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Computer-Engineering

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1.)  $x^{1/2} \ln x$

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

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

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

$$\int \frac{v du}{dx} + \int u dv$$

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

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

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

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

2.)  $2 \int \cos 6t \cos t dt = 12 \int \cos 6t \cos t dt$

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

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

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

$$= \frac{1}{2} [\cos 7t + \cos 5t]$$

$$\int 2 \cos 6t \cos t dt = \frac{1}{2} \int [2 \cos 7t + \cos 5t]$$

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

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

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

$$u = \cos x$$

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

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

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

Since

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

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

Recall that

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

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

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

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

but  $(\cos x) = u = \cos x$

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

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

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

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

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