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(1)

19/MHS01/236

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COURSE CODE: MAC 101

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(1) $2x^2 \ln x$

Soln

$$u = \ln x, \quad \frac{du}{dx} = \frac{1}{x}$$

$$dv = 2x^2, \quad v = \frac{2x^3}{3}$$

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

$$= \int \frac{2x^3}{3} \cdot \frac{dx}{x}$$

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

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

(2) $\int 3t e^{2t} \, dt$

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

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

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

(3)

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

$$u = x^2, \quad \frac{du}{dx} = 2x, \quad du = 2x \, dx$$

$$dv = \sin x, \quad v = -\cos x$$

(2)

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$$\begin{aligned} \int x^2 \sin dx &= -x^2 \cos x - \int -2x \cos x dx \\ &= -x^2 \cos x + \int 2x \cos x dx \\ &= -x^2 \cos x + 2x \sin x \end{aligned}$$

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

$$(4) \int \cos 5x \cos 6x dx$$

$$\begin{aligned} \cos A \cos B &= \frac{1}{2} [\cos(A+B) + \cos(A-B)] \\ &= \frac{1}{2} [\cos(5x+6x) + \cos(5x-6x)] \\ &= \frac{1}{2} [\cos 11x + \cos x] \end{aligned}$$

$$\int \cos 5x \cos 6x dx = \frac{\cos 11x}{2} + \frac{\cos x}{2}$$

$$(5) \int \sin 7x \cos 5x dx$$

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

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

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

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