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Computer Engineering

1, $x^{1/2}\ln x$
2, $2\cos 6t \cos t$
3, $\sin^3 x \cos^4 x$

Solution

1, $x^{1/2}\ \ln x$

$\int x^{1/2}\ln x$

$u = x^{1/2} \quad du = \ln x$

$\frac{dy}{dx} = \frac{1}{2}x^{-1/2}$

$\int \frac{V\,du}{dx} + \int \frac{U\,du}{dx}$

$\ln x \int \frac{x^{1/2}}{dx} + x^{1/2}\int \frac{C\ln x}{dx}$

$\ln x\left[\frac{x^{3/2}}{3/2}\right] + x^{1/2}\left[\int \frac{1}{x}\right]$

$\frac{2\ln x}{3} \cdot x^{3/2} + \frac{x^{1/2}}{x} +$

$\frac{2x^{3/2}\ln x}{3} + \frac{\sqrt{x}}{x}$

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(2) $\int 2\int \cos 6t \cos t \, dt = 12 \int \cos 6t \cos t \, dt$

let $A = 6t$ $B = 1t$

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

$= \frac{2}{2}[\cos(6+1) + \cos(6-1)]$

$= \frac{2}{2}[\cos 7t + \cos 5t]$

$\cancel{= \frac{1}{2}[}$

$\int 2 \cos 6t \cos t \, dt = \frac{1}{2}\int (2\cos 7t + \cos 5t)$

$= \frac{2}{7}\left[\frac{\cancel{1}\sin 7t}{7} - \frac{\sin 5t}{5}\right]$

$= \frac{\sin 7t}{7} - \frac{\sin 5t}{5} + c$

3) $\int \sin^3 x \cos^4 x \, dx$

$u = \cos x$

$\frac{du}{dx} = -\sin x \Rightarrow dx = \frac{du}{-\sin x}$

$\int \cos^4 x \; \sin^3 x \, dx$

$\int u^4 \cancel{\sin^3 x} \; \frac{-du}{\sin x}$

$= \int u^4 \sin^2 x - du$

$= \int u^4 \sin^2 x \cdot du$

Recall that

$\sin^2 x + \cos^2 x = 1$

$\sin^2 x = 1 - \cos^2 x$

$= \int \sin^2 x \, u^4 \cdot du$

$= \int (1 - \cos^2 x) u^4 \, du$

but $u = \cos x$

$= \int (1 - u^2) u^4 \, du$

$= \int (u^4 - u^6) \, du$

$= \left[\frac{u^{4+1}}{4+1} - \frac{u^{6+}}{6+1} \right] + c$

$= \left[\frac{u^5}{5} - \frac{u^7}{7} \right] + c$

$\frac{(\cos x)^7}{7} - \frac{(\cos x)^5}{5} + c$