$$\int x^2 e^{5x}\,dx$$

traded in this

for this

Wrong Way

$u =$ $dv =$

$du =$ $v =$

$$\overbrace{\int x^2 e^{5x}\,dx} = \tfrac{1}{3}x^3 e^{5x} -$$

Correct Way

$u =$ $dv =$

$du =$ $v =$

$$\int x^2 e^{5x}\,dx =$$

$$\int x^2 e^{5x}\,dx = \tfrac{1}{5}x^2 e^{5x} - \tfrac{2}{5}\boxed{}$$

I.B.P. again

$u =$ $dv =$

$du =$ $v =$

$$\int x^2 e^{5x}\,dx = \tfrac{1}{5}x^2 e^{5x} - \tfrac{2}{5}\overbrace{\left[\tfrac{1}{5}xe^{5x} - \tfrac{1}{5}\int e^{5x}\,dx\right]}$$

$$\int x^2 e^{5x}\,dx =$$

$$\boxed{\int x^2 e^{5x}\,dx = }$$

Shortcut: Works when you have one of the following two situations :

1.

2.

$$\int x^2 e^{5x}\,dx$$

Step 1: Differentiate the polynomial down to 0.

Step 2: Integrate the trig. or exponential the same amount of times

Step 3: Multiply along diagonals going down to the right applying an alternating sign starting with $+$

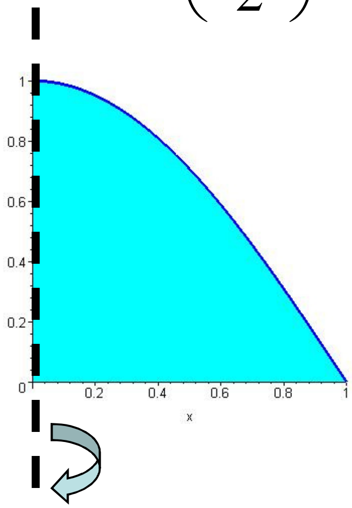
$$\boxed{\int x^2 e^{5x}\,dx = \tfrac{1}{5}x^2 e^{5x} - \tfrac{2}{25}xe^{5x} + \tfrac{2}{125}e^{5x} + C}$$

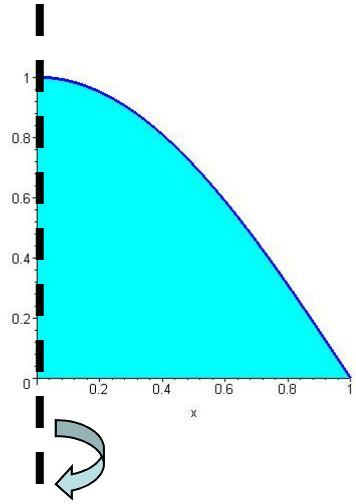
$$\int_0^1 x\cos(\pi x)\,dx$$

$$\int_0^1 x\cos(\pi x)\,dx =$$

Find the volume of the solid of revolution formed by rotating the region bounded by the curves

$$y = \cos\left(\frac{\pi x}{2}\right),\ \ y = 0,\ \ 0 \le x \le 1 \text{ about the } y-\text{axis.}$$





Try disk method

Use Shells

$$V = 2\pi \int_0^1 x \cos\left(\frac{\pi x}{2}\right) dx$$

$$\int_4^9 \frac{\ln y}{\sqrt{y}}\,dy$$

✘ **Short-cut doesn't work here**

Wrong Way

$$u = \frac{1}{\sqrt{y}} \qquad dv = \ln y\ dy$$

$$du = \qquad v = ????$$

$$f = y^{-1/2}$$

Correct Way

$$u = \ln y \qquad dv = \frac{1}{\sqrt{y}}\ dy$$

$$du = \qquad v =$$

$$\int y^{-1/2}dy$$

$$\int \frac{\ln y}{\sqrt{y}}\,dy$$

$$\int_4^9 \frac{\ln y}{\sqrt{y}}\,dy$$

$$\int_1^{\sqrt{3}} \arctan\left(1/x\right) dx$$

✘ **Short-cut doesn't work here**

$$f = \arctan\left(1/x\right)$$

<u>Only Way</u>

$u = \arctan\left(1/x\right)$ $\quad dv = dx$

$du =$ $\quad v =$

$$\int \arctan\left(1/x\right) dx =$$

$$\int \arctan\left(1/x\right) dx =$$

$$\int_1^{\sqrt{3}} \arctan\left(1/x\right) dx =$$

$$\int e^{-t}\sin(t)\,dt$$

× Short-cut doesn't work here

$u =$ $dv =$

$du =$ $v =$

$$\Rightarrow \int e^{-t}\sin(t)\,dt = \underbrace{\qquad\qquad}$$

$u =$ $dv =$

$du =$ $v =$

$$-e^{-t}\cos(t) - \int e^{-t}\sin(t)\,dt$$

$$\Rightarrow \int e^{-t}\sin(t)\,dt =$$

Fall 2012

8. The volume of the solid of revolution obtained by rotating the region bounded by $y = x^2 e^{-x^2}$ and the x-axis for $0 \le x \le 1$ about the y-axis is:

a) $\frac{2}{3}\pi$ (b) $\frac{1}{2}\pi$ (c) $\frac{3}{2}$ (d) $2\pi(e-1)$ (e) $\frac{5}{3}\pi e$ (f) $\pi - \frac{2\pi}{e}$