Some identities we need to use:

$$\sin 2x = 2\sin x\cos x, \quad \sin^2 x + \cos^2 x = 1, \quad \sin^2 x = \frac{1}{2}(1-\cos 2x), \quad \cos^2 x = \frac{1}{2}(1+\cos 2x)$$

$$\sec^2 x = 1 + \tan^2 x, \quad \frac{d}{dx}\tan x = \sec^2 x, \quad \frac{d}{dx}\sec x = \sec x\tan x \quad \int \tan x\, dx = \ln|\sec x| + C$$

Part 1. