Odoba Victoria AEH EHIGOCHO
19MHS01/280

MATHS 104

1) Integrate the following functions

a) $2x^2 \ln x \, dx$

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

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

Recall:

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

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

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

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

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

b) $3te^{2t}dt$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

d) $\int \cos 5x \cos 6x \, dx$

let $A = 5x$ and B

Recall that;

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

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

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

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

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

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

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

e) $\int \sin 7x \cos 2x \, dx$

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

Recall;

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

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

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

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

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

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

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

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