LEC16 - Integration By Parts Continued

February 11, 2025

Section 3.1

Warm-Up Problem

For which of the following integrals is integration by parts a suitable method?

1. $\int \arctan(3x)\,dx$ 2. $\int 3x\cos(\pi x)\,dx$ 3. $\int xe^{x^2}\,dx$ 4. $\int x^2 e^x$

Example

Evaluate $\int e^x\cos(2x)\,dx$

$u = \cos(2x)$ $\quad dv = e^x$

$du = -2\sin(2x)$ $\quad v = e^x$

$$\Rightarrow \int e^x\cos(2x)\,dx = e^x\cos(2x) + 2\int e^x\sin(2x)\,dx$$

$u = \sin(2x)$ $\quad dv = e^x$

$du = 2\cos(2x)$ $\quad v = e^x$

$$\Rightarrow \int e^x\cos(2x)\,dx = e^x\cos(2x) + 2\left[e^x\sin(2x) - 2\int e^x\cos(2x)\,dx\right]$$

$$\Rightarrow 5\int e^x\cos(2x)\,dx = e^x\cos(2x) + 2e^x\sin(2x)$$

$$\Rightarrow \int e^x\cos(2x)\,dx = \frac{e^x\cos(2x) + 2e^x\sin(2x)}{5}$$