RUFUS FORTUNE CHINAEZE
19/MHS01/388
MAT104

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

$u = \ln x$

$\frac{du}{dx} = \frac{1}{x}$

$du = \frac{1}{x} dx$

$dv = 2x^2$

$v = \frac{2x^3}{3}$

$$\int u\,dv = uv - \int v\,du$$
$$= \ln x\left(\frac{2x^3}{3}\right) - \int \frac{2x^3}{3} \cdot \frac{1}{x} dx$$
$$= \frac{2x^3}{3}\ln x - \int \frac{2x^2}{3} dx$$
$$= \frac{2x^3}{3}\ln x - \frac{2x^3}{9} + C$$

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

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

$u = 3t$

$\frac{du}{dt} = 3$

$du = 3dt$

$dv = e^{2t}$

$v = \frac{e^{2t}}{2}$

$$\int u\,dv = uv - \int v\,du$$
$$= \frac{3e^{2t}}{2} - \int \frac{e^{2t}}{2} \cdot 3dt$$
$$= \frac{3e^{2t}}{2} - \frac{3}{2}\int e^{2t} \cdot dt$$
$$= \frac{3e^{2t}}{2} - \frac{3}{2} \cdot \frac{e^{2t}}{2} + C$$
$$= \frac{3e^{2t}}{2} - \frac{3e^{2t}}{4} + C$$
$$\cancel{= \frac{3e^{2t}}{2}\left(1 - \frac{1}{2}\right) + C}$$

$$\int 3te^{2t} \, dt = \frac{3e^{2t}}{4} + C$$

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

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

$\frac{du}{dx} = 2x \quad v = -\cos x$

$du = 2x\,dx$

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

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

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

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

$= -x^2 \cos x + \cancel{2} \cdot \frac{x^2}{\cancel{2}} \sin x + C$

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

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

4. $\sin 7x \cos 2x = \frac{1}{2}\{\sin(A+B) + \sin(A-B)\}$

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

$= \frac{1}{2}(\sin 9x + \sin 5x)$

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

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

$=$

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

5. $\cos 5x \cos 6x\,dx = \frac{1}{2}[\cos(A+B) + \cos(A-B)]$

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

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

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

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

$= \frac{1}{2}\left(\frac{\sin 11x}{11} - \frac{\sin(-x)}{1}\right)dx$

$= \frac{1}{2}\frac{\sin 11x}{22} - \frac{\sin(-x)}{2} + C$

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