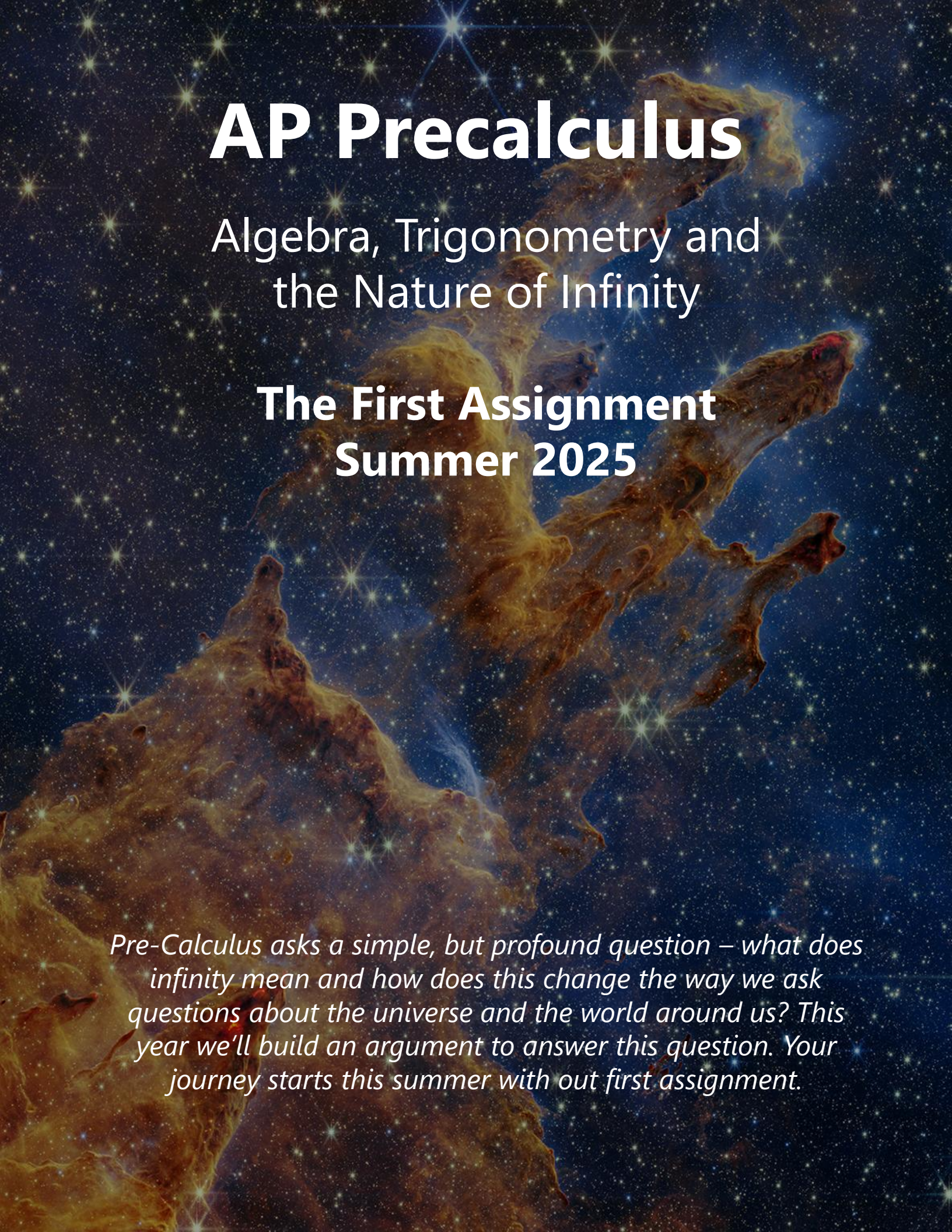


AP Precalculus

Algebra, Trigonometry and the Nature of Infinity

The First Assignment
Summer 2025

Pre-Calculus asks a simple, but profound question – what does infinity mean and how does this change the way we ask questions about the universe and the world around us? This year we'll build an argument to answer this question. Your journey starts this summer with out first assignment.

