Integration by Parts

To find the anti-derivative of integrals involving products of the type $x^n e^{ax}$, $x^n \sin(ax)$, $\mathrm{x}^n \cos(ax)$ with n a positive integer and a a constant, use the following **integration by parts** formula:

$$\int u \frac{dv}{dx} dx = uv - \int v \frac{du}{dx} dx$$

When using this integration formula for these types of products, Integrate by parts n times, differentiating the power of x and integrating the e^{ax}, $\sin(ax)$, or $\cos(ax)$ each time.

The anti-derivative for some integrals involving $\ln(x)$, $\arcsin(x)$, $\arctan(x)$ can be found using the **u-substitution method** ($u = \ln(x)$, $u = \arcsin(x)$, or $u = \arctan(x)$). The Anti-derivative for other such integrals can be found by **integration by parts** in which the function $\ln(\mathrm{x})$, $\arcsin(x)$, or $\arctan(x)$ is differentiated.

Integrate by *parts* **twice** when integrating integrals of the type:

$\sin(\mathrm{ax})\sin(\mathrm{bx})$ or $\cos(ax)\cos(bx)$ with $a^2 \neq b^2$

$e^{ax}\sin(bx)$, $e^{ax}\cos(bx)$, or $\sin(\mathrm{ax})\cos(\mathrm{bx})$ with arbitrary constants a and b