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Serial number : 6 (MAT 104)

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

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

$\frac{du}{dx} = \frac{1}{x} \qquad v = \frac{2x^{3/2}}{3}$

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

$$\int x^{1/2}\ln x = \frac{2x^{3/2}\ln x}{3} - \int \frac{2x^{3/2}}{3}\cdot\frac{dx}{x}$$

$$= \frac{2x^{3/2}\ln x}{3} - \int \frac{2x^{1/2}}{3}\,dx$$

$$\int x^{1/2}\ln x = \frac{2x^{3/2}\ln x}{3} - \frac{4x^{3/2}}{9} + C$$

2) $\int 2\cos 6t \cos t \, dt$

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

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

$$= \frac{1}{2}\int \left[2\cos(7t) + \cos 5t\right]$$

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

$$\int 2\cos 6t \cos t \, dt = \frac{\sin 7t}{7} + \frac{\sin 5t}{10}$$

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

$u = \cos x$

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

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

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

$= \int \sin x \cdot \sin^2 x \cdot u^4 \cdot \frac{-du}{\sin x}$

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

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

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

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

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

$= \frac{u^7}{7} - \frac{u^5}{5}$

$$\int \sin^3 x \cos^4 x \, dx = \frac{(\cos x)^7}{7} - \frac{(\cos x)^5}{7} + C$$