Assignment 1 2025

Introduction: Congratulations on making the choice to challenge your intellect and improve your character. This course will be demanding, thought-provoking and rewarding. Pre-Calculus has come to represent an integral component in measuring college-readiness; taking on this endeavor means you've made a choice that will affect the opportunities that come your way. I'm not trying to oversell the importance of Pre-Calculus, however there is a harsh but honest-truth tied to difficult math classes in high school. The issues of social inequity, advancement and opportunity has deep ties to the availability of rigorous mathematics in your community. As global forces push the competitive nature of success, you'll need to work even harder to achieve your goals. I'm here to help you accomplish the first steps toward reaching your version of success, but it needs to start with you. This summer you'll need to stay active and motivated. I value your time. I've thought through this assignment with great consideration. In order to remain competitive and begin our class with a deeper connection to math and science you'll need to practice the following.

Overview of the Assignment: This assignment is meant to boost your abilities for next school or at least keep them stable. That means the ideal approach is to complete a little portion each week. There are 3 general types of mathematical knowledge. Now that you're stepping it up, you'll need to intentionally target each type of knowledge: Factual knowledge, Procedural knowledge and Conceptual knowledge. You'll complete 3 tasks that are meant to strengthen these parts of your mathematical abilities.

Details (how to get credit): Do the following to get credit for the assignment:

1) Complete each of the 3 tasks by following the instructions on the following pages. Collect your work in a 3-prong portfolio or binder.

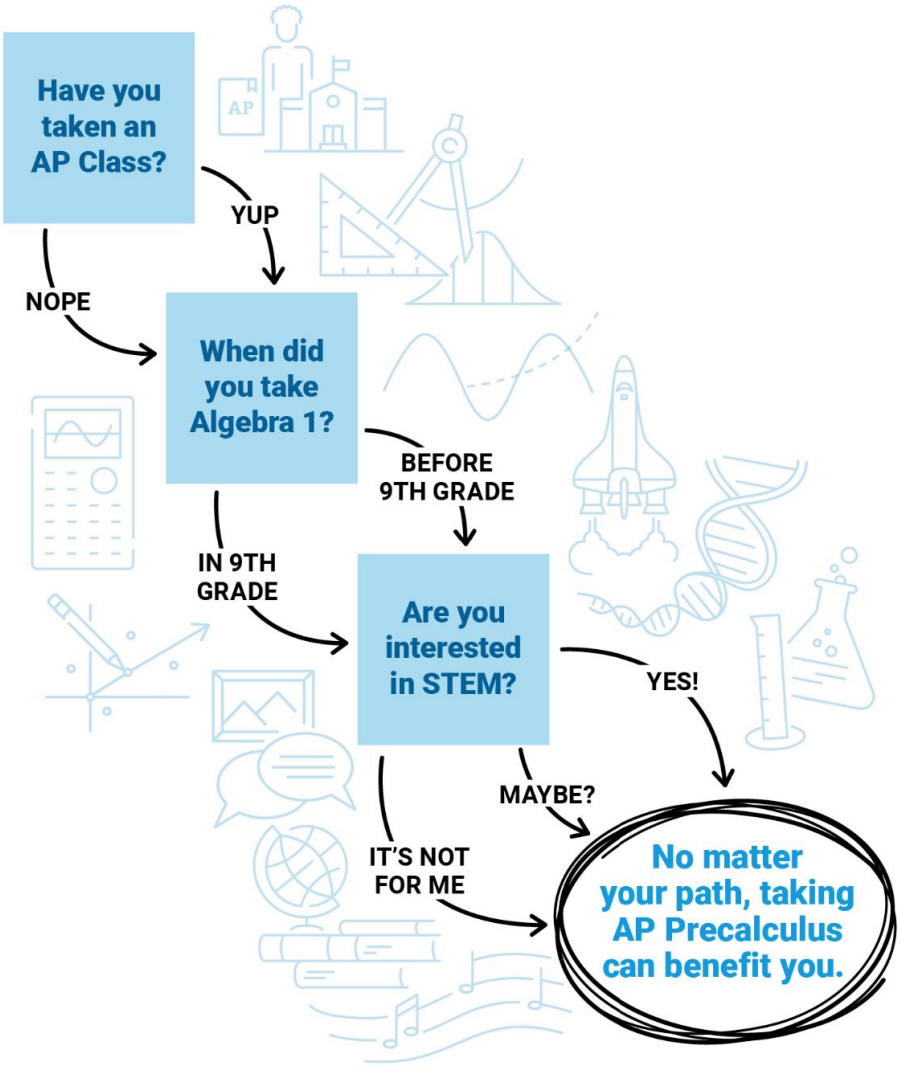
2) Organize your work into sections using dividers and title pages.

