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19/MHS01/431
Medicine & Surgery

$\int 2x^2 \ln x$

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

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

$dx = x$

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

$= 2/3 x^3 \ln x - 2/3 \int x^2 dx$

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

$= 2/3 x^3 \ln x - 2/9 x^3 + C$

$= 2/3 \left[x^3 \ln x - 1/3 \cdot x^3\right] + C$

$\int 3te^{2t}$

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

$du/dt = 3 \qquad v = 1/2 e^{2t}$

$\int 3te^{2t} = 1/2 e^{2t} 3t - \int 3/2 e^{2t}$

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

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

$= \frac{3}{2} e^{2t} \left[t - 1/2\right] + C$

3 $\int x^2 \sin x$

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

$du/dx = 2x$; $V = -\cos x$

$\int x^2 \sin x = -x^2 \cos x - \int -2x \cos x$

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

$\int x \cos x$ —— ①

$u = x$; $dv = \cos x$

$du/dx = 1$ $V = \sin x$

$\int x \cos x = x \sin x - \int \sin x$

$= x \sin x - (-\cos x) + C$

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

put ② into ①

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

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

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

4 $\cos 5x \cos 6x$

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

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

$\cos 5x \cos 6x$

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

$$\int \cos 5x \cos 6x = \int \tfrac{1}{2}[\cos 11x + \cos(-x)]$$

$$= \tfrac{1}{2}\int (\cos 11x + \cos(-x))$$

$$= \tfrac{1}{2}\left[\tfrac{1}{11}\sin 11x + \cos(-x)\right]$$

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

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

5 $\sin 7x \cos 2x$

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

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

$A+B = 9x \quad A-B = 5x$

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

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

$= \tfrac{1}{2}\int \sin 9x + \sin 5x$

$= \tfrac{1}{2}\left[-\tfrac{1}{9}\cos 9x - \tfrac{1}{5}\cos 5x\right] + C$

$= -\tfrac{1}{18}\cos 9x - \tfrac{1}{10}\cos 5x + C$