-solving strategies, and to interpret results and/or support conclusions.

Cooperative learning and best practices in study-team strategies are implemented throughout the class, beginning on the first day of school. Students also are encouraged to work together and form study groups outside of class. Thus, students discuss and communicate openly the calculus topics learned and problem-solving strategies used as a normal facet of their learning venue.

**Outline of Required Topics**: (Taken directly from College Board)

**I. Functions, Graphs, & Limits:**

* **Analysis of graphs** with the aid of technology, graphs of functions are often easy to produce. The emphasis is on the interplay between the geometric and analytic information and on the use of calculus both to predict and to explain the observed local and global behavior of a function.
* **Limits of functions (including one-sided limits)**
	+ An intuitive understanding of the limiting process
	+ Calculating limits using algebra
	+ Estimating limits from graphs or tables of data
* **Asymptotic and unbounded behavior**
	+ Understanding asymptotes in terms of graphical behavior
	+ Describing asymptotic behavior in terms of limits involving infinity
	+ Comparing relative magnitudes of functions and their rates of change (for example, contrasting exponential growth, polynomial growth, and logarithmic growth)
* **Continuity as a property of functions**
	+ An intuitive understanding of continuity. (The function values can be made as close as desired by taking sufficiently close values of the domain)
	+ Understanding continuity in terms of limits
	+ Geometric understanding of graphs of continuous functions (Intermediate Value Theorem and Extreme Value Theorem)

**II. Derivatives:**

* **Concept of the derivative**
	+ Derivative presented graphically, numerically, and analytically
	+ Derivative interpreted as an instantaneous rate of change
	+ Derivative defined as the limit of the difference quotient
	+ Relationship between differentiability and continuity
* **Derivative at a point**
	+ Slope of a curve at a point. Examples are emphasized, including points at which there are vertical tangents and points at which there are no tangents.
	+ Tangent line to a curve at a point and local linear approximation
	+ Instantaneous rate of change as the limit of average rate of change
	+ Approximate rate of change from graphs and tables of values
* **Derivative as a function**
	+ Corresponding characteristics of graphs of *f*  and *f’*
	+ Relationship between the increasing and decreasing behavior of *f* and the sign of *f’*
	+ The Mean Value Theorem and its geometric consequences
	+ Equations involving derivatives. Verbal descriptions are translated into equations involving derivatives and vice versa
* **Second derivatives**
	+ Corresponding characteristics of the graphs of *f, f’,* and *f”*
	+ Relationship between the concavity of *f* and the sign of *f”*
	+ Points of inflection as places where concavity changes
* **Applications of derivatives**
	+ Analysis of curves, including the notions of monotonicity and concavity
	+ Optimization, both absolute (global) and relative (local) extrema
	+ Modeling rates of change, including related rates problems
	+ Use of implicit differentiation to find the derivative of an inverse function
	+ Interpretation of the derivative as a rate of change in varied applied contexts, including velocity, speed, and acceleration
	+ Geometric interpretation of differential equations via slope fields and the relationship between slope fields and solution curves for differential equations
* **Computation of derivatives**
	+ Knowledge of derivatives of basic functions, including power, exponential, logarithmic, trigonometric, and inverse trigonometric functions
	+ Basic rules for the derivative of sums, products, and quotients of functions
	+ Chain rule and implicit differentiation

**III. Integrals:**

* **Interpretations and properties of definite integrals**
	+ Definite integral as a limit of Riemann sums
	+ Definite integral of the rate of change of a quantity over an interval interpreted as the change of the quantity over the interval:
	
	+ Basic properties of definite integrals (examples include additivity and linearity)
* **Applications of integrals** Appropriate integrals are used in a variety of applications to model physical, biological, or economic situations. Although only a small sampling of applications can be included in any specific course, students should be able to adapt their knowledge and techniques to solve other similar application problems. Whatever applications are chosen, the emphasis is on using the method of setting up an approximating riemann sum and representing its limit as a definite integral. To provide a common foundation, specific applications should include using the integral of a rate of change to give accumulated change, finding the area of a region, the volume of a solid with known cross sections, the average value of a function, and the distance traveled by a particle along a line.
* **Fundamental Theorem of Calculus**
	+ Use of the Fundamental Theorem to evaluate definite integrals
	+ Use of the Fundamental Theorem to represent a particular anti-derivative, and the analytical and graphical analysis of functions so defined
* **Applications of antidifferentiation**
	+ Finding specific antiderivatives using initial conditions, including applications to motion along a line
	+ Solving separable differential equations and using them in modeling (in particular, studying the equation *y’* = *ky* and exponential growth)
* **Numerical approximations to definite integrals** Use of Riemann sums (using left, right, and midpoint evaluation points) and trapezoidal sums to approximate definite integrals of functions represented algebraically, graphically, and by tables of values.

