Math 124 Midterm I Study Guide

Below are the topics you are responsible for the first midterm. Start your review with archived midterms and see which, if any, problems give you trouble and resort to the textbook and lecture notes for anything you feel you need to work extra on. Remember that you will be graded on showing your work as well as the final answer, so look at the solutions of at least a couple of exams to see how much work you are expected to show for a particular kind of problem.

Pre-calculus, Circles and Lines

This was the first week of lectures and the first two homework assignments and quizzes. You need to know the equation of a line

$$y - y_0 = m(x - x_0)$$

and the equation of a circle

$$(x - a)^2 + (y - b)^2 = r^2$$

and the fact that the tangent to a circle is perpendicular to the radial line drawn at that point so their slopes satisfy $m_1 m_2 = -1$.

See the details from lecture notes. For example problems besides the homework questions, you can look at old exams. Note that many problems require **solid algebra skills** including, but not limited to, simplifying, factoring and the use of the quadratic formula. You are also responsible for basic geometry (Pythagorean Theorem, areas, volumes) and trigonometry as prerequisite material covered in algebra and pre-calculus.

Limits and Continuity- Sections 2.2, 2.3, 2.5 and 2.6

1. Determining limits and continuity from a graph.

2. Determining limits and continuity from formulas, including multi-part functions.
   Continuous means the limit equals the function value at a point. For evaluating limits, remember that some will require algebra tricks like factoring, dividing by the highest power and multiplying by conjugate. Those are the indeterminate forms "$\frac{0}{0}$", "$\frac{\infty}{\infty}$" and "$\infty - \infty$". Know which trick is used when. You can use your calculators to verify answers but the calculator values cannot used in place of reasoning on the exam.

The derivative- Sections 2.1, 2.7 and 2.8

1. Determining differentiability and the value of a derivative (approximately) from a graph.

2. Using the limit definition of the derivative

   $$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

   to compute the derivative.

3. Interpreting and working with the graph of the derivative function $y = f'(x)$ as the graph of slopes for the function $y = f'(x)$. This was most of Worksheet 3 and Section 2.8 homework. The relationship between the derivative $f'(x)$ being positive or negative and the function $f(x)$ increasing and decreasing. Also, how do you interpret the derivative (slopes) increasing or decreasing for the original function $f(x)$? Draw pictures, add some tangent lines and see what happens.

4. Interpreting the derivative as instantaneous rate of change. The most familiar example is that of distance and velocity. What are the units of the derivative? Hint: Quotient notation helps.

Differentiation Rules - Sections 3.1-3.3, part of Section 3.4

1. Differentiation rules for x^a (which includes $\sqrt[n]{x}$ and $\frac{1}{x^b}$), e^x, $\sin x$, $\cos x$, $\tan x$, $\sec x$, $\csc x$, $\cot x$.

   The ones you have not memorized yet should go on your note sheet.

2. The sum rule, multiplication by a constant rule (we use these two from Section 3.1 without thinking), the *product rule*, the *quotient rule*.

3. From Section 3.4, you are responsible for using the *Chain Rule* for compositions of two functions, as much as it appears in Part I of that homework.