

AP CALCULUS AB

Ivy Collegiate School

2022-2023

Department: Mathematics	Time: MTuW 11:20 – 12:20
Email: mathematics@ivycollegiateschool.org	Place: Seminar Room.

Course References: This is a list of various interesting and useful books and online resources that were used in the construction of the course. You are not required to purchase any of these, but they may be useful for occasional consultation. (Note: They are available in the restricted library.)

- James Stewart, *Essential Calculus: Early Transcendentals*, Cengage Learning, 1st ed., 2010.
- Deborah Hughes-Hallett, *Calculus: Single & Multivariable*, Wiley, 6th ed., 2013.
- David Bock, Dennis Donovan, and Shirley Hockett *Barron's AP Calculus*, Barrons Educational Series, 15th ed., 2019.

Objectives: This course is the first course in Calculus at Ivy Collegiate School, and also the first Calculus course in the AP curriculum. Following successful completion of Precalculus, students are introduced to the key concepts of differential and integral calculus beginning with a thorough examination of limits and continuity. Students will then develop their understanding of the derivative as both a rate of change and as an interpretation of slope at a given point. They will evaluate function behavior using derivatives of multiple orders. Particular emphasis is placed on applying the techniques of differentiation to problems involving motion, economics, and geometry. During the second half of the course, students are introduced to the key concept of integral calculus. They will learn to evaluate integrals as "antiderivatives" and use Riemann Sums to approximate the solutions to various integrals. They will learn about the Fundamental Theorem of Calculus and develop a toolkit of techniques for solving integrals of different classes. They will learn to apply integration to solve problems involving motion, exponential growth and decay, and volumes of solids of revolution. The final topics in this course do not belong to the traditional AB curriculum but are intended to further prepare students for the concepts covered in AP Calculus BC. This course is comprised of four "Big Ideas":

- BIG IDEA #1: Limits & Continuity
- BIG IDEA #2: Derivatives
- BIG IDEA #3: Integrals & the Fundamental Theorem of Calculus
- BIG IDEA #4: Applications of Calculus

AP Calculus AB is an exciting and fast-paced introduction to the world of higher mathematics, and students who do well in this course will gain great insights into the many beautiful applications of mathematics to other fields.

Co-/Prerequisites: Precalculus

Notes on AP courses: AP courses culminate in an examination May with scores ranging from 1 to 5 (5 - Extremely well-qualified; 4 - Well-qualified; 3 - Qualified; 2 - Somewhat qualified; 1 - Not qualified). Students are expected to devote additional time beyond their normal class and homework hours to preparing for this examination. While time for instructor-led review is always allotted during the Spring semester, it is

important that students begin their review independently and early. At ICS, AP courses have an additional component in the requirement of the completion of a Capstone Project at the end of the year (in lieu of a traditional Final Examination). More details regarding the Capstone Project(s) may be found below.

AP Calculus AB Course Outline:

Week One	Limits
Week Two	Continuity
Week Three	Definition of the derivative
Week Four	Basic differentiation
Week Five	Implicit differentiation & higher-order derivatives
Week Six	Basic applications and theorems of differentiation
Week Seven	Curve sketching and optimization
Week Eight	Motion problems and related rates
Week Nine	Exponential and logarithmic differentiation
Week Ten	Additional select topics in differential calculus
Week Eleven	Antidifferentiation and the Integral
Week Twelve	Definite integration and Riemann sums
Week Thirteen	Exponential and logarithmic integration techniques
Week Fourteen	Area between curves and polar integration
Week Fifteen	REVIEW
Week Sixteen	Volumes of solids of revolution
Week Seventeen	Integration by parts and partial fraction decomposition
Week Eighteen	Advanced integrals of trigonometric functions
Week Nineteen	Additional select topics in integral calculus
Week Twenty to Thirty-two	SPRING REVIEW PERIOD
Week Thirty-three to Thirty-seven	CAPSTONE RESEARCH
Week Thirty-eight	CAPSTONE PRESENTATIONS

Grading Policy: Homework and quizzes (60%), Finals and Project (40%)

Capstone Project: The Capstone projects are designed to give you the opportunity to showcase (beyond the examination) what you have learned and the skills you have mastered as part of the course. While every project assignment may be different in scope, target, grading, and type of organization, each is intended to require you to “dig deep” and impress us with your creativity. For this set of courses, you are required to submit a project that captures the full-depth of your knowledge of select topic(s) from the course. Examples may include writing an original research paper related to a topic you have learned in class, producing a 30-minute video tutorial on a select topic, or developing a programming project related to a concept from the course. Rubrics will be available in the Spring semester.

Important Dates:

Final Examination, Semester I	Dec 2022
AP Examination	May 8, 2023
Capstone Deadline	TBD

Course Policy:

- A TI-NSpire CX-CAS is required.
- It is recommended that you refer to the Class of 2018’s *AP Calculus AB Study Guide* for additional review.

Class Policy:

- Regular attendance is essential and expected.
- All assignments should be submitted with complete worked-out solutions.

Academic Honesty: Students are expected to abide by the policies regarding Academic Honesty as laid out in the ICS Student Handbook. Any violations will be forwarded for administrative review and the possible imposition of academic penalties.