

Lecture 5

5.4 Indefinite Integrals

Definition 1. An **indefinite integral** of a function f is antiderivative of the function f , that is

$$\int f(x)dx = F(x) \quad \text{such that} \quad F'(x) = f(x)$$

Table of Indefinite Integrals

$$\int x^n dx = \frac{1}{n+1}x^{n+1} + C$$

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

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

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

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

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

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

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

$$\int \sec x \cdot \tan x dx = \sec x + C$$

$$\int \csc x \cdot \cot x dx = -\csc x + C$$

$$\int \frac{dx}{1+x^2} = \tan^{-1} x + C$$

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

Integrating Rules

- 1 Constant Multiple Rule $\int cf(x)dx = c \int f(x)dx$
- 2 Sum Rule $\int(f(x) + g(x))dx = \int f(x)dx + \int g(x)dx$
- 3 Difference Rule $\int(f(x) - g(x))dx = \int f(x)dx - \int g(x)dx$

Theorem 1. Net Change Theorem

The integral of the rate of change is the net change:

$$\int_a^b F'(x)dx = F(b) - F(a)$$