


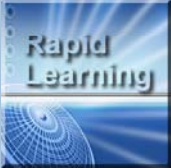
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Rapid Learning Center Present ...

Teach Yourself
AP Calculus AB Visually in 24 Hours




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 **Introduction to AP
Calculus AB**

Rapid Learning Tutorial Series

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Learning Objectives

By completing this tutorial, you will:



- Learn the definition and scope of Calculus
- Learn the Definition of AP Calculus
- Learn typical topics covered in AP Calculus AB and AP Calculus BC
- Learn tips for understanding Calculus

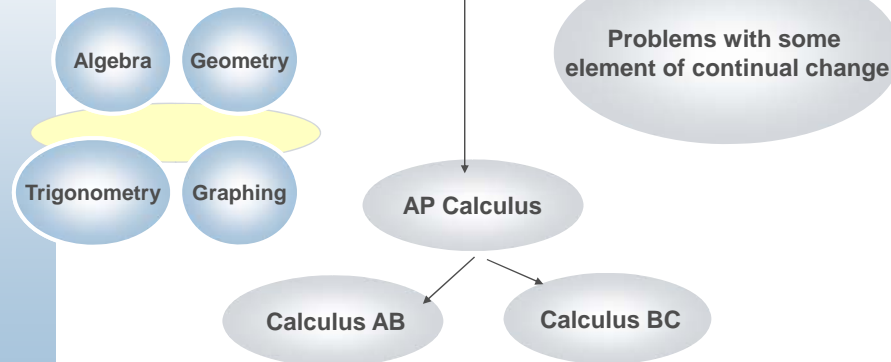
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Concept Map


Previous content

New content





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What is Calculus?




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Definition: Calculus - 1

Calculus is the study of how things **change**.

Whereas **Algebra**, **Arithmetic**, and **Geometry** are sufficient to study many types of problems, they are not suitable to study problems where there is some type of continual change. These types of problems require **Calculus**.



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Definition: Calculus - 2

Consider the problem of finding the **surface area** of the roof of a building.

In some cases, it would be easy to do using only **Geometry** or **Algebra** because there are non-complicated flat-like surfaces.



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Definition: Calculus - 3

But in other cases, it would be a much harder problem because of **irregular shapes** and **constantly changing** quantities.



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Where Did Calculus Come From?

In the 1680's two men, **Gottfried Leibniz** and **Isaac Newton**, independently developed the foundations that led to Calculus.



Leibniz



Newton

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How Is It Done?

Since Calculus is the mathematics of calculating problems that are continually **evolving**, the process can sometimes be complicated.



Generally speaking, there are **three steps** to Calculus problems.

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Calculus Problem Solving - Step 1

Breaking down the problem into **infinitesimally** small pieces.

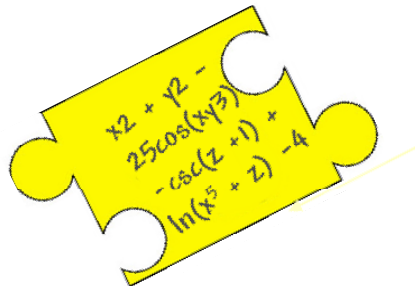


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Calculus Problem Solving - Step 2

Solving each **individual** piece



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Calculus Problem Solving - Step 3

Adding the results of each individual calculation.



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Piecing It Together

For example, even with an irregularly shaped roof, it could be broken down into **small pieces**.

The surface area of **each small piece** would be relatively easy to find.




Adding together the surface area of all of the small pieces gives a good **estimate** of the surface area of the entire roof.


The **smaller** the individual pieces, the **better** the estimate.


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What is AP Calculus?





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Definition: AP Calculus

- **Advanced Placement (AP) Calculus** is one of two calculus courses offered by the College Board for high school students. These courses are **AP Calculus AB** and **AP Calculus BC**.
- AP Calculus courses emphasize a multi-representational approach with concepts, results, and problems being expressed graphically, numerically, analytically, and verbally.
- AP Calculus allows the student to seek college credit, college placement or both from colleges and universities by taking the AP Exam.



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Pre-requisites for AP Calculus

- **Four years of college prep mathematics:**
 - Algebra
 - Geometry
 - Trigonometry
 - Analytic geometry
 - Elementary functions.



