

In-Class Assignment 5: Integration by Parts

MATH 142

Directions: Work neatly on a separate sheet of paper. Your group will hand in one write-up with everyone's name on it. **DO NOT** fold the corner over to hold everything together!

Work together on each problem; do not delegate different problems to different people.

On this worksheet, we will develop a way to “undo” the product rule. The technique is called **integration by parts**.

1. Recall the **Product Rule**: $\frac{d}{dx}(f(x)g(x)) = f'(x)g(x) + g'(x)f(x)$. What is $\int(f'(x)g(x) + g'(x)f(x))dx$?
2. To simplify the notation, let $u = f(x)$ and $v = g(x)$. Translate your work from Problem 1 into terms of u and v . If you see $u'dx$, rewrite it as du ; if you see $v'dx$, rewrite it as dv .
3. Suppose you encounter an integral of the form $\int uv'dx = \int u dv$. Using your work from Problem 1, find another expression for this integral. This is the Integration by Parts formula.
4. Apply the integration by parts formula to integrate.

(a) $\int 2xe^x dx$. (Which factor plays the role of u ? Which factor plays the role of $dv = v'dx$?)

(b) $\int_0^{\pi/2} t \cos t dt$

(c) $\int x \ln x dx$

(d) $\int \ln x dx$

(e) $\int 6x^2 \cos x dx$

(f) $\int e^x \sin x dx$