19/MHS01/314

5.) $\int \sin 7x \cos 2x \, dx$

Solution.

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

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

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

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

$\therefore \int \sin 7x \cos 2x \, dx =$

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

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1. $\int 2x^2 \ln x \, dx$

Solution

$\int 2x^2 \ln x \, dx$

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

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

$du = 1/x \, dx$

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

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

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

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

$\therefore \int 2x^2 \ln x \, dx = \frac{2}{3}x^3(\ln x - \frac{1}{3}) + c$

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

Solution

$\int 3t e^{2t} dt$

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

$du/dt = 3$ $\qquad v = \frac{e^{2t}}{2}$

$du = 3dt$

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

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

$= \frac{3t}{2}(e^{2t}) - \frac{3}{2}\left[\frac{e^{2t}}{2}\right] + c$

$= \frac{3t}{2}(e^{2t}) - \frac{3}{4}e^{2t} + c$

$\therefore \int 3t e^{2t} dt = \frac{3}{2}e^{2t}(t - \frac{1}{2}) + c$

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

Solution.

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

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

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

$du = 2x \, dx$

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

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

$-x^2 \cos x + \int$ $u = x \qquad dv = \cos x$

$du/dx = 1 \qquad v = \sin x$

$du = dx$

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

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

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

4. $\int \cos 5x \cos 6x \, dx$

Solution

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

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

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

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

$\cos(-x) = \cos x$

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

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

$= \frac{1}{2}\left(\frac{\sin 11x}{11} + \frac{\sin x}{1}\right) + c$

$\therefore \int \cos 5x \cos 6x \, dx = \left[\frac{\sin 11x}{22} + \frac{\sin x}{2}\right] + c$