Title Page: Name, Date, Period, Name of Assignment
Divider 1: "Factual Knowledge"
Divider 2: "Procedural Knowledge"
Divider 3: "Conceptual Knowledge"
Organization: Stick these into a 3prong portfolio pocket folder (about 50 cents at Staters or Target)

3) On the First 3 days of school you'll have a chance to ask questions and organize your work. There will be an online site created for you to scan your work into a PDF and submit. You'll turn in the physical copy as confirmation and to help me grade your work.

Some Context and Motivation: During summer, wealthier communities will be sending their students to AP summer boot camps, SAT prep courses and college writing workshops. As a college-student I worked for one of these companies. They would charge families between $5000-$12,000 for summer enrichment. These parents were hoping to give their children a small boost to get into the same colleges and universities that you will be applying to next year. My family could have never afforded to give me this opportunity – but with commitment on your end and time spent investing in your future you can build these same opportunities for yourself, for free. Money is a powerful resource, but so is time! Work smarter and harder, you can make this happen!

Assignment 1 2025



> My passions are writing and music. Math just isn't my 'thing.' I'm taking AP English Language and Composition in my junior year so I know what to expect in an AP course. Then, I'm going to tackle AP Precalculus senior year so I'll be able to focus my energy and time in college on my real passions.
>
> *TAYLOR (Not interested in STEM majors; has taken AP course(s); took Algebra 1 in 9th grade)*

> I love science! My dream is to work at NASA, but I know I need to improve and sharpen my math skills to make it through calculus and any other STEM courses that will be part of my college major. I'm going to take AP Precalculus senior year, so I'll be more confident and prepared to tackle the higher-level math I'll face in advanced courses.
>
> *SYDNEY (Interested in STEM majors; has taken AP course(s); took Algebra 1 in 9th grade)*

The most common math courses for freshman students at UCI and UCSD are typically the introductory calculus sequences.

For example, at UC Irvine (UCI), the standard sequence for freshmen is Math 2A/2B, which covers Single-Variable Calculus I and II1. These courses are foundational for students pursuing further studies in mathematics, exact sciences, and engineering. Freshmen who have AP/IB credit for Math 2A are advised to enroll in Math 2B, and if they have credit for Math 2B, they should proceed to Math 2D2.

Factual Knowledge Task 1

Introduction: Factual Knowledge is a set of facts or ideas that you can recall. You use these as tools to build arguments, solve problems or make predictions. These could be definitions, formulas or useful facts. The tricky part here is that some of these ideas started as difficult concepts in elementary or middle school and are now part of your everyday toolbox.

Overview of Task 1: Developing Mathematical Language and Literacy.
This next part of the school year you will be writing ABOUT and WITH mathematics. This means word-choice becomes critical. Mathematics is a unique language. All terms are well defined and precise. It's much less fluid than common language, but this allows for detailed descriptions that imply a great deal of meaning without the use of too many characters, symbols or words.

Details (How to get credit): Give a definition for each term. In addition, include clue words, drawings, examples or graphs to help give meaning to the words. (If you took AP world, or AP US, think of these as really basic "Say-it, Say-its"... you may fit these onto flash cards to help study to the SAT's!!!)

