$\int \sin 7x \cos 2x \, dx$

$\Rightarrow \frac{1}{2} \int (\sin 9x + \sin 5x) \, dx$

$= \frac{1}{2} \left[-\frac{\cos 9x}{9} - \frac{\sin x}{5} \right] + C$

$= -\frac{\cos 9x}{18} - \frac{\sin x}{10} + C$

$= \frac{1}{2}(\cos 11x + \cos x)$

$\int \cos 5x \cos 6x \, dx = \frac{4}{2} \int \cos 11x + \cos$

$= \frac{1}{2}\left[\frac{\sin 11x}{11} + \sin x\right] + c$

$\Rightarrow \frac{\sin 11x}{22} + \frac{\sin x}{2} + c$

5. Note that $\sin a \cos b =$

$\frac{1}{2}\left[\sin(a+b) + \cos(a-b)\right]$

$\sin 7x \cos 2x$

$= \frac{1}{2}\left[\sin(7x+2x) + \sin(7x-2x)\right]$

$\frac{1}{2}\left[\sin(9x) + \sin(5x)\right]$

$du = 2x\,dx$

$dv = \sin x\,dx$

$v = \int \sin x\,dx = -\cos x$

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

picking $\int 2x \cos x\,dx$

$u = 2x \quad \frac{du}{dx} = 2 \quad du = 2dx$

$dv = \cos x\,dx$

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

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

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

$\therefore \int x^2 \sin x\,dx = -x^2 \cos + 2x \sin x + 2\cos x + C$

4. Note that $\cos a \cos b \frac{1}{2}[\cos(a+b) + \cos(a-b))$

$\cos 5x \cos 6x = \cos 6x \cos 5x$

$= \frac{1}{2}(\cos(6x+5x) + \cos(6x-5x))$

(2) $\int 3te^{2t}\,dt$

$u = 3t, \quad \frac{du}{dt} = 3 \Rightarrow du = 8dt$

$dv = e^{2t}\,dt, \quad v \int e^{2t}\,dt = \frac{e^{2t}}{2}$

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

$\int 3te^{2t}\,dt = \frac{3te^{2t}}{2} - \int \frac{3te^{2t}}{2}\,dt$

$= \frac{3}{2}te^{2t} - \frac{3}{2} \times \frac{1}{2} e^{2t} + C$

$= \frac{3}{2}te^{2t} - \frac{3}{4}e^{2t} + C$

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

going by integration of part

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

$u = x^2, \quad \frac{du}{dx} = 2x$

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① $\int 2x^2 \ln x$.

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

by rearranging $\int \ln x . 2x^2 dx$

$u = \ln x \quad \frac{dy}{dx} = \frac{1}{x}$

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

$dv = 2x^2 dx \quad v = \int 2x^2 dx = \frac{2x^3}{3}$

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

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

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

$= \frac{2x^3 \ln x}{3} - \frac{2}{3} \times \frac{1}{3} x^3 + C$

$= \frac{2x^3 \ln x}{3} - \frac{2}{9} x^3 + C$