

Evaluate the integral.

1. (2.5 pts) $\int x^2 \cos 3x dx$

Solution:

$$\begin{aligned} & \int x^2 \cos 3x dx \\ &= \frac{1}{3} x^2 \sin 3x - \frac{1}{3} \int \sin 3x (2x) dx \\ &= \frac{1}{3} x^2 \sin 3x - \frac{2}{3} \left(\frac{-\cos 3x}{3} x - \frac{1}{3} \int (-\cos 3x) dx \right) \\ &= \frac{1}{3} x^2 \sin 3x + \frac{2}{9} x \cos 3x - \frac{2}{27} \sin 3x + C. \end{aligned}$$

□

2. (2.5 pts) $\int \sin^6 x \cos^3 x dx$

Solution: Let $u = \sin x$. $du = \cos x dx$.

$$\begin{aligned} & \int \sin^6 x \cos^3 x dx \\ &= \int \sin^6 x \cos^2 x \cos x dx = \int \sin^6 x (1 - \sin^2 x) \cos x dx \\ &= \int u^6 (1 - u^2) du = \int (u^6 - u^8) du \\ &= \frac{u^7}{7} - \frac{u^9}{9} = \frac{\sin^7 x}{7} - \frac{\sin^9 x}{9} + C. \end{aligned}$$

□