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

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

Apply linearity

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

$\int \sin(9x)\, dx$

let u be $9x$ so $dx = \frac{1}{9} du$

$= \frac{1}{9} \int \sin(u)\, du$

$\int \sin(u)\, du = -\cos(u)$

$\frac{1}{9} \int \sin(u)\, du$

$= \frac{\cos(u)}{9}$

let u be $9x$

so $= -\frac{\cos(9x)}{9}$

NOW

$\int \sin(5x)\, dx$

let u be $5x$ so $dx = \frac{1}{5} du$

$= \frac{1}{5} \int \sin(u)\, du$

$\int \sin(u)\, du = -\cos u$

$\frac{1}{5} \int \sin(u)\, du = -\frac{\cos(u)}{5}$

let $u = 5x$ ~~so~~

$= -\frac{\cos(5x)}{5}$

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

$= -\frac{\cos(9x)}{18} - \frac{\cos(5x)}{10}$

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

$= -\frac{\cos(9x)}{18} - \frac{\cos(5x)}{10} + C$

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

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

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

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

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

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

or

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

4) $\int \cos(5x)\cos(6x)\,dx =$

$= \int \frac{\cos(11x) + \cos(x)}{2}\,dx$

Apply linearity

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

$\int \cos(11x)\,dx$

let u be $11x$ so $dx = \frac{1}{11}\,du$

$= \frac{1}{11}\int \cos(u)\,du$

$\int \cos(u)\,du = \sin u$

$\frac{1}{11}\int \cos(u)\,du = \frac{\sin(u)}{11}$

let u be $11x$

$= \frac{\sin(11x)}{11}$

$\int \cos(x)\,dx = \sin x$

$\therefore \frac{1}{2}\int \cos(11x)\,dx + \frac{1}{2}\int \cos(x)\,dx$

$= \frac{\sin(11x)}{22} + \frac{\sin x}{2}$

so $\therefore \int \cos(5x)\cos(6x)\,dx$

$= \frac{\sin(11x) + 11\sin(x)}{22} + C$

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

$(x)\,dx$

$n(x)$

$\int \sin(x)\,dx$

(x)

$x)$

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1) $\int 2x^2 \ln(x)\,dx$

Apply linearity

$2\int x^2 \ln(x)\,dx$

$= \int x \ln(x)\,dx$

$\frac{x^3 \ln(x)}{3} - \int \frac{x^2}{3}\,dx$

$\int x^2/3\,dx$

Apply linearity

$1/3 \int x^2 dx$

$\int x^2 dx$

$= \frac{x^3}{3}$

$\frac{x^3 \ln(x)}{3} - \int \frac{x^2}{3}\,dx$

$= \frac{x^3 \ln(x)}{3} - \frac{2x^3}{9}$

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

$= \frac{2x^3 (3\ln(x) - 1)}{9} + C$

2) $\int 3t\, e^{2t}$

Apply linearity

$3\int t e^{2t}\,dt$

$\int t e^{2t}\,dt$

$\int \frac{e^{2t}}{2}\,dt$

let u be $= 2t$ so $du/dt = 2$

$dt = 1/2$

$= 1/4 \int e^u du$

$\int e^u du$

Apply exponential rule

$\int a^u du = \frac{a^u}{\ln(a)}$

$= e^u$

$1/4 \int e^u du$

$= \frac{e^u}{4}$

let u be 2t

$= \frac{e^{2t}}{4}$

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

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

$\int 3te^{2t}\,dt = \frac{3te^{2t}}{2} - \frac{3e^{2t}}{4}$

$= \frac{3(2t-1)e^{2t}}{4} + C$

~~3) $2x\sin(x)$~~

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

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

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

Apply linearity

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

~~$\int x\cos(x)\,dx = x\sin(x)$~~

$\int x\cos(x)\,dx = x\sin(x) - \int \sin(x)$

$\int \sin(x)\,dx = -\cos(x)$

$x\sin(x) - \int \sin(x)\,dx$

$= x\sin(x) + \cos(x)$