

What you need to know for Exam 1

You should know Trigonometry, including the definitions of the Circular Functions and their (wave) graphs and then values for different Quadrants. Also, Derivatives in Chapter 2, including the new Trigonometric derivatives. Also, Section 3.9 on Antiderivatives, including Equations of Motion. The following is a list of most of the topics covered. **THIS IS NOT A COMPREHENSIVE LIST, BUT MERELY AN AID.** Remember, no calculators in any exams.

- 2.3: Differentiation Rules: Sum, Difference, Constant Multiple, Product, Quotient, Power. Know how to use them.
- 2.4: Know the derivatives of the Trigonometric functions. Know how to compute Tangent Line Equations involving Trig functions. Label everything carefully.
- 2.5: Chain rule. Know it well... Be able to compute derivatives involving both chain rule and quotient/product rules, paying attention to the order. Work especially with Trig functions as well. Place parentheses carefully! Remember to prep powers of Trig functions, $\sin^3 x = (\sin x)^3$ so it is clear which is the *outside* or *inside* function.
- 2.6: Implicit differentiation. To find the tangent line to a curve described by some equation involving x and y , we think of y as a function of x , without knowing the actual formula for $y = f(x)$ (hence, an implicit, rather than explicit, function). So if we differentiate with respect to x , we must remember that y is a function of x and use the chain rule (or product rule, or quotient rule) when appropriate. We revisited this section mainly with respect to Trig functions where the variables x and y are all *mixed up*.
- 2.8: Related rates involving Trig functions. Know the method (either the steps listed in the book, or the steps I listed in class and on the tips handout!). Write down the *Key Moment* Given information and also what you are trying to solve for. It will help guide you towards your Equation. Make sure not to substitute given values until **after** you have differentiated and formed an equation involving *rates that are related*. Label all parts of the solution and give a final answer in words.
- 3.9: Antiderivatives. Given a function f , know the definition of *an* Antiderivative of f , and know the definition of *the* (Most General) Antiderivative of f . Know how to compute the most common antiderivatives that we have seen. Know the Antidifferentiation Rules to split up your Antiderivative into simpler pieces. KEY: If you work with Products or Quotients of powers of x , then you must use Algebra to first simplify your function. Remember, there is **no** antiderivative rule for Products or Quotients. Next, know how to solve Initial Valued Differential Equations using Antidifferentiation and the given point information. Also, know the applications to these Initial Valued problems, that is, the Physics type problems involving Position, Velocity, and Acceleration. Remember the Falling Body Equations of Motion. Read the problem carefully to pick off given information.

Common Types of Problems to Prepare, Know how to ...

- Compute Trig Values in all 4 Quadrants. Justify using the Unit Circle and the special Trig Triangles and symmetry.
- Be able to plot the $\sin x$, $\cos x$, and $\tan x$ (periodic) wave function graphs.
- Computes Derivatives of Trig functions using the Constant Multiple, Power, Product, Quotient, and Chain Rule(s), etc, including evaluation at a given angle value.
- Be able to **PROVE** that $\frac{d}{dx} \tan x = \sec^2 x$ and $\frac{d}{dx} \sec x = \sec x \tan x$.
- Compute Equation of Tangent Line involving Trig Functions.
- Compute the Derivative using Implicit Differentiation involving Trig functions.
- Solve Related Rates word problems involving Trig and Angular information.
- Compute Antiderivatives. Find the Most General Antiderivative involving all Power Rules, Constant, Constant Multiple Rules and Trig functions too. **Remember to add $+C$** as the constant of Antidifferentiation so you present all functions that share that same given derivative. TIP: Remember if you are given a function involving a Product or Quotient of powers of x then you must simplify using algebra and finish using Power Rules. Always **prep** your powers to the numerator using exponential algebra. Review all exponential algebra for simplifying your powers.
- Solve *Initial Valued Differential Equations* for a specific Antiderivative.
- Solve Physics type word problems, involving either horizontal linear motion or vertical falling bodies type motion. Compute Position, Velocity or Acceleration given any of the other motion equations. Remember which direction is the Derivative and which is the Antiderivative. A problem may give you Velocity and ask for Position and Acceleration, so you might use *both* differentiation and antidifferentiation. Write down the given info as that might help you solve for $+C$. Know the Equations of Motion using $a(t) = -32 \text{ ft/sec}^2$. Review what each constant $+C$ was for these falling body problems.

$$\begin{array}{c}
 \xrightarrow{\hspace{1cm}} \\
 \text{DIFFERENTIATE} \\
 \frac{d}{dt} \quad \frac{d}{dt} \\
 s(t) \curvearrowright v(t) \curvearrowright a(t) \\
 \int^{\leftarrow} \dots dt \quad \int^{\leftarrow} \dots dt \\
 \xleftarrow{\hspace{1cm}} \\
 \text{ANTIDIFFERENTIATE}
 \end{array}$$

$a(t)$	$= -32$	feet per second ²
$v(t)$	$= -32t + v_0$	feet per second
$s(t)$	$= -16t^2 + v_0t + s_0$	feet