integration by parts

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Suppose we have two function $u(x)$ and $v(x)$. Then the product rule states

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

Rearranging gives

$$uv' = \frac{d}{d(x)}(uv) - u'v$$

Integrating both sides gives

$$\begin{aligned}\int uv'dx &= \int \frac{d}{d(x)}(uv) - \int u'vdx \\ &= uv - \int u'vdx\end{aligned}$$

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