Lecture 37: Practice Integral

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$$\int \sec^4 x\,dx = uv - \int v\,du \quad \cdots\cdots$$

parts: $u = \sec x\,dx \qquad du = \sec x \tan x\,dx$

$dv = \sec^3 x\,dx \qquad v = \frac{1}{2}\left[\ln|\sec x + \tan x| + \sec x \tan x\right]$

$$\int \sec^3 x\,dx = \int \sec^2 x \sec x\,dx$$

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

$$= \int (\sec x + \sec x \tan^2 x)\,dx$$

$$= \int \sec x\,dx + \int \sec x \tan^2 x\,dx$$

$$= \ln|\sec x + \tan x| + \int \sec x \tan^2 x\,dx$$

$$\int \sec^3 x\,dx = \ln|\sec x + \tan x| + \sec x \tan x - \int \sec^3 x\,dx$$

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

$dv = \sec x \tan x\,dx \qquad v = \sec x$

$u = \tan x \qquad du = \sec^2 x\,dx$

$$\int \sec^3 x\,dx = \frac{1}{2}\left[\ln|\sec x + \tan x| + \sec x \tan x\right] + C$$

Another try:

$$\int \sec^4 x\,dx = \int \sec^2 x \sec^2 x\,dx = \int (1+\tan^2 x)\sec^2 x\,dx$$

$$= \int \sec^2 x\,dx + \int \tan^2 x \sec^2 x\,dx$$

$$= \tan x + \cdots$$

$$\int \tan^2 x \sec^2 x\,dx = \tan x \tan^2 x - 2\int \tan^2 \sec^2 x\,dx$$

$u = \tan^2 x \qquad du = 2\tan x \sec^2 x\,dx$

$dv = \sec^2 x\,dx \qquad v = \tan x$

so $\quad 3\int \tan^2 x \sec^2 x\,dx = \tan^3 x$

$$\int \tan^2 x \sec^2 x\,dx = \frac{1}{3}\tan^3 x + C$$

$$\int \sec^4 x\,dx = \tan x + \int \tan^2 x \sec^2 x\,dx$$

$$= \tan x + \frac{1}{3}\tan^3 x + C$$