**Additional Topics that will be Included in the Course:**

* L’Hospital’s Rule including its use in determining limits and convergence of improper integrals and series.
* Calculation of volume through use of cylindrical shells in addition to disk and washer methods.
* Integration by Parts

**Goals:**

There are two primary objectives for the Advanced Placement Calculus AB class. The first objective is to insure students are prepared to take the AP Exam in May. The second objective is to insure students leave the halls of SFHS prepared for success in future math courses.

**Preparing for the AP Exam:**

The expectation is for all students to take the AP exam. This is one of the main goals of the course and we will be working towards this goal all year. It is a great experience, reinforces important calculus concepts, and students may earn college credit.

Pending unforeseen events, there will be 2-3 weeks devoted to AP Exam preparation and practice; inclusive of a complete 3-hour mock exam. During this time, students will work on multiple choice problems as well as free-response questions. The cooperative learning environment remains constant throughout the year so students will continue to dialogue with others, explaining solutions and problem-solving strategies. In addition, the AP grading rubrics will be incorporated into discussions and peer evaluations in order to increase the richness of students’ conversations

**The Role of Technology in AP Calculus:**

Technology is designed to make our lives as mathematicians easier; yet, technology is not a substitute for mathematical understanding and proficiency. Students are expected, both by the instructor and by College Board, to understand the underlying mathematical concepts associated with the use of technology. Calculator and non-calculator portions on the AP exam emphasize this requirement; as a result, tests in this course will frequently be divided in the same fashion.

A graphing calculator is recommended, but not required.

**Grading Policy:**

Santa Fe ISD grading policy states major grades must count 60% and daily grades are to count 10%. Major grades consist of tests and projects. Daily grades consist of homework and classwork. Quizzes are 30%.

**Classroom Expectations**

* You are expected to respect and value yourself, your school environment and the diversity of the SFHS community.
* You are expected to contribute to classes and work cooperatively whenever the situation requires.
* You are expected to come to class prepared and you are responsible for all missing work.
* You are expected not to talk while I am speaking or interrupt while other people are speaking.
* You may use the bathroom only during personal work time.
* No eating or drinking in the classroom. If you have a water bottle, you may sip water as long as it does not become a distraction.
* Cell phones must be put away during instruction. Students are allowed one warning before the phone is take up by me until the end of class. On a 3rd infraction, the phone will be taken up and sent to the office with a $15.00 retrieval fee, per school policy.

### Evaluation:

Tests will be given roughly every two to three weeks and will always be announced in advance. Quizzes may be given with or without warning and are to be completed in (what the instructor determines to be) a reasonable amount of time.

*\*Note: Although tests count considerably more than homework in the overall course grade, homework is the most important component of this course.* ***If a student does not complete the assigned homework, she/he will not succeed in this course.*** *Homework will be graded based on a subset of {correctness, completion}. Homework assignments are designed to be challenging. (Often, we can learn more from incorrect solutions than we can from correct ones).*

**Recommended Materials:**

* Lined paper, Graph paper, pencil, eraser
* NOTEBOOK PAPER or composition notebooks. NO metal binders or spiral notebooks. Paper or plastic folder WITHOUT brads in the middle.

Calculus is a great human achievement that I hope each of you will come to appreciate this year. I am excited about teaching this course and hope you are as excited about taking it. You have been preparing yourselves for college all your lives. If you do well in this course, you will have an advantage over those admitted to college without AP experiences. I look forward to working closely with each of you throughout the academic year to ensure your success in this course and in your future mathematical education.

***I’m looking forward to a great year with each one of you!!!***