Salahaddin University-Erbil
College of Engineering
Department of Architectural Engineering
First Year Students
2nd Semester

Mathematics I
Integration
Indefinite Integration and Substitution Rule (Ch.4)

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Integration

- Integration is used to find the length of curved paths, cross section area of machine parts, and volume.

Indefinite integration

The function f is called the indefinite integral of f with respect to x, and is symbolized by

$$\int f(x)\, dx$$

Corollary: if $f'(x) = 0$ for all x in interval I then f has a constant value of I, that there is a constant c such that $f(x) = c$ for all x in I.

Definition

If the function $f(x)$ is a derivative then the set of all antiderivatives of f is the indefinite integral of f with respect to x

$$\int f'(x)\, dx = f(x) + c$$

Power Rule

$$\int u^n du = \frac{u^{n+1}}{n+1} + c$$

- Examples

$$\int 2x.dx$$

$$\int \sqrt{1+y^2}.2ydy$$

$$\int \sqrt{4t-1}dt$$

Rules of Algebra for antiderivatives

1. Constant multiple rule

$$\int kf(x)dx = k \int f(x)dx$$

2. Rule for negatives

$$\int -f(x)dx = - \int f(x)\,dx$$

3. Sum and difference rule

$$\int [f(x) \pm g(x)]dx = \int f(x)dx \pm \int g(x)$$

Basic trigonometric functions integration formulas

- $\int \cos u\, du = \sin u + c$

- $\int \sin u\, du = -\cos u + c$

- $\int \sec^2 u\, du = \tan u + c$

- $\int \csc^2 u\, du = -\cot u + c$

- $\int \sec u \tan u\, du = \sec u + c$

- $\int \csc u \cot u\, du = -\csc u + c$