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19/MHS01/351

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

Solution

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

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

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

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

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

$\int u dv = \frac{2x^3}{3} \ln x - \frac{2x^3}{4} dx$

$\int 2x^2 \ln x \, dx = \frac{2x^3}{3} \left[\ln x - \frac{1}{3}\right] + c$

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

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

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

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

$\int u dv = 3t \left(\frac{1}{2} e^{2t}\right) - \int \frac{1}{2} e^{2t} \cdot 3 dt$

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

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

$$\int u\,dv = \frac{3}{2}\left[t e^{2t} - \frac{1}{2} e^{2t}\right] + c$$

$$\int 3t\, e^{2t}\, dt = \frac{3}{2}\left[t e^{2t} - \frac{1}{2} e^{2t}\right] + c$$

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

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

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

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

$$\int u\,dv = x^2(-\cos x) - \int -\cos x \cdot 2x\, dx$$

$$\int u\,dv = -\cos x\,(x^2) - (-\sin x) \cdot \frac{2x^2}{2} + c$$

$$\int u\,dv = -\cos x\,(x^2 + \sin x\,\frac{2x^2}{2} + c$$

$$\int x^2 \sin x\, dx = -\cos x\,(x^2) + \sin x\left(\frac{2x^2}{2}\right) + c$$

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

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

~~Cos~~ $A = 5x$; $B = 6x$

$A + B = 5x + 6x = 11x$

$A - B = 5x - 6x = -x$

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

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

$\int \cos 5x \cos 6x \, dx = \frac{1}{2}\left(\frac{\sin 11x}{11} - \sin x\right) + c$

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

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

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

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

$A+B = 7x + 2x = 9x$

$A-B = 7x - 2x = 5x$

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

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

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

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