Assignment

1. $\int 2x^2 \ln x$

$u = \ln x \qquad dv = 2x^2$

$du = \frac{1}{x}dx \qquad v = \frac{2x^3}{3}$

$\int tt \int \ln x \cdot 2x^2 = \frac{2x^2}{3}\ln x - \int \frac{2x^3}{3} \cdot \frac{1}{x} dx$

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

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

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

$u = \cancel{2t}, \quad \cancel{dv = e^{2t} dt}$

$du = \cancel{2dt} \qquad v = \cancel{1/2}\, e^{2t}$

~~uv~~ $\int \quad u = 3t \qquad dv = e^{2t}dt$

$du = 3dt \qquad v = \frac{1}{2}e^{2t}$

$\int 3t e^{2t}dt = 3t \cdot \frac{1}{2}e^{2t} - \int \frac{1}{2}e^{2t} \cdot 3dt$

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

3) $\int \cos 5x \cos 6x$

$\int \cos 5x \cos 6x = \frac{1}{2}\int [\cos(5x + 6x) + \cos(6x - 5x)]\, dx$

$\int \cos 5x \cos 6x = \frac{1}{2}\int \{\cos 11x\, dx + \frac{1}{2}\int \cos x$

$= \frac{1}{2} \times \frac{1}{11}\sin 11x + \frac{1}{2}\sin x + C$

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

4) $\int \sin 7x \cos 2x$

$\frac{1}{2}\left[\cancel{\cos}\sin(A+B) + \sin(A-B)\right]$

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

$\int \sin 7x \cos 2x\,dx = \frac{1}{2}\int\left[\sin 9x + \sin 5x\right]dx$

$\int \sin 7x \cos 2x\,dx = \frac{1}{2}\left[-\frac{\cos 9x}{9} - \frac{\cos 5x}{5}\right] + C$

$= \cancel{-\frac{1}{2}\cdot\cos x}$

$\int \sin 7x \cos 2x\,dx = -\frac{\cos 9x}{18} - \frac{\cos 5x}{10} + C$

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

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

$u = x^2 \quad dv = \sin x$

$du = 2x\,dx \quad \cancel{d}\ v = -\cos x$

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

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

$\int x^2 \sin x\,dx = -x^2\cdot\cos x + 2\left(x\cdot\sin x - \int \sin(x)\,dx\right)$

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

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