

Will's Guide To Life, Volume 4

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. Do not waste time simplifying expressions unless specifically directed to do so, or is required to answer the question.

Section 4.1

Antiderivatives. The “ $+C$ ” for any indefinite integral, we can find families of antiderivatives, there is never only one. The Power Rule for antiderivatives. Every derivative you learned is an antidifferentiation rule. General properties of antiderivatives. The natural logarithm as an antiderivative.

Section 4.2

Sums and Sigma Notation. How to set up a basic sum. The index of summation. Some basic sums you need to know in Theorem 2.1. Basic properties of sums. The Principle of Mathematical Induction.

Section 4.3

Area. Using left-hand and right-hand sums to approximate area under a curve. More rectangles give better approximations. The definition of area under the curve and its relation to Riemann Sums. Why we can pick any point in a subinterval in a Riemann Sum.

Section 4.4

The Definite Integral. How sums, area under the curve and the integral relate to each other. The definition of the definite integral, how this relates to Riemann Sums. The idea of signed or algebraic area versus total area, why this idea is useful. How to compute definite integrals from the definition. Basic properties of the definite integral. Average values, the formula and what it means physically. The Integral Mean Value Theorem.

Section 4.5

The Fundamental Theorem of Calculus. How antiderivatives and the area under the curve relate. How antiderivatives and derivatives relate to each other, effectively tying together the two main topics of this course. The area function. Finding derivatives of functions defined by integrals.

Section 4.6

Integration by Substitution. How this relates to the Fundamental Theorem of Calculus and the Chain Rule. How to choose an appropriate substitution, making sure to completely substitute. The logarithmic integral. Substitution in definite integrals, the two ways to deal with this. Never leaving the limits of integration alone.

Section 4.7

Numerical Integration. The Midpoint Rule. The Trapezoidal Rule. Simpson's Rule. The reasons why each rule was developed. How they can improve summation. Why we need these rules.

Section 4.8

The Natural Logarithm as an integral. Defining the natural logarithm by a definite integral. How all the properties of natural logarithms follow from this definition. How this allows us to be sure of the rules we have for differentiating exponential and logarithmic functions.

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