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Algebra for Calculus

- Simplifying exponents, radicals, and logarithms and fractional expressions
- Factoring polynomials
- Solving equations and solving inequalities



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Geometry for Calculus

- Perimeter and area formulas of all two dimensional shapes
- Surface area and volume formulas of all regularly shaped three dimensional figures
- Coordinate Geometry including the midpoint and distance formulas
- Pythagorean Theorem



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Trigonometry for Calculus

- Radian and degree measurement of angles
- The unit circle
- Definitions of the six trigonometric functions: sine, cosine, tangent, cosecant, secant, cotangent
- Graphs for the six trig functions and their inverses.
- Basic trigonometric identities including the pythagorean identities and the reciprocal identities



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Pre-requisite Course - Precalculus

- Familiarity with properties, the algebra, and the graphs of the following families of functions: linear, polynomial, rational, exponential, logarithmic, trigonometric, inverse trigonometric and piecewise defined functions.
- Understanding of the language of functions including: domain and range, odd and even, periodic, symmetry, zeros, and intercepts.
- Know the values of trigonometric functions at the following numbers and their multiples:

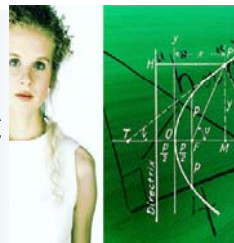
$$0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2}$$



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Calculus AB vs. BC



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What's the Difference?

The traditional Calculus course sequence in college is broken into three semesters: Calculus I (limits, derivatives, beginning integration), Calculus II (advanced integration, infinite series, introductory differential equations, parametric equations), and Calculus III (multivariable functions and vector calculus).



AP Calculus AB is the equivalent of Calculus I (one semester of college calculus taught over one year of high school.)

AP Calculus BC is equivalent to Calculus I *and* Calculus II (two semesters of college calculus taught over one year of high school).

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Which One to Take?

AP Calculus AB is generally considered equivalent to a college or university Calculus 1 course

AP Calculus BC is generally considered equivalent to a college or university Calculus I and Calculus 2 course. The AP exam for Calculus BC contains approximately 60% of the information from Calculus AB exam.



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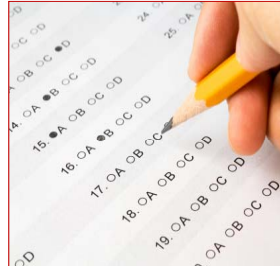


What is the AP Exam?

- Each AP course has a corresponding comprehensive exam given in May. AP exams consist of two sections: multiple choice and free response.
- AP exams are scored on a 5 point scale. The raw scores from multiple choice and free response are summed to give a composite score.

Score Interpretation

5	Extremely well qualified
4	Well Qualified
3	Qualified
2	Possibly Qualified
1	No recommendation

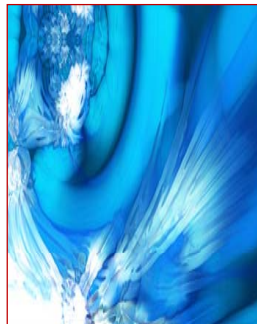


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Topics in AP Calculus AB

The general topics covered in AP Calculus AB are:



- Analysis of Graphs
- Limits and Continuity of Functions
- Derivatives and Higher Order Derivatives
- Applications of Derivatives
- Integration
- Applications of Integration

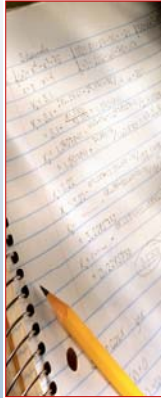
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Topics in AP Calculus BC

The general topics covered in AP Calculus BC are:



- Analysis of Graphs
- Limits and Continuity of Functions, including parametric, polar and vector.
- Derivatives and Higher Order Derivatives including parametric, polar and vector functions.
- Applications of Derivatives including using Euler's method and L'Hopital's Rule
- Integration
- Applications of Integration
- Polynomial Approximations and Series

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Use of Graphing Calculators

Graphing calculators are an integral part of both AP calculus courses.


Technology should be used on a regular basis and students are expected to use them on the AP exam to perform the following:




- (1) Plot the graph of a function within an arbitrary viewing window.
- (2) Find the zeros of functions (solve equations numerically).
- (3) Calculate the derivative of a function numerically.
- (4) Calculate the value of a definite integral numerically.


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Applications of Calculus




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What's It Good For?


The question is

What is Calculus good for?



Calculus is deeply integrated into every branch of the **sciences**. The applications are endless. . .

Following are some of the **general types** of problems found in Calculus.

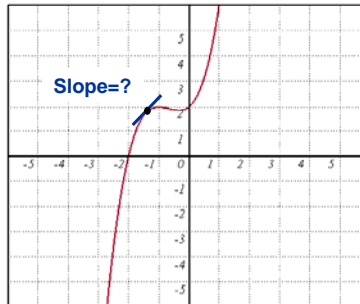
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Slope of a Curve - 1

Any curve that is not a line is constantly changing.

