Maths 104 Assignment 20/5/20

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Level: 100

Integrate the following

1 $2x^2 \ln x$

Solution

$U = \ln x$, $dv = 2x^2$

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

$\int U dV = UV - \int V du$

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

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

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

2 $3te^{2t} \Longrightarrow \int 3te^{2t}\, dt$

Solu

$U = 3t$ $dV = e^{2t}$

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

$\int U dv = UV - \int V du$

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

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

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

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

3 $x^2 \sin x \Rightarrow x^2 \sin x \, dx$

Solu

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

$du/dx = 2x \qquad v = -\cos x$

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

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

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

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

$du = 2dx \qquad v = \sin x$

$\Rightarrow 2x\sin x - \int \sin x \, 2dx$

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

$= -x^2\cos x + 2x\sin x - 2(-\cos x) + c$

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

4 $\cos 5x \cos 6x$

Solu

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

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

$\frac{1}{2}[\cos 11x + \cos -1x]$

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

$= \frac{1}{2}\left[\frac{\sin 11x}{11} - \frac{\sin x}{1}\right]$

$= \frac{\sin 11x}{22} - \frac{\sin x}{2} + c$

5 $\sin 7x \cos 2x$

Solu

$A = 7x, \quad B = 2x$

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

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

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

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

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