

# Will's Guide To Life, Volume 1

Math 220

Spring 2009

## Preliminaries

Remember that the work is more important than the final answer! There is a limit on time, so work hard and work efficiently, do not spend all of your time working any one problem. It is better to have studied too much and be over-prepared than to understudy and do poorly.

You will be expected to know the definitions and statements of the major results and ideas covered in lecture. You need to be able to state **all** hypotheses of the Theorems.

## Section 0.1

Lines and slopes. Point-slope and slope-intercept forms of the line. Parallel and perpendicular lines and the relations between their slopes. The precise definition of a function, graph, polynomial, and rational function. The vertical line test. Finding zeroes of functions. Domain and range of a function.

## Section 0.3

Precise definitions of inverse functions and one-to-one functions. The equivalent definitions of one-to-one and how to use them to show a function is one-to-one. The horizontal line test. How to make a function invertible by restricting the domain. Symmetry properties of graphs of inverses.

## Section 0.4

Basic trigonometric functions. Precise definitions of the inverse trigonometric functions. Be very careful with domains! Simplification of compositions of trigonometric and inverse trigonometric functions, **always** using the reference triangle.

## Section 0.5

Rules of Exponents and Rules of Logarithms. How these rules relate to each other. Precise definitions of exponential and logarithmic functions. Graphs of logarithmic and exponential functions. The change of base formulas and common bases. Solving equations with logarithms and exponentials, always being aware of domain issues. The hyperbolic trigonometric functions.

## Section 0.6

The precise definitions of compositions of functions. The basic transformations of functions and their effect on the graph.

## Section 1.1

Some history, the questions and ideas that led to the development of calculus. The limit as the “fundamental unit” of calculus. Estimating the “slope of a curve” through the use of secant lines. Estimating the length of curves with line segments.

## Section 1.2

The idea of a limit. One-sided limits. What has to happen for a limit to exist. Why the limit does not consider the value of the function at the point. Algebraic manipulations that allow you calculate limits. Using graphs to estimate limits. The rigorous (or precise) definition of a limit (think  $\epsilon$  and  $\delta$ .)

## Section 1.3

The Limit Laws with **all** the hypotheses. When the Limit Laws can fail. Functions that behave nicely with limits. More algebraic manipulations that allow you to calculate limits. The Squeeze Theorem. Limits for piecewise-defined functions.

## Section 1.4

Precise definition for a function to be continuous at a point and on an interval, both closed and open. Removable discontinuities, why this name is appropriate. Functions that are continuous. Continuity rules and their relation to the Limit Laws. How limits and continuous functions play together. The Intermediate Value Theorem, why it intuitively makes sense and its applications.

## Section 1.5

Asymptotes: vertical, horizontal and slant. What it means to say that a limit does not exist,  $= \infty$  or  $= -\infty$ . Remembering that the last two are shorthand and specifically what they mean. Limits at infinity. Indeterminate forms and how to deal with them algebraically.

## Other Info

- The exam will test both your knowledge of the concepts and ideas presented as well as your ability to work problems.
- Remember that the right work is far more important than the right final answer.
- Be sure to clearly indicate your final answer to a problem by boxing or circling and labeling it as your final answer.
- The best way to study is to re-read your lecture notes and the book, work through the suggested homework problems and look over your graded work. Learn from the mistakes you have made on quizzes and homework, do not repeat them on the exam.

For more Math 220 related information, be sure to check the course website: [www.math.uiuc.edu/~wgreen4/math220\\_spring09.html](http://www.math.uiuc.edu/~wgreen4/math220_spring09.html)