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Elect/Elect Engg

S/N: 12

### MAT104 Assignment

Integrate

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

(ii)  ~~$x^2 \ln x$~~  Use part (i)

(iii)  $\sin^3 x \cos^4 x$

Solution

(i)  $\int x^{1/2} \ln x \, dx := x^{1/2} \ln x$

$\ln x = dv$

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

$dv = \ln x$ ;  $\int \ln x \, dx = x \ln(x) - x$

$= UV - \int V \, du$

$x^{1/2} \cdot x \ln(x) - \int \ln(x) \cdot \left[ \frac{x^{-1/2}}{2} \right]$

$x^{1/2} (x \ln(x) - x) - \left[ \frac{x^2 \ln x}{2} - \frac{x^2}{4} \cdot \frac{x^{1/2}}{3} \right]$

Hence;

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

$= x^{3/2} \ln x - \left( \frac{x^2 \ln x}{2} - \frac{x^2}{4} \right) \left( \frac{x^{1/2}}{3} \right) + C$

x

ln x

(ii)  $\int 2 \cos 6t \cos t \, dt : 2 \int \cos 6t \cos t$   
 $A = 6t ; B = t$   
 $\cos A \cos B = \frac{1}{2} [\cos(A+B) + \cos(A-B)]$   
 $\frac{1}{2} [\cos 7t + \cos 5t]$   
 $2 \int 2 \cos 6t \cos t \, dt = 2 \times \frac{1}{2} \int (\cos 7t + \cos 5t) \, dt$   
 $= \left[ \frac{\sin 7t}{7} + \frac{\sin 5t}{5} \right] + c$   
 $= \left( \frac{\sin 7t}{7} + \frac{\sin 5t}{5} \right) + c \quad \checkmark$

(iii)  $\int \sin^3 x \cos^4 x \, dx : U = \cos x$   
 $\frac{du}{dx} = -\sin x ; dx = -\frac{du}{\sin x}$

Hence,

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

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

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

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

$$= \int U^6 - U^4 \, du$$

$$= \left[ \frac{U^7}{7} - \frac{U^5}{5} \right] + c$$

$$= \frac{(\cos x)^7}{7} - \frac{(\cos x)^5}{5} + c \quad \checkmark$$