Wk 1 Thurs

[Int. By Parts]

$$\int u \cdot v' = uv - \int v \cdot u'$$

want this to be "easier than" the OG.

Int. By Parts

$u' = du$

Ultra Violet minus Super Voo Doo`

ex $\int x \cdot e^x dx = xe^x - \int e^x dx = xe^x - e^x + C = e^x(x-1) + C$

$u = x$

often you should set u = to something whose derivative is more simple than u

$du = dx$

$dv = e^x dx$

$\downarrow$ integrate

$\int dv = \int e^x dx$

$v = e^x$

EVERYTHING behind the integration sign gets used

check!

$\frac{d}{dx}(ans) = e^x(x-1) + e^x(1) = e^x \cdot x$

↳ is exactly the integrand.

ex $\int (4x+3)e^x dx = (4x+3)e^x - \int e^x 4\,dx = (4x+3)e^x - 4e^x + C$

$u = 4x+3$ $\quad dv = e^x dx$

$du = 4dx$ $\quad v = e^x$

check:

$\frac{d}{dx}(ans) = 4e^x + (4x+3)e^x - 4e^x$

$= 0.5.$

Stuck? To choose u … LIPET, LIATE (log, polynomial, log, trig, exponentials; inv. trig, algebraic)

ex $\int \ln(x)dx = x\ln x - \int x\left(\frac{1}{x}\right)dx = x\ln x - x + C = x(\ln x - 1) + C$

$u = \ln(x)$ $\quad dv = dx$

$du = \frac{1}{x}dx$ $\quad v = x$

check

$\frac{d}{dx}(ans) = 1\cdot(\ln x - 1) + x\left(\frac{1}{x}\right) = \ln x - 1 + 1 = \ln x$

sometimes, you'll have to use I.B.P. multiple times in the same problem

ex $\int x^2 e^x dx = x^2e^x - \int e^x 2x\,dx = x^2e^x - \left[2xe^x - \int 2e^x dx\right] = x^2e^x - 2xe^x + 2e^x + C$

$-2\int xe^x dx$

$u = x^2$ $\quad dv = e^x dx$ $\quad u = 2x$ $\quad dv = e^x dx$

$du = 2x\,dx$ $\quad v = e^x$ $\quad du = 2dx$ $\quad v = e^x$

ex how would you solve? $\int x^5 e^x dx$

ex

$$\int x\cdot\cos(3x)\,dx = x\cdot\tfrac{1}{3}\sin(3x) - \int \tfrac{1}{3}\sin(3x)\,dx = \tfrac{x}{3}\sin(3x) - \tfrac{1}{3}\int \sin(3x)\,dx = \tfrac{x}{3}\sin(3x) + \tfrac{1}{9}\cos(3x) + C$$

$u = x$ $\quad dv = \cos(3x)\,dx$

$du = dx$ $\quad v = \int \cos(3x)\,dx = \int \cos(w)\tfrac{1}{3}\,dw = \tfrac{1}{3}\int \cos(w)\,dw = \tfrac{1}{3}\sin(3x)$

$w = 3x$

$dw = 3dx$

$\tfrac{1}{3}dw = dx$

don't forget your u-sub in the middle parts

ex

$$\int e^x\cos(x)\,dx = e^x\sin x - \int \sin x\, e^x\,dx = e^x\sin x - \left[e^x(-\cos x) - \int(-\cos x)e^x\,dx\right]$$

$u = e^x$ $\quad dv = \cos x\,dx$

$du = e^x dx$ $\quad v = \sin x$

$u = e^x$ $\quad dv = \sin x\,dx$

$du = e^x$ $\quad v = -\cos x$

$$= e^x\sin x + e^x\cos x - \int e^x\cos x\,dx$$

$$\Rightarrow 2\int e^x\cos x\,dx = e^x\sin x + e^x\cos x$$

$$\int e^x\cos x\,dx = \tfrac{1}{2}\left(e^x\sin x + e^x\cos x\right) + C$$