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DEPARTMENT OF MATHEMATICS

21UCR304: BUSINESS CALCULUS AND FINANCIAL COMPUTATION

ELEMENTARY INTEGRAL CALCULUS

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What Is an Integral?

Definition

- Integral is the reverse process of differentiation.
- It represents **accumulated quantity** such as area, distance, or total change.

General Form

- $\int f(x)\,dx = F(x) + C$

  (where $F'(x) = f(x)$)

Types of Integrals

1. Indefinite Integral

- No limits
- Produces a family of functions

2. Definite Integral

- Has limits a to b
- Gives a numerical value
- Represents area under a curve

Basic Integration Rules

1. Power Rule

- $\int x^n \, dx = x^{n+1} / (n+1) + C$

2. Constant Rule

- $\int k \, dx = kx + C$

3. Sum Rule

- $\int [f(x) + g(x)] \, dx = \int f(x) \, dx + \int g(x) \, dx$

4. Difference Rule

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

StanMathematicsrd Integrals

Common Results

- $\int 1/x \, dx = \ln|x| + C$
- $\int e^x \, dx = e^x + C$
- $\int a^x \, dx = a^x / \ln(a) + C$
- $\int \sin(x) \, dx = -\cos(x) + C$
- $\int \cos(x) \, dx = \sin(x) + C$

Definite Integral

Definition

$\int$ from a to b f(x) dx = F(b) - F(a)

Properties

- If a = b → value is 0
- If a > b → integral becomes negative
- $\int$ from a to b (f(x) + g(x)) dx = $\int$ f(x) dx + $\int$ g(x) dx

Problem

Evaluate

$\int (3x^2 + 5x + 2)\, dx$

Solution

Step 1: Integrate term by term

- $\int 3x^2\, dx = x^3$
- $\int 5x\, dx = (5x^2)/2$
- $\int 2\, dx = 2x$

Step 2: Combine

Answer = $x^3 + (5x^2)/2 + 2x + C$

THANK YOU