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COLLEGE: MEDICINE AND HEALTH SCIENCES

DEPARTMENT: MEDICINE AND SURGERY

100 LEVEL

MAT 104 ASSIGNMENT FOR MBBS

Integrate the following functions (1) $2x^2 \ln x$ (2) $3te^{2t}$
(3) $x^2 \sin x$ (4) $\cos 5x \cos 6x$ (5) $\sin 7x \cos 2x$

Answers

1. $2x^2 \ln x$ Solution:

$$\int 2x^2 \ln x$$

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

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

$$du = \frac{1}{x} dx$$

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

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

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

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

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

2. $\int 3te^{2t} dx$

Solution

$$u = 3t \quad dv = e^{2t}$$

$$\frac{du}{dt} = 3 \implies du = 3dt$$

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

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

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

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

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

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

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

Solution!

$$u = x^2$$

$$dv = \sin x$$

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

$$v = -\cos x$$

$$du = 2x dx$$

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

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

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

for $\int 2x \cos x dx$

$$u = 2x$$

$$dv = \cos x$$

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

$$v = \sin x$$

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

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

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

4. $\cos 5x \cos 6x$

Solution

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

$$\cos 5x \cos 6x = \frac{1}{2} [\cos 11x + \cos x]$$

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

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

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

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

Solution

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

$$\sin 7x \cos 2x = \frac{1}{2} [\sin 5x + \sin 9x]$$

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

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

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