3.1A Integration By Parts in class

LogsInverseAlgebraicTrigExponential

Definition: $\int u\,dv = uv - \int v\,du$

④ $\int (x^2+5)e^{2x}\,dx$ $\quad u = x^2+5 \quad dv = e^{2x}$

$du = 2x \quad v = \frac{e^{2x}}{2}$

$$\int (x^2+5)(e^{2x}) = (x^2+5)\left(\frac{e^{2x}}{2}\right) - \int \left(\frac{e^{2x}}{2}\right)(2x)\,dx$$

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

need to do integration by Parts again.

$u = x$	$dv = e^{2x}$
$du = 1$	$v = \frac{e^{2x}}{2}$

$$= \frac{(x^2+5)e^{2x}}{2} - \left(\frac{xe^{2x}}{2} - \int \frac{e^{2x}}{2}\,dx\right)$$

$$= \frac{(x^2+5)e^{2x}}{2} - \left(\frac{xe^{2x}}{2} - \frac{1}{4}\int e^u\,du\right)$$

need to do u-sub

$u = 2x \quad du = 2\,dx$

$dx = \frac{1}{2}\,du$

$$= \frac{(x^2+5)e^{2x}}{2} - \frac{xe^{2x}}{2} + \frac{e^{2x}}{4} + C$$

$$= \boxed{\frac{(x^2+5)e^{2x} - xe^{2x}}{2} + \frac{e^{2x}}{4} + C}$$