Dr.SNS RAJALAKSHMI COLLEGE OF ARTS AND SCIENCE
(Autonomous)
Accredited by NAAC – UGC with 'A+ Grade (Cycle IV)
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Coimbatore- 49

DEPARTMENT OF MATHEMATICS

21UCR304: BUSINESS CALCULUS AND FINANCIAL COMPUTATION

INTEGRATION BY PARTS

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Introduction

- Used when integrand is a **product of two functions**
- Based on the product rule of differentiation
- Very useful for:
  - Algebraic × exponential
  - Algebraic × trigonometric
  - Logarithmic/exponential × polynomial

Formula (Main Rule)

From Product Rule:

$$\frac{d}{dx}(uv) = u\frac{dv}{dx} + v\frac{du}{dx}$$

Integrating both sides:

$$\int u\,dv = uv - \int v\,du$$

Choosing u and dv – LIATE Rule

LIATE Preference Order

Choose u based on:

1. L – Logarithmic ($\ln x$)
2. I – Inverse Trigonometric ($\tan^{-1}x$)
3. A – Algebraic (x^n)
4. T – Trigonometric ($\sin x$, $\cos x$)
5. E – Exponential (e^x)

Example 1

Evaluate:

$$\int xe^x dx$$

Choose:

- $u = x$
- $dv = e^x dx$

Then:

- $du = dx$
- $v = e^x$

Apply formula:

$$\int xe^x dx = xe^x - \int e^x dx$$

$$= xe^x - e^x + C$$

$$= e^x(x-1) + C$$

Example 2

Evaluate:

$$\int x \sin x \, dx$$

Choose:

$u = x,\ dv = \sin x dx$

So:

- $du = dx$
- $v = -\cos x$

Apply formula:

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

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

Example 3

Evaluate:

$$\int \ln x \, dx$$

Choose:

$u = \ln x, \; dv = dx$

Then:

- $du = \frac{1}{x} dx$
- $v = x$

Apply formula:

$$\int \ln x dx = x \ln x - \int x \cdot \frac{1}{x} dx$$

$$= x \ln x - \int 1 dx$$

$$= x \ln x - x + C$$

THANK YOU