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Mechanical Engineering 10011

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Serial No: 205

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

$$\int x^{1/2} \ln x dx = \int u dv = uv - \int v du$$

Let  $u = \ln x$

$$dv = x^{1/2}$$

$$\frac{du}{dx} = \frac{1}{x}$$

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

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

$$v = \frac{2x^{3/2}}{3}$$

$$\int u dv = \ln x \left( \frac{2x^{3/2}}{3} \right) - \int \frac{2x^{3/2}}{3} \frac{dx}{x}$$

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

$$= \ln \left( \frac{2x^{3/2}}{3} \right) - \frac{2}{3} \frac{x^{3/2}}{3/2}$$

$$= \ln \left( \frac{2x^{3/2}}{3} \right) - \frac{4}{9} x^{3/2} + C$$

2.  $2 \cos 6t \cos t$

$$\int 2 \cos 6t \cos t$$

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

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

$$= \int \cos 5t + \cos 7t$$

$$= \int \cos 5t dt + \int \cos 7t dt$$

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

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

$$\int \sin^3 x \cos^4 x dx = \int (\sin x) (\sin^2 x) (\cos^4 x)$$

$$= \int \sin x [1 - \cos^2 x] \cos^4 x$$

$$\text{Let } u = \cos x$$

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

$$du = -\sin x dx$$

$$\int (\sin x) (1 - u^2) u^4 dx = \int (1 - u^2) u^4 \sin x dx$$

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

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

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

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