More Integral Exchange: Integration By Parts
Class 17: Wednesday March 5

Goal
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.**

Again, the goal is to exchange one (difficult) integral for another (less difficult) integral.

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

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

How is this useful? ____

Examples

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 as

In **every** Integration By Parts problem we have exactly TWO choices. We look at the integrand and
pick a function to ____________________ and one which to ____________________

General Rules

Generally you should choose to DIFFERENTIATE the MORE COMPLICATED FUNCTION in the integrand, and ANTI-DIFFERENTIATE the LESS COMPLICATED FUNCTION.

INCREASING COMPLEXITY: e^x, b^x, $\sin(x)$ or $\cos(x)$, x^n, $\ln(x)$

In other words, the functions at the RIGHT END of the list are more likely to be the function you want to choose to DIFFERENTIATE and the functions at the LEFT END of the list are more likely to the functions you want to ANTI-DIFFERENTIATE

GroupWork

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

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

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

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

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