USE THESE TERMS: Factual Knowledge Terms/Ideas

1) Natural Numbers
2) Whole Numbers
3) Integer Numbers
4) Rational Numbers
5) Real Numbers
6) Mathematical Identity
7) Function
8) Linear Functions
9) Exponential Functions
10) Quadratic Functions
11) Polynomial Functions
12) Rational Functions
13) Zero Product Property
14) Roots or Zeros of a Function
15) Asymptotes
16) Infinity
17) Distance Formula
18) Midpoint Formula
19) Point Slope Form
20) Slope Intercept Form
21) Quadratic Formula
22) Domain
23) Range
24) Conjugate
25) Trigonometric Functions

Step 1: *Check out this introduction video introduction to get an idea of where this class is heading and to introduce our first set of terms!*

(500) Imaginary Numbers Are Real [Part 1: Introduction] - YouTube

Step 2: *Complete the assignment using the list of terms on the left. This will help you build up the ideas necessary for us to eventually get to the ideas in the introduction video! Use the website below to find definitions and examples.*

Mathwords A to Z

Procedural Knowledge Task 2

Introduction: This type of knowledge is sometimes called algorithmic thinking. This is a set of steps you follow to produce an output, build a model or eliminate an outcome. This is the part of math you are probably most used to. It will still be an important part of this class, but it will take a second priority after the kind of thinking you'll do in part 3.

Question Set:
Collegeboard has put together an awesome resource. They have collected 13 lessons they think will help you prepare for a 5 on the AP exam this next year and/or boost your confidence going into next years class. The goal is for you to spread this assignment over 2 weeks throughout the summer.

Problem Set Question Only

These are the questions by themselves. You find 13 mini lessons. You can try these free style at first. If you need help look below.

Problem Set Solutions

These are the questions with written out answers. Each procedural step is included. You should use this if all you need is confirmation that you are on the right track. If you need more help look below.

Problem Set Explanation Video Playlist.

These are video guides with a full explanation of how these ideas work. Use this if you a stumped on any of the problem sets! If you have additional questions remember you have the first 3 days of school to ask me follow up questions. I'll also be available everyday afterschool for tutoring.

Conceptual Knowledge Task 3

Introduction: This type of knowledge is different than what most students are used to. This is deeper than a set of steps. On a basic level this knowledge answers WHY ideas are true. This kind of thinking is what makes mathematicians masters of problem solving. It opens the door to creativity in math: creating viable arguments and critiquing the reasoning of others. Ultimately, in the era of dominating AI, building conceptual knowledge is a process that makes a human mathematician worth supporting! We discuss, predict, express and connect – essentially this part of mathematics open the human story of mathematical thinking.

Details: This is the most important part. It's difficult to practice on your own. During the course of the next school year, you will be asked to describe why things work. Take some time in summer to reflect on WHY ideas and concepts worked through your Algebra course work.

Provide an answer with evidence or examples to support your ideas. Responses should build a legitimate paragraph.

Part 1)

Step 1: Go to youtube and watch the following video.
http://www.youtube.com/watch?v=lkwh4ZaxHIA

Step 2: Technical descriptions are a critical skill in the sciences and mathematics. Scientists and researchers spend a lifetime precisely describing observations and findings. Describe what you see in the video using the precise mathematical language found on part 1 or used in other math classes.

Step 3: You should try to connect this to ideas you've learned. Which Algebra 1 model would best fit this situation? Linear? Exponential or Quadratic? Why so?

Step 4: Let's get closer into one model in particular. When you solved quadratic equations in algebra 1, the equation had to equal to zero before using quadratic formula – why is that?

Step 5: Why do you think some quadratic equations have no solutions? Provide a graph as additional evidence, and reference a real-world example to give context.

Part 2) Why do those formulas Work? Check out the link, then answer the question below.

1) Was the "triangle" formed truly a triangle? Explain why or why not.

2) What would we need to do to the number of "peels" in order to make the so-called "triangle" formed look more smooth (like a true triangle) vs. a "choppy" triangle?

3) Suppose an above-the-ground circular swimming pool has a radius of 12 feet. What is the area of the exposed surface of the water it contains?

4) Suppose a circular track (that surrounds grass) has a circumference of 500 feet. If 3 bags of grass seed are needed to be spread out across every 100 square feet of grass in the circular region inside this track, determine how many entire bags of grass seed will be needed to cover the entire area of the circular region surrounded by this track.

5) Suppose a 12-inch pizza (pizza with diameter = 12 inches) costs $12.00. Suppose a 24-inch pizza costs $24.00. Which pizza is the better buy? Explain why this pizza is the better buy. (Assume both pizzas have the same thickness.)

AP Calculus AB &BC

Change at an instant, summing infinities, philosophy and the universe.

