$\log_e x = \frac{1}{x}$

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

<u>Solution</u>

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

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

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

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

$\int \frac{V\,dU}{dx} + \int \frac{U\,dV}{dx}$

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

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

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

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

$$(2)\quad \cancel{\int} 2\int \cos 6t \cos t \, dt = 12\int \cos 6t \cos t \, dt$$

$$A = 6t \quad B = 1t$$

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

$$= \tfrac{2}{2}\left[\cos(6+1) + \cos(6-1)\right]$$

$$= \tfrac{2}{2}\left[\cos 7t + \cos 5t\right]$$

$$\cancel{= \tfrac{1}{2}\left[\right.}$$

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

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

$$= \frac{2\sin 7t}{7} - \frac{\sin 5t}{5} + c$$

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 $u = \cos x$

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

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

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

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

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