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Mech. Engr.

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

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

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

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

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

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

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

$$\int 2 \cos 6t \cos 5t \, dt$$

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

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

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

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

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

$$u = \cos x$$

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

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

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

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

$$= \int (u^4 - 1) \cdot u^4 \, du = \int (u^6 - u^4) \, du$$
$$= \frac{u^7}{7} - \frac{u^5}{5}$$

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