You ever heard the phrase – "well its not rocket science." With AP Calculus I'm proud to share – it finally IS rocket science.

Humanity began this journey with Xeno's thought experiment and it literally took us to new heights. We are the only species from earth to master enough mathematics to explore beyond its safety and look back at ourselves to ask . . . why?

Assignment 1 2025

Introduction: Congratulations on making the choice to challenge your intellect and improve your character! This course will be demanding, thought-provoking and rewarding. The path to a life of happiness is stability – for better, or worse, you were born in a time of human history when more mathematical power buys greater access to stability.

AI and deeply-divisive social issues have the next generation questioning the role of school and math in a world where you can ask AI to complete any homework assignment and when people seem to make millions sharing their lives on social media. You should be worried about a future where 100's of millions of people use a service that only a small handful control or understand how it's created and how it works. We'll need your experience and wisdom at the table where humanity's biggest questions are being debated.

Success in math and science could be a pathway to join these conversations. It will amplify your voice and life story to the only platform that can make a difference long term. Push yourself, humanity needs you and calculus, and mathematics at large, can be a tool to influence, understand and predict change in the world.

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Calculus AB versus Calculus BC

How does College Board describe the difference?

COLLEGE BOARD
October 22, 2021

What are AP Calculus AB and AP Calculus BC?

AP Calculus AB is an introductory college-level course in calculus that explores the concepts and applications of differential and integral calculus. This AP course culminates in an AP Exam that's designed to test your understanding of the theoretical basis of course content and your ability to solve problems by applying your knowledge and skills.

AP Calculus BC is similar to AP Calculus AB. It explores the same concepts and applications, only it adds a few new topics. In other words, AP Calculus BC covers more content than AP Calculus AB, though both courses require you to apply the same skills.

How AP Calculus AB and AP Calculus BC are similar

The two courses cover content and skills that are introduced in a first-semester calculus course at the college level. **All topics in the eight units of AP Calculus AB are included in AP Calculus BC.**

These are the topics taught in both courses:

- Limits and continuity (Unit 1)
- Differentiation: Definition and fundamental properties (Unit 2)
- Differentiation: Composite, implicit, and inverse functions (Unit 3)
- Contextual applications of differentiation (Unit 4)
- Analytical applications of differentiation (Unit 5)
- Integration and accumulation of change (Unit 6)
- Differential equations (Unit 7)
- Applications of integration (Unit 8)

Because both courses and exams cover many of the same topics, the prerequisites needed for both courses and exams are comparable. Recommended mathematics courses to take before either AP Calculus AB or AP Calculus BC include those in which you study algebra, geometry, trigonometry, analytic geometry, and elementary functions.

How AP Calculus AB and AP Calculus BC are different

AP Calculus AB focuses on topics that are taught in the **college-equivalent first-semester calculus class**. AP Calculus BC focuses on topics covered in **both first- and second-semester calculus classes**.

All topics in the eight units of AP Calculus AB are also included in AP Calculus BC. However, AP Calculus BC contains **two additional units (Units 9 and 10), plus some extra topics in Units 6–8.**

These topics are only taught in AP Calculus BC:

- Additional techniques of integration (Unit 6)
- Euler's method and logistic models with differential equations (Unit 7)
- Arc length and distance traveled along a smooth curve (Unit 8)
- Parametric equations, polar coordinates, and vector-valued functions (Unit 9)
- Infinite sequences and series (Unit 10)

Calculus AB versus Calculus BC

How does Perez describe the difference?

