Team 2

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

$\sin^2 x = \frac{1}{2}(1+\cos 2x)$

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

$= \frac{x}{2} + \frac{1}{4}\sin 2x + C$

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

$u = x$

$du = dx$

$dv = \sin x\,dx$

$v = -\cos x$

$-x\cos x - \int -\cos x\,dx$

$-x\cos x + \sin x + C$

3. $\int x\cos x\,dx$

$u = x \qquad dv = \cos x\,dx$

$du = dx \qquad v = \sin x$

$x\sin x - \int \sin x\,dx$

$\boxed{x\sin x + \cos x + C}$

4. $\int \cos^2 x \, dx$

$u = \cos x$ $\quad dv = \cos x \, dx$

$du = -\sin x \, dx$ $\quad v = \sin x$

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

$= \cos x \sin x + \int 1 \, dx - \cos^2 x \, dx$

$\int \cos^2 x \, dx = \dfrac{\cos x \sin x + x}{2} + C$

Final Solution: Max Z.

$$\int \underbrace{x\sin x}_{u}\underbrace{\cos x\,dx}_{dv}$$

$v = \sin x$

$du = \sin x + x\cos x$

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

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

$$= \frac{x}{2} - \frac{\sin x\cos x}{2}$$

$$\int = \frac{x\sin^2 x}{2} - \frac{x}{4} + \frac{\sin x\cos x}{4}$$

Next

$$\int x^2\cos^2 x\,dx \qquad u = x^2\cos x \quad v=\sin x$$
$$dv=\cos x\,dx \quad du = 2x\cos x - x^2\sin x$$

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

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

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

$$2\int = x^2\cos x\sin x - 2\left(\frac{x\sin^2 x}{2} - \frac{x}{4} + \frac{\sin x\cos x}{4}\right) + \frac{x^3}{3}$$

$$\int = \frac{x^2\cos x\sin x}{2} - \frac{x\sin^2 x}{2} + \frac{x}{4} - \frac{\sin x\cos x}{4} + \frac{x^3}{6}$$

$$\int = \frac{x^2\sin 2x}{4} + \frac{x\cos 2x}{4} - \frac{\sin 2x}{8} + \frac{x^3}{6} + C$$

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