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MATRIC NO: 19/MHS01/277
COURSE: MAT 104

Assignment

~~1) $2x^2 \ln x$~~ Integrate the following functions

1) $2x^2 \ln x$

Solution

$\int 2x^2 \ln x$

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

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

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

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

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

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

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

$\int 2x^2 \ln x = \frac{2x^3}{3} \ln x - \frac{2}{3}\left[\frac{x^3}{3}\right] + C$

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

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

2.) ~~$3te^{2t}$~~ $3te^{2t}$

Solution

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

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

$du = 3dt$

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

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

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

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

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

3.) $x^2 \sin x$

Solution

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

$\frac{du}{dx} = 2x \quad v = -\cos x$

$\therefore du = 2x\,dx$

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

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

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

$\int 2x \cos x\,dx$

$u = 2x \quad dv = \cos x$

$\frac{du}{dx} = 2 \quad v = \sin x$

$\therefore du = 2dx$

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

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

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

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

$\int 2x \cos x = 2x \sin x + 2\cos x + C$

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

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

Solution

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

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

$$\cos 5x \cos 6x = \frac{1}{2} \cdot \left[\cos(5x+6x) - \cos(5x-6x)\right]$$

$$\cos 5x \cos 6x = \frac{1}{2}\left[\cos 11x - \cos(-x)\right]$$

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

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

$$\int \cancel{C}\cos 5x \cos 6x = \frac{1}{2} \cdot \left[\frac{\sin 11x}{11} + \sin(-x)\right] + C$$

$$\int \cos 5x \cos 6x = \frac{1}{22} (\sin 11x) + \frac{1}{2}(\sin(-x)) + C$$

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

Solution

~~Sin A Co~~ $A = 7x$, $B = 2x$

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

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

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

$$\int \sin 7x \cos 2x = \frac{1}{2}\left[\cancel{C}(\sin 9x + \sin 5x)\right.$$

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

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

$$\int \sin 7x \cos 2x = \frac{-1}{18}(\cos 9x) - \frac{1}{10}(\cos 5x) + c$$