



## MATHEMATICS 201-BNK-05

Advanced Calculus

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# Integration Formulas

## Definition

$$\int_a^b f(x) dx = \lim_{n \rightarrow \infty} \sum_{i=1}^n f(x_i^*) \Delta x$$

where  $\Delta x = \frac{b-a}{n}$  and  $x_i = a + i\Delta x$  if using RHS.

## Table of Indefinite Integrals

1.  $\int cf(x) dx = c \int f(x) dx$

2.  $\int [f(x) + g(x)] dx = \int f(x) dx + \int g(x) dx$

3.  $\int k dx = kx + C$

4.  $\int x^n dx = \frac{1}{n+1} x^{n+1} + C \quad (n \neq -1)$

5.  $\int \frac{1}{x} dx = \ln|x| + C$

6.  $\int e^x dx = e^x + C$

7.  $\int a^x dx = \frac{a^x}{\ln a} + C$

8.  $\int \sin x dx = -\cos x + C$

9.  $\int \cos x dx = \sin x + C$

10.  $\int \sec^2 x dx = \tan x + C$

11.  $\int \csc^2 x dx = -\cot x + C$

12.  $\int \sec x \tan x dx = \sec x + C$

13.  $\int \csc x \cot x dx = -\csc x + C$

14.  $\int \tan x dx = \ln|\sec x| + C$

15.  $\int \cot x dx = \ln|\sin x| + C$

16.  $\int \sec x dx = \ln|\sec x + \tan x| + C$

17.  $\int \csc x dx = \ln|\csc x - \cot x| + C$

18.  $\int \frac{1}{x^2 + a^2} dx = \frac{1}{a} \arctan\left(\frac{x}{a}\right) + C$

19.  $\int \frac{1}{\sqrt{1-x^2}} dx = \arcsin x + C$

## Techniques

Substitution:  $\int f(x) g'(x) dx = \int f(u) du$  where  $u = g(x)$

$$\int_a^b f(x) g'(x) dx = \int_{g(a)}^{g(b)} f(u) du$$

Integration by parts:  $\int u dv = uv - \int v du$