$$\int \sin^5 x \cos^3 x \, dx \qquad \text{(SAVE ONE } \cos x\text{)}$$

$$= \int \underbrace{\sin^5 x \cos^2 x}_{} \underbrace{\cos x \, dx}_{du} \qquad u = \sin x$$

$$\cos^2 x = 1 - \sin^2 x$$

$$= \int \underbrace{\sin^5 x (1 - \sin^2 x)}_{\text{func. of } u = \sin x} \underbrace{\cos x \, dx}_{du} \quad \left\| \begin{array}{l} u = \sin x \\ du = \cos x \, dx \end{array} \right.$$

$$= \int u^5 (1 - u^2) \, du$$

NOW THIS IS EASY!

$$\int (2 - \sin\theta)^2 \, d\theta$$

$$= \int (4 - 4\sin\theta + \sin^2\theta) \, d\theta$$

EASY

HALF-ANGLE

$$\sin^2\theta = \frac{1}{2}(1 - \cos 2\theta)$$

$$= \int \left[4 - 4\sin\theta + \frac{1}{2} - \frac{1}{2}\cos 2\theta\right] d\theta$$

$$= 4\theta + 4\cos\theta + \frac{1}{2}\theta - \frac{1}{4}\sin 2\theta + C$$

$$\int \tan^4 x \sec^4 x \, dx$$

$$= \int \tan^4 x \, \sec^2 x \, \underbrace{\sec^2 x \, dx}_{du} \qquad u = \tan x$$

$$\sec^2 x = 1 + \tan^2 x$$

$$= \int \underbrace{\tan^4 x \, (1 + \tan^2 x)}_{\text{func. of } u = \tan x} \, \underbrace{\sec^2 x \, dx}_{du} \qquad \begin{vmatrix} u = \tan x \\ du = \sec^2 x \, dx \end{vmatrix}$$

$$= \int u^4 (1 + u^2) \, du \qquad \underline{\text{EASY!}}$$

$$= \int (u^4 + u^6) \, du$$

$$= \frac{1}{5} u^5 + \frac{1}{7} u^7 + C$$

$$= \underline{\frac{1}{5} \tan^5 x + \frac{1}{7} \tan^7 x + C}$$

$$\int \cot^2 x \, dx$$

$\cos^2 x + \sin^2 x = 1$

↓ divide by $\sin^2 x$

$\cot^2 x + 1 = \csc^2 x$

$$\int (-1 + \csc^2 x) \, dx$$

$$= -\int dx + \int \csc^2 x \, dx$$

$$= -x + (-\cot x) + C$$

$$= -x - \cot x + C = -x - \cot x + C$$

$$\int \sqrt{\cos x}\ \sin^3 x\, dx$$

$$= \int \sqrt{\cos x}\ \sin^2 x\ \underbrace{\sin x\, dx}_{-du}$$

$u = \cos x$

$\sin^2 x = 1 - \cos^2 x$

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

$u = \cos x$

$du = -\sin x\, dx$

$$= -\int \sqrt{u}\ (1-u^2)\, du$$

EASY!

$$\int x \tan^2 x \, dx$$

$\tan^2 x = \sec^2 x - 1$

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

$$= \int \underbrace{x}_{u} \underbrace{\sec^2 x \, dx}_{dv} - \int x \, dx$$

PARTS

$u = x \quad du = dx$

$dv = \sec^2 x \, dx$

$v = \tan x$

$$= x \tan x - \int \tan x \, dx - \frac{1}{2} x^2$$

$$= x \tan x - \ln|\sec x| - \frac{1}{2} x^2 + C$$