Calculus 1, Chapter 5 "Integration" Study Guide

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The following is a *brief* list of topics covered in Chapter 5 of *Thomas' Calculus*.

5.1 Area and Estimating with Finite Sums. Approximation of areas with rectangles, upper sums, lower sums, midpoint rule, improving approximations, applications to distance traveled (displacement and total distance traveled), average value of a function.

5.2 Sigma Notation and Limits of Finite Sums. Sigma notation (index of summation, term of the sum), Algebra of Finite Sums (Theorem 5.2.A), The Sum of Powers of the First n Natural Numbers (Theorem 5.2.B), partition of $[a, b]$, subintervals, concerns over positive and negative functions (heights versus "heights," and areas versus "areas"), Riemann sums, norm of a partition, limits of Riemann sums.

5.3 The Definite Integral. Definite integral of f over $[a, b]$, integrable, definite integrals as limits as $\|P\| \to 0$, difference between definite integral/indefinite integral/antiderivative, using equal-width partitions (i.e., "regular partitions") to evaluate integrals (Note 5.3.A), Integrability of Continuous Functions (Theorem 5.1), a non-integrable unction (Example 5.3.1), Rules Satisfied by Definite Integrals (Theorem 5.2), $\int_a^b c\,dx$ (Exercise 5.3.63), $\int_a^b x\,dx$ (Exercise 5.3.A), $\int_a^b x^2\,dx$ (Exercise 5.3.65), the area under a nonnegative function, definition of average value of a function.

5.4 The Fundamental Theorem of Calculus. Mean Value Theorem for Definite Integrals (Theorem 5.3), motivation of the Fundamental Theorem of Calculus Part 1, Fundamental Theorem of Calculus, Part 1 (Theorem 5.4(a)) and applications, Fundamental Theorem of Calculus Part 2 (Theorem 5.4(b)) and applications to definite integrals, the Net Change Theorem (Theorem 5.5).

5.5 Indefinite Integrals and the Substitution Method. The Substitution Rule (Theorem 5.6), applications of the Substitution Rule and u-substitution, in-

tegrals of $\tan x$ and $\sec x$ (Examples 5.5.7(c) and 5.5.8(b)), integrals of $\cot x$ and $\csc x$ (Exercises 5.5.71 and 5.5.72).

5.6 Substitution and Area Between Curves. Substitution in Definite Integrals (Theorem 5.7), even and odd functions (and Theorem 5.8), area between curves, areas between functions of y, dx and dy "slices."