

INTEGRATION BY PARTS (§6.3)

"LIPET"

A method of integration that **undoes the product rule**.

Using the product rule to find derivative of a product of two function u and v gives us

$$(uv)' = u'v + v'u$$

Taking the antiderivative (and replacing u' and v' with du and dv) of both sides yields

$$uv = \int v du + \int u dv$$

Solving for $\int u dv$ means that

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

To integrate the left side, determine which part of the integral is u and which part is dv .

"**LIPET**" ... is a guideline for which part to make u .

L = logarithm functions

I = inverse trig functions

P = polynomial functions

E = exponential functions

T = trig functions

Example: $\int xe^x dx$

According to *LIPET* ... Let $u = x$, and $dv = e^x dx$.

This means that $du = dx$ and $v = e^x$...

"Get du by taking the differential of u , and get v by taking the antiderivative of dv "

Plugging all this into $\int u dv = uv - \int v du$, we see that

$$\begin{aligned}\int xe^x dx &= x \cdot e^x - \int e^x dx \\ &= x \cdot e^x - e^x + C\end{aligned}$$