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MAT 104

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

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

$\frac{du}{dx} = \frac{1}{x} \quad dv = x^{1/2}, \quad V = \frac{x^{3/2}}{3/2}$

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

$\int x^{3/2} \ln x = \ln x \, x^{3/2}/3/2 - x^{5/2}/5/4 \ln x + C$

$= \ln x \left[\frac{2x^{3/2}}{3} - \frac{4x^{5/2}}{4} \right] + C$

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

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

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

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

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

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

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

$$\int u^4 \sin^3 x \cdot \frac{du}{\sin x}$$

$$= -\int u^4 \sin^3 x \, dx$$

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

recall that

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

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

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

but $u = \cos x$

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

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

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

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

$$\left[\frac{(\cos x)^5}{5} - \frac{(\cos x)^7}{7}\right] + C$$