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MAT 104 Assignment

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

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

using Integration by part

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

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

$$V = \int dv = \int x^2 \; ;$$

$$\frac{du}{dx} = \frac{2}{x}$$

$$V = \frac{x^3}{3}$$

$$\therefore \quad 2\ln x \cdot \frac{x^3}{3} = \int 2\ln x \cdot x^2 + \int \frac{x^3}{3} \cdot \frac{2}{x}$$

rearranging

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

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

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

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

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

let $u = 3t$
$du = 3$
$dv = e^{2t}$
$v = \frac{e^{2t}}{2}$

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

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

$$\frac{3te^{2t}}{2} = \int 3te^{2t} + \int \frac{3e^{2t}}{2}$$

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

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

$$\therefore \int 3te^{2t} = \frac{3}{2}te^{2t} - \frac{3}{2}\left(\frac{e^{2t}}{2}\right)$$

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

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

$u = x^2$
$du = 2x$
$dv = \sin x$
$v = -\cos x$

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

$$\int x^2 \sin x = -x^2 \cos x - \int (-\cos x)\cdot 2x$$

$\int x^2 \sin x = -x^2 \cos x + \int 2x \cos x$ —— (1)

$\int 2x \cos x$ let $u = 2x$, $du = 2$

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

$\int u\,dv = uv - \int v\,du$; $\int 2x \cos x = 2x \sin x - \int 2\sin$

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

$\int 2x \cos x = 2x \sin x + 2\cos x$ —— (ii)

~~Subbing~~ Sub. The value of $\int 2x \cos x$ into eq(1)

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

(3) $\int \cos 5x \cos 6x \, dx$

$\int \cos 5x \cos 6x = \int \cos A \cos B$

~~$\cos A \cos B = \frac{1}{2}\big($~~

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

$\therefore \int \cos A \cos B = \int \frac{1}{2}\left(\cos(A-B) + \cos(A+B)\right)$

$\int \cancel{\cos 5x}$ let $A = 5x$ and $B = 6x$

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

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

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

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

$\therefore \int \cos 5x \cdot \cos 6x = \frac{\sin x}{2} + \frac{\sin 11x}{22} + C$

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(6) $\int \sin 7x \cos 2x \, dx$

$\sin 7x \cos 2x$, let $A = 7x$ and $B = 2x$

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

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

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

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

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

$$\int \sin 7x \cos 2x = \frac{1}{2}\left(-\frac{\cos 9x}{9} - \frac{\cos 5x}{5}\right) + C$$

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