Note: Answers for #3 is at back of this page

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

use integration by parts formula $= \int u\,dv = uv - \int v\,du$

$u = x^2$

$du = 2x$

$dv = \cos 2x$

$v = \int \cos 2x \, dx$

use u-substitution

$u = 2x$

$du = 2\,dx$

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

$= \frac{1}{2}\int \cos u \, du$

$= \frac{1}{2} \sin u$

$\boxed{v = \frac{1}{2} \sin 2x}$

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

$\int x^2 \cos 2x \, dx = \boxed{\frac{x^2}{2} \sin 2x} - \boxed{\frac{1}{2}} \int \sin 2x \, (2x) \, dx$

$\Downarrow$

to integrate also use integration by parts

$u = 2x$

$du = 2$

$dv = \sin 2x$

$v = \int \sin 2x \, dx$

use u-substitution

$u = 2x$

$du = 2dx$

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

$v = \frac{1}{2}\int \sin u \, du$

continued at back

$v = 1/2 \int \sin u \, du$

$= 1/2(-\cos u)$

$= -1/2 \cos u$

substitute back the x

$v = -1/2 \cos 2x$

integration by parts formula $\int u \, dv = uv - \int v \, du$

$= -1/\cancel{2} \cos 2x \times \cancel{2}x + 1/\cancel{2}\int \cos 2x (\cancel{2}) \, dx$

use u substitution

$u = 2x$

$du = 2dx$

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

$1/2 \int \cos u \, du$

$= 1/2 \sin u$

$\boxed{= 1/2 \sin 2x}$

$\boxed{= -x\cos 2x + 1/2 \sin 2x}$

Final Answer 8

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

$\boxed{= \frac{x^2}{2}\sin 2x + 1/2 x\cos 2x - 1/4 \sin 2x + C}$

$= \boxed{1/2 \sin 2x (x^2 - 1/2) + x/2 \cos 2x + C}$ FINAL ANSWER for #3

Great job.