MATH1210: Midterm 2 Study Guide

The following is an overview of the material that will be covered on the first exam.

§2.1 The Idea Behind The Derivative

- The intuitive meaning of the derivative (as the slope of the tangent to the graph of $f(x)$)
- Calculating derivatives from the graph of a function.
- Calculating the equation of the tangent line to a graph at a specified point.

§2.2 The Derivative

- *KNOW THE LIMIT DEFINITION OF THE DERIVATIVE AND BE ABLE TO USE IT.*
- Calculating the derivative of functions using the limit definition.
- Recognizing all the different notations for the derivative (i.e., $f'(x)$, df/dx, $D_x(f)$, etc.).
- Using the graph of $f(x)$ to graph the derivative, $f'(x)$.
- Identifying places where the derivative of a function is not defined using the graph.

§2.3 Rules for Finding Derivatives

- Know the power rule, the sum/difference rule, the constant multiple rule, and the product/quotient rules for differentiating functions.
- Taking derivatives of polynomials and rational functions.
- Problems similar to $45 - 53$ from §2.1.

§2.4 Derivatives of Trigonometric Functions

- Know the pythagorean identity ($\sin^2 x + \cos^2 x = 1$).
- Know the sum and difference of angles formulas (note that the double angle formulas are special cases of these).
- Know the derivatives of the standard trigonometric functions (you can always get away with just knowing sine and cosine, and then deriving the others using the product and quotient rules).
- Prove that $\frac{\mathrm{d}}{\mathrm{d}x}(\cos x) = -\sin x$.
- Find points where the tangent line to the graph of a function is horizontal.

§2.5 The Chain Rule

- *KNOW THE CHAIN RULE AND BE ABLE TO USE IT IN YOUR SLEEP.*
- Computing derivatives using the chain rule.

§2.6 Higher Order Derivatives

- Know how to find higher order derivatives.
- Know the different notations for higher order derivatives.

- The physical interpretation of the first and second derivatives of position with respect to time.

§2.7 Implicit Differentiation

- *KNOW HOW TO DO IMPLICIT DIFFERENTIATION.*

§2.8 Related Rates

- Be able to do related rate problems. This almost always involves using a combination of the chain rule and implicit differentiation.