

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

Solution

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

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

$$\int u dv = uv - \int v du$$
$$= \ln x \cdot \frac{2x^3}{3} - \int \frac{2x^3}{3} \cdot \frac{dx}{x}$$

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

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

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

OR

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

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

Solution;

$$u = 3t$$

$$dv = e^{2t}$$

$$du = 3 dt$$

$$v = \frac{1}{2} e^{2t}$$

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

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

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

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

$$\therefore \int 3te^{2t} dt = \left[ \frac{3te^{2t}}{2} - \frac{3}{4} e^{2t} \right] + C$$

3)  $x^2 \sin x$

SOLUTION

$$u = x^2$$

$$dv = \sin x$$

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

$$v = -\cos x$$

$$dx = 2x dx$$

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

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

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

$$= -x^2 \cos x + \left[ \begin{array}{l} u = 2x \quad dv = \cos x \\ du = 2 dx \quad v = \sin x \end{array} \right]$$

$$= -x^2 \cos x + uv - \int v du$$

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

$$\int 2 \sin x dx$$

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

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

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

solution

~~A~~  $A = 5x, B = 6x$

Recall that;

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

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

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

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

5.)  $\sin 7x \cos 2x$

solution;

$A = 7x, B = 2x$

Recall that;

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

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

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