What are my long-term goals in math, science, or engineering? Am I aiming for STEM majors, selective schools, or advanced placement in college? TEIR 1 Universities?	*If you're excited by deep mathematical thinking or plan to enter a highly quantitative field, BC may give you a head start. AB is a solid and respected foundation for all paths.*
How confident do I feel about my math skills and pace of learning? Do I enjoy challenges, or do I prefer a steadier, more reflective pace?	*BC moves faster and covers more material, while AB allows for deeper exploration of core concepts. Both can be rewarding—pick the pace that lets you thrive, not just survive.*
Have I had strong success with Algebra, Geometry, Precalculus, and Trigonometry?	*BC builds directly on Precalculus, especially series and parametric functions. If those ideas felt intuitive, you may love BC. If not, AB can give you more time to build mastery. We can also check how well you did on the AP precalculus Exam. Passing the exam is a good indicator.*
Do I enjoy solving complex problems and connecting ideas across multiple topics?	*BC will ask deeply conceptual and creative questions that put together all your learning all courses since middle school. AB does the same but the AP test is more focused and narrow – often times you can guess what they expect. Either way you'll expand your thinking!!*
How much time and energy can I realistically dedicate to this course next year? Consider other APs, extracurriculars, jobs, family responsibilities	*You deserve balance. Choosing AB doesn't mean you're not ambitious—it means you're being wise about how you grow. BC is a good fit if you can devote consistent effort. This is the single most important factor. Will you give most*
Am I excited to possibly earn more college credit or place into higher college math?	*BC often earns credit for two semesters of college calculus. while AB often covers just the first. Either way, colleges value both!*

What does my gut say?

Creating a story of excellence requires more than just math. Plan time around this course to give back to others and uplift your community. If BC is your route, master time management, effort, and GANAS! Calculus AB is an opportunity for most people from Lake Elsinore. Both classes are a call to action and offer the chance to give back to those you love. BC suits those committed to STEM as their way of giving back, requiring extra time and sacrifice. AB opens doors in higher learning across all majors. Either class would be the right choice.

Common Misconceptions

Introduction: Every year of calculus students struggle. Its part of the experience. They key is to make sure its productive struggle. Growth happens when things get tough, but you should never feel like you're drowning! When you are challenged this year – lets make sure you have the basics covered.

Overview of Task 1: The AlgebaBros (from flipped mathematics "Mr. Bean") have put together a list of Algebra questions that students often struggle with. As you complete this think to yourself, "what exactly do you think students are struggling with?" Is the issue factual, procedural, conceptual or a combination.

Details (How to get credit): Complete each of these questions then complete the steps below to unpack what makes calculus so difficult for so many students.

Step 1: *There are 90 questions so pace yourself. They are organized into groups. Complete 1 group then answer the reflection questions.*

Use this link to find the problem set

Step 2: *Repeat this process. For the next group of questions. Look through the solutions guide. Use it to help you with any question you need some small guidance on.*

Use this link to find the solutions to the problem set.

Step 3: *Last move is to vote for the topics of our first misconception study session. You will have an Exam on these questions, I'll need to know which questions you would like extra support with! Complete this survey. It will take awhile to complete so don't procrastinate on this part.*

Use this link to give feedback about your confidence on the problem set questions.

Conceptual Knowledge: Big Questions

Introduction: Xeno was questioning the idea of motion – his quest led humanity to the discovery and invention of calculus through Newton and Leibniz. However, even these geniuses left out one essential question to their discoveries.

Semester 1 Essential Question (don't answer this yet)
Can change occur at an instant? We'll need to break this question into its smaller parts below.

Essential Question 1: Calculus is the study of change. How would you define change? Think of this philosophically and also in terms of physics.

Essential Question 2: It's difficult to describe change, without evoking time. So, what is time? Think of this philosophically and also in terms of physics.

Video Break: Check out this video to inspire you.

Essential Question 3: So now you you've thought about time – what about a moment in time? What is present? How long is it? What is an instant?

Essential Question 4: What would Xeno have us think about what an instant is – how long does it last? How many instant moment make up an hour? So shouldn't an hour be . . .

Conceptual Knowledge: BC ONLY

Introduction: Xeno was questioning the idea of motion – his quest led humanity to the discovery and invention of calculus through Newton and Leibniz. However, we never actually added up Xeno's list using mathematical calculations

Semester 2 Essential Question (don't answer this yet)
Can you capture infinity? Not all lists that are never-ending can be summed up to a fixed total – but some can. How do we know which ones can and cannot?

Essential Question 1: Show how to add the numbers from 1 to 10. Can you think of a strategy to make this more efficient? Short cut?

Video Break: Check out this video to inspire you.

Essential Question 2: Gauss had the inspiration to add a large list of numbers by introducing a second list – what was the usefulness of this second list?

Essential Question 3: How do you the Gauss's idea would work for a list that is much bigger than 1 to 100. What do you think would need to change use Gauss's idea for a never-ending list?