Integration By Parts

Similar to the way in which we obtain the method of **Integration by Substitution** from the differentiation rule called **The Chain Rule** we can obtain the method of **Integration by Parts** from the differentiation rule called **The Product Rule.**

The Product Rule states that if u and v are both functions of x, then

$$(uv)' = \underline{\hspace{6cm}}.$$

If we integrate both sides of the equation above, we get

$$\underline{\hspace{2cm}} = \int (uv)'\, dx = \underline{\hspace{6cm}}.$$

Q: How is this useful?
A: We can exchange a more complicated integral for a simpler integral.

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1. $\int 2xe^{7x}\, dx =$

2. $\int_1^4 \ln(x)\, dx =$

NOTES

In terms of functions $u(x)$ and $v(x)$ the Integration By Parts formula can be written

In every Integration By Parts problem we look at the integrand and pick a function to ____________________ and one which to ____________________

As you choose which function is which, you should choose to DIFFERENTIATE the MORE COMPLICATED FUNCTION in the integrand, and ANTI-DIFFERENTIATE the LESS COMPLICATED FUNCTION.

GROUPWORK

In **groups of 3 or 4** use integration by parts to evaluate the following integrals:

In each case ask yourself which function in the integrand do you prefer to differentiate, and which function do you prefer to anti-differentiate.

3. $\int_0^1 xe^{-x}\,dx =$

4. $\int x\cos(x)\,dx =$

5. $\int \frac{\ln(x)}{x^4}\,dx =$

6. $\int_{-1}^{2} x^2 2^x\,dx =$