November 7

SWBAT:
Find the integral using integration by parts

$\int 4x^2 e^x \, dx$

$u = 4x^2 \qquad dv = e^x \, dx$

$du = 8x \, dx \qquad v = e^x$

$\int 4x^2 e^x \, dx = 4x^2 e^x - \int 8x e^x \, dx$

$u = 8x \qquad dv = e^x \, dx$

$du = 8 \, dx \qquad v = e^x$

$= 4x^2 e^x - \left(8x e^x - \int 8 e^x \, dx\right)$

$= 4x^2 e^x - 8x e^x + 8e^x + C$

$= 4e^x(x^2 - 2x + 2) + C$

tabular method

u	dv
$+4x^2$	e^x
$-8x$	e^x
$+8$	e^x
-0	e^x

$= 4x^2 e^x - 8x e^x + 8e^x + C$

*only works if u is a power function

$$\int 5x^3\cos(2x)\,dx$$

	u	dv
$+$	$5x^3$	$\cos(2x)$
$-$	$15x^2$	$\frac{1}{2}\sin(2x)$
$+$	$30x$	$-\frac{1}{4}\cos(2x)$
$-$	30	$-\frac{1}{8}\sin(2x)$
$+$	0	$\frac{1}{16}\cos(2x)$

$$\int -\frac{1}{8}\sin(2x)\,dx$$

$u=2x$

$du=2\,dx$

$\frac{1}{2}du=dx$

$$-\frac{1}{8}\int \sin u\cdot\frac{1}{2}du$$
$$=-\frac{1}{16}\int \sin u\,du$$
$$=\frac{1}{16}\cos u+C$$
$$=\frac{1}{16}\cos 2u+C$$

$$5x^3\left(\frac{1}{2}\sin(2x)\right)-15x^2\left(-\frac{1}{4}\cos(2x)\right)+30x\left(-\frac{1}{8}\sin(2x)\right)$$
$$-30\left(\frac{1}{16}\cos(2x)\right)+C$$
$$=\frac{5}{2}x^3\sin(2x)+\frac{15}{4}x^2\cos(2x)-\frac{30}{8}x\sin(2x)-\frac{30}{16}\cos(2x)+$$

$$\int_0^1 x^2e^{3x}\,dx$$

$$=x^2\left(\frac{e^{3x}}{3}\right)-2x\left(\frac{e^{3x}}{9}\right)+\frac{2e^{3x}}{27}\Big|_0^1$$
$$=1^2\left(\frac{e^3}{3}\right)-2(1)\left(\frac{e^3}{9}\right)+\frac{2e^3}{27}-\left(0^2\left(\frac{e^{3\cdot0}}{3}\right)-2(0)\left(\frac{e^{3\cdot0}}{9}\right)+\frac{2e^{3\cdot0}}{27}\right)$$
$$=\frac{e^3}{3}-\frac{2e^3}{9}+\frac{2e^3}{27}-\frac{2}{27}$$

$\int e^x \sin x\, dx$

$$\int e^x \sin x\, dx$$

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

$$du = \cos x\, dx \qquad v = e^x$$

$$\int e^x \sin x\, dx = \sin x\left(e^x\right) - \int \left(e^x\right)\cos x\, dx$$

$$= e^x \sin x - \int e^x \cos x\, dx$$

$$u = \cos x \qquad dv = e^x\, dx$$

$$du = -\sin x\, dx \qquad v = e^x$$

$$\int e^x \sin x\, dx = e^x \sin x - \int e^x \cos x\, dx$$

$$= e^x \sin x - \left(\cos x\left(e^x\right) - \int \left(e^x\right)\left(-\sin x\right) dx\right)$$

$$\int e^x \sin x\, dx = e^x \sin x - \left(e^x \cos x + \int e^x \sin x\, dx\right)$$

$$\int e^x \sin x\, dx = e^x \sin x - e^x \cos x - \int e^x \sin x\, dx$$

$$+\int e^x \sin x\, dx \qquad\qquad +\int e^x \sin x\, dx$$

$$2\int e^x \sin x\, dx = e^x \sin x - e^x \cos x + c$$

$$\int e^x \sin x\, dx = \frac{e^x \sin x - e^x \cos x + c}{2}$$

$\int e^x \sin x\, dx$

$$\int e^x \sin x\, dx$$

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

$$du = e^x\, dx \qquad v = -\cos x$$

$$\int e^x \sin x\, dx = e^x\left(-\cos x\right) - \int -\cos x\left(e^x\right) dx$$

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

$$u = e^x \qquad dv = \cos x\, dx$$

$$du = e^x\, dx \qquad v = \sin x$$

$$\int e^x \sin x\, dx = e^x\left(-\cos x\right) - \int -\cos x\left(e^x\right) dx$$

$$= -e^x \cos x + \left(e^x \sin x - \int \sin x\left(e^x\right) dx\right)$$

$$\int e^x \sin x\, dx = -e^x \cos x + e^x \sin x - \int e^x \sin x\, dx$$

$$+\int e^x \sin x\, dx \qquad\qquad +\int e^x \sin x\, dx$$

$$2\int e^x \sin x\, dx = -e^x \cos x + e^x \sin x + c$$

$$\int e^x \sin x\, dx = \frac{-e^x \cos x + e^x \sin x + c}{2}$$