RUFUS FORTUNE CHINAZA
19/MHS01/388
MAT 104

1. $\int \sin^6 x \, dx$

Using reduction formula

$$\int \sin^n x \, dx = -\frac{1}{n}\sin^{n-1} x \cos x + \frac{n-1}{n}\int \sin^{n-2} x \, dx$$

$$= -\frac{1}{6}\sin^5 x \cos x + \frac{5}{6}\int \sin^4 x \, dx$$

$$= -\frac{1}{6}\sin^5 x \cos x + \frac{5}{6}\left[-\frac{1}{4}\sin^3 x \cos x + \frac{3}{4}\int \sin^2 x \, dx\right]$$

$$= -\frac{1}{6}\sin^5 x \cos x + -\frac{5}{24}\left[\frac{1}{4}\sin^3 x \cos x + \frac{3}{4}\int \sin^2 x \, dx\right.$$

$$= -\frac{1}{6}\sin^5 x \cos x - \frac{5}{24}\sin^3 x \cos x + \frac{5}{8}\left[-\frac{1}{2}\sin x \cos x + \frac{1}{2}\int \sin 0x \, dx\right]$$

$$= -\frac{1}{6}\sin^5 x \cos x - \frac{5}{24}\sin^3 x \cos x - \frac{5}{16}\sin x \cos x + \frac{5}{16}x + C$$

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

~~$\int uv = uv - \int v\,du$~~

let $u = \cos x$ let,

$du = -\sin x$

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

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

$u = \cos x \quad du = -\sin x \, dx \quad dx = \frac{du}{-\sin x}$

$-\int \sin x (1 - \cos^2 x)(\cos^2 x)^2 \frac{du}{\sin x}$

$-\int (1 - u^2)(u^2)^2 \, du$

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

$-\int (u^4 - u^6) \, du$

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

$= -\frac{1}{5}\cos^5 x + \frac{1}{7}\cos^7 x + C$

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

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

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

let $u = \cos x$ $du = -\sin x \, dx$ $dx = \frac{du}{-\sin x}$

$= -\int \sin x (1 - u^2) u \cdot \frac{du}{\sin x}$

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

$= -\int (u - u^3) \cdot du$

$= -\frac{u^2}{2} + \frac{u^4}{4} + C$

$= -\frac{1}{2}\cos^2 x + \frac{1}{4}\cos^4 x + C$