

10.8

Q 4.iii) Find $I = \int e^x \sin(x) dx$

\int e^x $\sin(x)$ dx
 \downarrow \downarrow
 dv u

Solⁿ

$$I = \sin(x) \cdot e^x - \int e^x \cdot \cos x dx$$

$$\int e^x \cos x dx = \cos(x) e^x + \int e^x \sin x dx$$

$$I = e^x \sin(x) - e^x \cos(x) - \int e^x \sin x dx$$

$$I = e^x \sin(x) - e^x \cos(x) - I$$

$$2I = e^x (\sin(x) - \cos(x))$$

$$I = \frac{1}{2} e^x (\sin(x) - \cos(x)) + C$$

4 ii) Find $I = \int t^2 e^t dt$

Soln

$$\begin{aligned} I &= t^2 e^t - \int e^t (2t) dt \\ &= t^2 e^t - 2 \int t e^t dt \end{aligned}$$

$$\begin{aligned} \int \underbrace{t} \underbrace{e^t} dt &= t e^t - \int e^t dt \\ &= t e^t - e^t + C \end{aligned}$$

$$I = t^2 e^t - 2 t e^t + 2 e^t + C$$

6) Find $I = \int \frac{\sqrt{16-x^2}}{x^2} dx$

Soln

$$x = 4 \sin \theta$$

$$dx = 4 \cos \theta d\theta$$

$$I = 4 \int \frac{\sqrt{16 - 16 \sin^2 \theta}}{16 \sin^2 \theta} \cos \theta d\theta$$

$$I = \frac{4 \cdot 4}{16} \int \frac{\sqrt{1 - \sin^2 \theta}}{\sin^2 \theta} \cos \theta d\theta$$

$$I = \int \frac{\sqrt{\cos^2 \theta}}{\sin^2 \theta} \cos \theta d\theta$$

$$I = \int \frac{\cos^2 \theta}{\sin^2 \theta} d\theta$$

$$8) \text{ Find } I = \int \frac{x+5}{x^2+x-2} dx$$

Soln

$$\frac{x+5}{x^2+x-2} = \frac{x+5}{(x+2)(x-1)}$$

$$= \frac{A}{x+2} + \frac{B}{x-1}$$

$$\frac{x+5}{(x+2)(x-1)} = \frac{A(x-1) + B(x+2)}{(x+2)(x-1)}$$

$$x+5 = A(x-1) + B(x+2)$$

$$\underline{x=-2} \quad 3 = -3A \quad \boxed{A = -1}$$

$$\underline{x=1} \quad 6 = 3B \quad \boxed{B = 2}$$

$$I = -\int \frac{1}{x+2} dx + 2 \int \frac{1}{x-1} dx$$

$$I = -\ln|x+2| + 2\ln|x-1| + C$$

$$I = \int \frac{1 - \sin^2 \theta}{\sin^2 \theta} d\theta$$

$$I = \int (\operatorname{cosec}^2 \theta - 1) d\theta$$

$$I = -\cot \theta - \theta + C$$

where $x = 4 \sin \theta$.

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