NAME: OBOLO FAITH IFEOLUWA
MAT NO: 19/MHJ01/274
MAT 104 ASSIGNMENT
Integrate the following functions.

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

Solution

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

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

Recall that;

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

$$= \left(\ln x \cdot \frac{2x^3}{3}\right) - \int \frac{2x^3}{3} \cdot \frac{1}{x}\, dx$$

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

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

$$= \frac{2x^3}{3}\left(\ln x - \frac{1}{3}\right) + c$$

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

Solution

$u = 3t$; $dv = e^{2t}$

$du = 3dx$; $v = \frac{1}{2}e^{2t}$

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

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

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

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

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

$= \frac{3}{2} te^{2t} - \left(\frac{3}{2} \int e^{2t} \right)$

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

3 $\int x^2 \sin x dx$

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

$du = 2x\, dx$; $v = -\cos x$

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

$= x^2 \cdot -\cos x - \int -\cos x \cdot 2x dx$

$= -x^2 \cos x + 2x \sin x + C.$

4) $\int \cos 5x \cos 6x dx$

Let $A = 5x$ and $B = 6x$

Recall that

$\cos A \cos B = \frac{1}{2} (\cos(A+B) + \cos(A-B))$

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

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

$\int \cos 5x \cos 6x dx = \frac{1}{2} \int (\cos 11x - \cos x) dx$

$= \frac{1}{2} \cdot \left(\frac{\sin 11x}{11} - \sin x \right)$

$\int \cos 5x \cos 6x dx = \frac{\sin 11x}{22} - \frac{\sin x}{2} + C$

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

Let $A = 7x$ and $B = 2x$

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

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

$= \frac{1}{2}(\sin 9x + \sin 5x)$

$\int \sin 7x \cos 2x \, dx = \frac{1}{2}\int (\sin 9x + \sin 5x)\, dx$

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

$= \frac{1}{2} \cdot \left(-\frac{\cos 9x}{9} - \frac{\cos 5x}{5}\right)$

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

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