Calculus can help to find the **slope of the curve** at a single point.



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Slope of a Curve - 2

These slopes contain information such as the **velocity** of a moving object, the **force** in a certain direction, or the **rate** at which a quantity is changing.



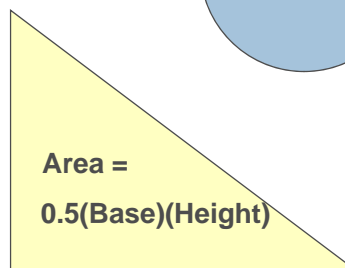
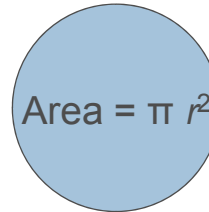
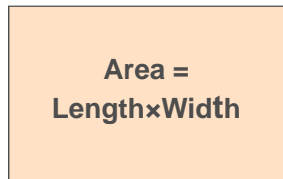
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Area of Irregular Shapes - 1

Some geometric figures have well-known formulas for the area.

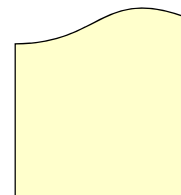
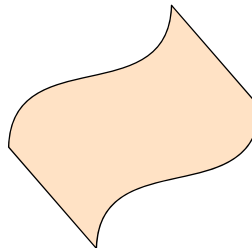
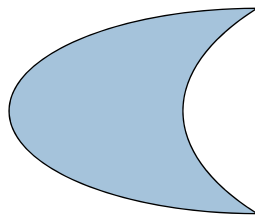


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Area of Irregular Shapes - 2

Irregularly shaped figures generally do not have a formula but Calculus can help find the **area** anyway.



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Area of Irregular Shapes - 3

Knowing the area of irregular shapes can help to determine . . .



. . . how many bricks are needed for a curved wall



. . . how much paint is needed for a room with curves

. . . how much glass is needed for an irregularly shaped building

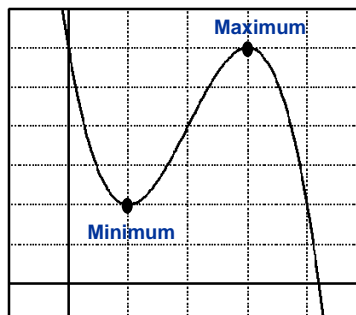


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Maximizing/Minimizing Functions - 1

Calculus can help to find the **maximum** or **minimum** values of a function.



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Maximizing/Minimizing Functions - 2

Knowing the maximum or minimum value of a function can help to determine . . .



. . . the **maximum** profit of a company



. . . the **minimum** amount of fence needed to enclose a fixed area

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How to Study Calculus



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Know Prerequisite Material

Mathematics in general is a **cumulative subject**. Calculus is no exception. Knowing the **prerequisite material** will make Calculus much easier.



Prerequisite Material Includes:

- Algebra
- Geometry
- Trigonometry
- Graphing

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Read Your Math Book

Remember that your **math book** is there to help you understand the content.



- Read your book carefully.
- Write down questions as you have them.
- Work through any steps that your book may skip over.

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Ask Questions

If you have trouble understanding the material, **ask questions**.



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Study With a Group

Your **classmates** are trying to learn the same material that you are. Take advantage of it.



- Organize a study group.
- Compare lecture notes.
- Work homework together.

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Get Something Out of the Study Group

Remember that you will be tested **individually**. When studying with a group, be sure to get something out of it.



- Be an active member of the study group.
- Work some exercises alone.

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Focus on the Concepts


Everything may not make sense all at once. Focusing on the **concepts** and how the **procedures** fit into the **big picture** will help you succeed in Calculus.



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Learning Summary




Skillful use of Graphing calculators is an integral part of both AP Calculus courses.

Calculus is the study of how things **change**.

Calculus problems involve finding **slopes** of curves, **areas** of irregular shapes, and **optimization** of functions.

The College Board offers two advanced placement calculus courses, Calculus AB and Calculus BC.

Both AP Calculus courses **topics** include Limits, Differentiation, Integration, and Applications.


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Congratulations

You have successfully completed the core tutorial

Introduction to AP Calculus AB

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What's Next ...

Step 1: Concepts – Core Tutorial (Just Completed)

→ Step 2: Practice – Interactive Problem Drill

Step 3: Recap – Super Review Cheat Sheet

Go for it!



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