Unit #2: Methods of Integration
Topic: Integration by Parts Formula
Objective: SWBAT evaluate an integral involving the product of two functions by using the integration by parts formula.

Warm Up #6:

a) *What are some of the common mistakes that could occur when answering the following question?*

"If $f(x) = 2xsinx - x^2cosx + 2cosx + 3$, find $f'(x)$."

b) *What is the actual answer to the problem given above?*

c) *Why couldn't we use a u-sub to integrate the answer found in part b?*

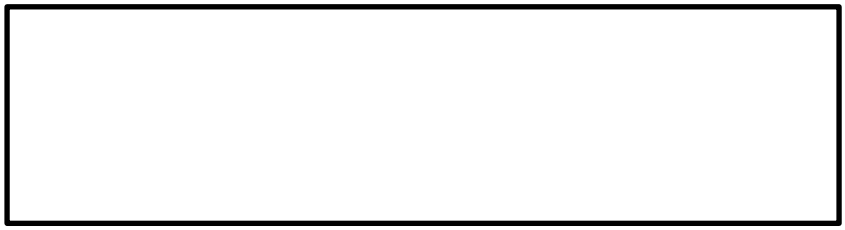
Integration by Parts is the "product rule" for integration. Just like integration by u-substitution, it is intended to split one complicated function into two easier ones.

Substitution looks for _____;

integration by parts looks for _____ *of two unrelated functions.*

For example: $\int x^2 sinxdx$

If u and v are functions of x and have continuous derivatives, then we can integrate using the formula:



The goal is to create an expression that contains an integral that is much easier to integrate than the original. When choosing *u* and *dv*, we want to find a *u* that will be simplified after we take its derivative, and a *dv* that won't be too complex after integrating it.

When deciding what to choose for *u*, remember L I P E T.

L - logarithmic function

I - inverse trig function

P - polynomial function

E - exponential function

T - trigonometry function

This is usually the preference order in which you would want to choose *u*.

Ok, Now let's try to integrate $\int udv = uv - \int vdu$

Example #1: $\int x^2 sinxdx$

Example #2: $\int lnxdx$

Example #3: $\int 4sin^{-1}x\,dx$

Problem Set #6: Integrate each of the following using the integration by parts formula.

1) $\int x^5 lnx dx$	2) $\int x csc^2 x dx$
3) $\int (x^2+1)e^{-x} dx$	4) $\int 2xe^{4x} dx$
5) $\int x^2 cos\left(\frac{x}{2}\right) dx$	6) $\int \frac{lnx}{x^2} dx$

7) $\int 3x^2e^{2x}dx$	8) $\int 3arctanxdx$
9) $\int xsec^2xdx$	10) $\int \sqrt{x}lnxdx$

Answer Key

1) $\frac{1}{6}x^6ln\|x\| - \frac{1}{36}x^6 + C$	2) $-xcotx + ln\|sinx\| + C$
3) $-e^{-x}(x^2+1) - 2xe^{-x} - 2e^{-x} + C$	4) $\frac{1}{2}xe^{4x} - \frac{1}{8}e^{4x} + C$
5) $2x^2sin\frac{1}{2}x + 8xcos\frac{1}{2}x - 16sin\frac{1}{2}x + C$	6) $-\frac{ln\|x\|}{x} - \frac{1}{x} + C$
7) $\frac{3}{2}x^2e^{2x} - \frac{3}{2}xe^{2x} - \frac{3}{2}e^{2x} + C$	8) $3xarctanx - \frac{3}{2}ln\|1+x^2\| + C$
9) $xtanx + ln\|cosx\| + C$	10) $\frac{2}{3}x^{3/2}ln\|x\| - \frac{4}{9}x^{3/2} + C$