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Maths Assignment Answer  
 Q1  
 $\int \sin^3 x$   
 Sol

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

$$\text{Recall } \sin^2(x) = 1 - \cos^2(x)$$

$$\int (\sin^2 x) \sin x \, dx = \int (1 - \cos^2 x) \sin x \, dx$$

$$= \int (1 - \cos^2 x) \sin x \, dx$$

$$= \int 1 \sin x \, dx - \int \cos^2 x \sin x \, dx$$

$$= -\cos x + \int \cos^2 x \sin x \, dx$$

$$= -\cos x + \int \cos x \sin x + \cos x \sin x \, dx$$

$$= -\cos x + \frac{1}{2} \sin^2 x + \frac{1}{2} \sin^2 x + C$$

$$= -\cos x + \sin^2 x + C$$

$$= \frac{1}{2} \sin^2 x - \cos x + C$$

Q2  
 $\int \cos^4 x \sin^2 x$   
 Sol

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

$$= \int \cos^2 x \sin^2 x \cos x \, dx$$

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

$$-du = -\sin x \, dx$$

$$-du = \sin x \, dx$$

$$\begin{aligned}
 &= \int \sin(x) (1-u^2) u^4 dx \\
 &= \int (1-u)^2 u^4 \sin(x) dx \\
 &= \int (1-u^2) u^4 \cdot -du \\
 &= \int (1-u^2) u^4 du \\
 &= \frac{1}{7} u^7 - \frac{1}{5} u^5 + C \\
 &= \frac{\cos^7(x)}{7} - \frac{\cos^5(x)}{5} + C
 \end{aligned}$$

3)  $\int \cos x \sin^3 x dx$   
 Sol

$$\int \sin^2 x \cos x dx$$

$$\sin a \cdot \cos a = \frac{1}{2} (\sin(2a) + \sin(2a))$$

$$\sin(3x) \cos(3x) = \frac{1}{2} (\sin(6x) + \sin(6x))$$

$$\int \sin(x) \cos^3(x) dx = \frac{1}{2} \int \sin(2x) dx + \frac{1}{2} \int \sin(2x) dx$$

$$= \frac{1}{2} \left( \frac{-\cos(2x)}{2} \right) + \frac{1}{2} \left( \frac{-\cos(2x)}{2} \right) + C$$

$$= \frac{-\cos(2x)}{4} - \frac{\cos(2x)}{4} + C$$