Tabular Method (for integration by parts)

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

Choose $u = x^2$

$dv = \sin x \, dx$

	u	dv
$+$	x^2	$\sin x$
$-$	$2x$	$-\cos x$
$+$	2	$-\sin x$
$-$	0	$\cos x$

Stop!!

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

$$= + x^2(-\cos x) - 2x(-\sin x) + 2(\cos x)$$

$$= -x^2 \cos x + 2x \sin x + 2\cos x + C$$

Try this $\boxed{\int x^3 \cos x \, dx}$

$$\boxed{\int x^3 \cos x \, dx}$$

Choose $u = x^3$

$dv = \cos x \, dx$

	u	dv
$+$	x^3	$\cos x$
$-$	$3x^2$	$\sin x$
$+$	$6x$	$-\cos x$
$-$	6	$-\sin x$
$+$	$\boxed{0}$	$\cos x$

Stop!

$$\int x^3 \cos x \, dx = + x^3 \sin x - 3x^2(-\cos x) + 6x(-\sin x) - 6\cos x$$

$$= x^3 \sin x + 3x^2 \cos x - 6x \sin x - 6\cos x + C$$

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

Solution: Choose $u = x^3 - 3x^2$

$dv = \cos(2x)\,dx$

	u	dv
$+$	$x^3 - 3x^2$	$\cos(2x)$
$-$	$3x^2 - 6x$	$\frac{1}{2}\sin(2x)$
$+$	$6x - 6$	$-\frac{1}{4}\cos(2x)$
$-$	6	$-\frac{1}{8}\sin(2x)$
$+$	$\boxed{0}$	$\frac{1}{16}\cos(2x)$

$\frac{d}{dx}(\sin(2x)) = \cos(2x)\cdot 2$

Stop

$$\int (x^3 - 3x^2)\cos(2x)\,dx = +(x^3-3x^2)\left(\frac{1}{2}\sin(2x)\right) - (3x^2-6x)\left(-\frac{1}{4}\cos(2x)\right)$$

$$+ (6x-6)\left(-\frac{1}{8}\sin(2x)\right) - (6)\left(\frac{1}{16}\cos(2x)\right)$$

$$= \frac{1}{2}(x^3-3x^2)(\sin(2x)) + \frac{1}{4}(3x^2-6x)(\cos(2x))$$

$$-\frac{1}{8}(6x-6)(\sin(2x)) - \frac{6}{16}\cos(2x) + C$$

1st

STOP : When the derivative becomes zero.

$$\boxed{\int e^x \sin x \, dx}$$

Solution: Choose $u = \sin x$

$dv = e^x \, dx$

	u	dv
$\oplus$	$\sin x$	e^x
$\ominus$	$\cos x$	e^x
$\oplus \int$	$-\sin x$	e^x

Stop at this row.

2nd STOP : When the product of that row has the same FACE as your integrand.

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

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

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

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

$$\boxed{\int e^{3x}\sin(2x)\,dx}$$

Choose $u = \sin(2x)$

$dv = e^{3x}$

	u	dv
$\oplus$	$\sin(2x)$	e^{3x}
$\ominus$	$2\cos(2x)$	$\frac{1}{3}e^{3x}$
$\oplus\int$	$-4\sin(2x)$	$\frac{1}{9}e^{3x}$

$$\frac{d}{dx}\left(e^{3x}\right) = 3e^{3x}$$

$$\int e^{3x}\sin(2x)\,dx = \sin(2x)\left(\frac{1}{3}e^{3x}\right) - 2\cos(2x)\left(\frac{1}{9}e^{3x}\right) + \int -4\sin(2x)\left(\frac{1}{9}e^{3x}\right)dx$$

$$\int e^{3x}\sin(2x)\,dx = \sin(2x)\left(\frac{1}{3}e^{3x}\right) - 2\cos(2x)\left(\frac{1}{9}e^{3x}\right) - \frac{4}{9}\int e^{3x}\sin(2x)\,dx$$

$$\frac{13}{9}\int e^{3x}\sin(2x)\,dx = \frac{1}{3}e^{3x}\sin(2x) - \frac{2}{9}e^{3x}\cos(2x)$$

$$\int e^{3x}\sin(2x)\,dx = \frac{3}{13}e^{3x}\sin(2x) - \frac{2}{13}e^{3x}\cos(2x) + C$$

1. $\int x^2 e^{-3x}\,dx$ 2. $\int e^{-x}\cos(3x)\,dx$

Before 14 Nov in CEB2