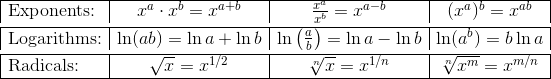
**Pre-Calculus Concepts**

Mathematics tends to build upon earlier mathematics, and calculus is no different.

* **General problem solving strategies**. This includes using context clues and identifying the *givens* and the *goals* of a problem.
* **Logic**. Strong helps to piece together various approaches to a given problem and helps in using theorems and properties.
* **Arithmetic**. A large part of the exam does not allow a calculator. You will have to know how to add, subtract, multiply and divide numbers, including fractions and decimals. Therefore, if you have relied on your calculator all throughout high school, now is the time to get back to basics.
* **Algebra**. This includes simplifying and interpreting algebraic *expressions* as well as setting up and solving algebraic *equations*. (Yes, there is a difference — an equation has an equals sign, while an expression does not.) Be familiar with the properties of exponents, logarithms, radicals, etc.



* **Geometry**. Know your basic perimeter, area, volume, and related formulas. Follow [this link](http://mdk12.msde.maryland.gov/instruction/curriculum/hsa/geometry/math_reference_sheet.html) for a comprehensive formula sheet.
* **Trigonometry**. Definitions must be memorized (“*SOH CAH TOA*“) as well as the most often used trig identities. Memorize the Unit Circle and Pythagorean Identities.
* **Pre-Calculus**. Know how to graph functions and how to interpret graphs. Be very familiar with linear functions, especially the concept of **slope**.

**Big Idea 1. Limits and Continuity**

* Know how to find limits algebraically or by estimating from numerical or graphical data.
* Definition of continuity in terms of limits. Check out [Limits and continuity](https://magoosh.com/hs/ap-calculus/2017/ap-calculus-exam-review-limits-continuity/).
* **Intermediate Value Theorem (IVT)**

If *f* is continuous on a closed interval [*a*, *b*], and if *L* is any number between *f*(*a*) and *f*(*b*), then there is at least one value *x* = *c* on the interval such that *f*(*c*) = *L*.

* **Extreme Value Theorem (EVT)**

If *f* is continuous on a closed interval [*a*, *b*], then *f* attains both an absolute maximum and minimum value on the interval.

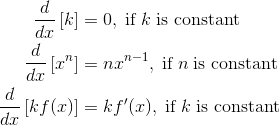
* Limits whose values are infinite and their relationship to [vertical asymptotes](https://magoosh.com/hs/ap-calculus/2017/find-vertical-asymptotes-function/)
* Limits as *x* → ±∞ and their relationship to [horizontal asymptotes](https://magoosh.com/hs/ap-calculus/2017/find-horizontal-asymptotes/)
* [Oblique asymptotes](https://magoosh.com/hs/ap-calculus/2017/oblique-asymptotes/)

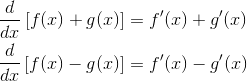
**Big Idea 2. Derivatives and Their Applications**

* Limit definition of the [derivative](https://magoosh.com/hs/ap-calculus/2016/derivatives-ap-calculus-ab-bc-exams/)

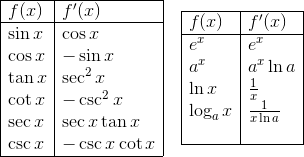
Limit definition of the derivative

* If a function is **differentiable** at a point, then it must also be **continuous** at that point. But not necessarily the reverse — for example, |*x*| is continuous at *x* = 0, but not differentiable there.
* Basic derivative rules.





* Derivatives of trigonometric, exponential, and logarithmic functions.



* [Product Rule](https://magoosh.com/hs/ap-calculus/2017/ap-calculus-review-product-rule/) and [Quotient Rule](https://magoosh.com/hs/ap-calculus/2017/ap-calculus-review-quotient-rule/)

Product Rule

Quotient Rule formula

* [Chain Rule](https://magoosh.com/hs/ap-calculus/2017/mastering-chain-rule/)

Statement of the Chain Rule

* The **tangent line** to the curve *y* = *f*(*x*) at a point *x* = *a* is measured by the derivative: *f* '(*a*).
* If *s*(*t*) is a **position** function, then
  + **Velocity** is *v*(*t*) = *s* '(*t*), and
  + **Acceleration** is *a*(*t*) = *s* ''(*t*).
* *Further topics and applications:*
  + Implicit Differentiation, [Analysis of Graphs](https://magoosh.com/hs/ap-calculus/2017/ap-calculus-exam-review-analysis-graphs/), including intervals of increase/decrease, relative minima/maxima, intervals of concavity, and inflection points.
  + [Mean Value Theorem](https://magoosh.com/hs/ap-calculus/2017/ap-calculus-review-mean-value-theorem/) and Rolle’s Theorem
  + Optimization
  + Related rates
  + Elementary differential equations and slope fields

**Big Idea 3. Integrals and Their Applications**

* Rules and formulas of Antidifferentiation

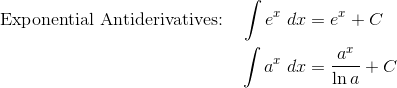
Power rule for integrals

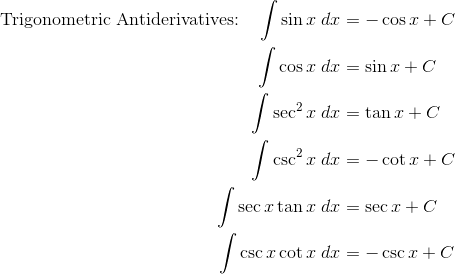
Sum and difference rule for integrals

Constant multiple rule for integrals

Constant Function Rule

Rule for 1/x





* Integration by **Substitution**

Substitution Rule

* The Fundamental Theorem of Calculus (both parts)

Definite integral of f(x) from x=a to x=b

Second Fundamental Theorem of Calculus

* Area below a curve

Area below f by definition integration

* Area between curves, with *f* on top and *g* on bottom

Area between f and g by definite integration

* Volumes of solids of revolution by washer method and shell method.

Washer method

Shell Method

* *Further topics and applications:*
  + Estimating area or displacement by finite Riemann sums or Trapezoid Rule
  + Average value of a function over an interval
  + Models for exponential growth and decay