

Introduction to Integration by Parts

Unlike the previous method, we already know everything we need to understand integration by parts. Integration by parts is like the reverse of the product formula:

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

combined with the fundamental theorem of calculus.

To derive the formula for integration by parts we just rearrange and integrate the product formula:

$$\begin{aligned}(uv)' &= u'v + uv' \\ uv' &= (uv)' - u'v \\ \int uv' dx &= \int (uv)' dx - \int u'v dx \\ \int uv' dx &= uv - \int u'v dx\end{aligned}$$

The integration by parts formula is:

$$\int uv' dx = uv - \int u'v dx.$$

For definite integrals, it becomes:

$$\int_a^b uv' dx = uv|_a^b - \int_a^b u'v dx.$$

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18.01SC Single Variable Calculus
Fall 2010

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