November 6

SWBAT:
Find the integral using integration by parts

$\int x \sin x \, dx$

use the product rule to find $d(u \cdot v)$

$d(uv) = uv' + vu'$

$d(uv) = u \cdot dv + v \cdot du$

$\int d(uv)$

$\int d(uv) = \int u \cdot dv + \int v \cdot du$

$uv = \int u \cdot dv + \int v \cdot du$

$-\int v du \qquad -\int v \cdot du$

Integration by Parts

$\int u \, dv = uv - \int v \, du$

# ULTRA VIOLET VOODOO

$$\int u\,dv = uv - \int v\,du$$

Integration by Parts

→ use when multiplying 2 functions "u" + "dv" (if u-substitution doesn't work)

How do you choose u?

① choose the function you don't know the antiderivative of

② choose the function whose derivative will eventually $=0$

③ pick one

Log — L

Inverse Trig — I

Power Functions — P

Exponential — E

Trig — T

$$\int x \sin x\, dx$$

$u = x \qquad dv = \sin x\, dx$

$du = dx \qquad v = \int \sin x\, dx$

$v = -\cos x$

$$\int x \sin x\, dx = x(-\cos x) - \int -\cos x\, dx$$

$$= -x\cos x + \int \cos x\, dx$$

$$= -x\cos x + \sin x + C$$

$$\int x^2 e^{3x} dx$$

$u = x^2 \qquad dv = e^{3x} dx$

$du = 2x\, dx \qquad v = \int e^{3x} dx$

$v = \frac{e^{3x}}{3}$

$$\int x^2 e^{3x} dx = x^2\left(\frac{e^{3x}}{3}\right) - \int \frac{e^{3x}}{3} 2x\, dx$$

$$= \frac{x^2 e^{3x}}{3} - \frac{1}{3}\int e^{3x} 2x\, dx$$

$u = 2x \qquad dv = e^{3x} dx$

$du = 2\, dx \qquad v = \frac{e^{3x}}{3}$

$$\frac{x^2 e^{3x}}{3} - \frac{1}{3}\left(2x\left(\frac{e^{3x}}{3}\right) - \int \frac{e^{3x}}{3} 2\, dx\right)$$

$$\frac{x^2 e^{3x}}{3} - \frac{1}{3}\left(\frac{2x e^{3x}}{3} - \frac{2}{3}\int e^{3x} dx\right)$$

$$\frac{x^2 e^{3x}}{3} - \frac{1}{3}\left(\frac{2x e^{3x}}{3} - \frac{2}{3}\left(\frac{e^{3x}}{3}\right)\right) + C$$

$\int \ln x \, dx$

$u = \ln x \qquad dv = 1\,dx$

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

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

$$= x \ln x - \int 1\,dx$$

$$= x \ln x - x + C$$

$\int x^2 \ln x \, dx$

$u = \ln x \qquad dv = x^2 dx$

$du = \frac{1}{x}dx \qquad v = \frac{x^3}{3}$

$$\int x^2 \ln x \, dx = \ln x\left(\frac{x^3}{3}\right) - \int \frac{x^3}{3}\left(\frac{1}{x}dx\right)$$

$$= \frac{x^3 \ln x}{3} - \frac{1}{3}\int x^2 dx$$

$$= \frac{x^3 \ln x}{3} - \frac{1}{9}x^3 + C$$