

Midterm I Study Guide for Calculus II

Definitions: *Be able to state these precisely and know what they mean.*

1. The definite integral of a continuous function f on a closed interval $[a, b]$
2. The indefinite integral of a function f . How is this different than the definite integral?

Results: *Be able to state these precisely, including all hypotheses, and be able to use them to compute integrals.*

1. Basic properties of the definite integral (pp. 373-375)
2. The Fundamental Theorem of Calculus I and II
3. Change of Variables (called “The Substitution Rule for Definite Integrals” in the text, p.404)

Proofs: *Be able to give complete and careful proofs of these results.*

1. The Fundamental Theorem of Calculus I and II
2. Change of Variables

Techniques of Integration:

1. Substitution
2. Integration by Parts
3. Using trig identities to compute integrals of trig functions
4. Reverse (trigonometric) substitution
5. Partial Fractions

Ideas: *Be able to write a short paragraph addressing each.*

1. Interpretation of / motivation for the definite integral in terms of the “area problem.” Be able to explain this problem in a way that tells me *why* the definite integral is defined the way it is.
2. Interpretation of the Fundamental Theorem of Calculus I and II as the statement that differentiation and integration are inverse processes.
3. Change of Variables / Substitution is the integral counterpart to the Chain Rule for derivatives.
4. Integration by Parts is the integral counterpart to the Product Rule for derivatives.

Indefinite Integral Formulas and Trigonometric Identities:

1. You must *know* the integral formulas listed as #1-10 and #17 on p.484 of Stewart.
2. You must *know* the following trigonometric identities:
 - $\cos^2 t + \sin^2 t = 1$
 - $1 + \tan^2 t = \sec^2 t$
 - $1 + \cot^2 t = \csc^2 t$
 - $\sin^2 t = \frac{1}{2}(1 - \cos(2t))$
 - $\cos^2 t = \frac{1}{2}(1 + \cos(2t))$
 - $\sin 2t = 2 \sin t \cos t$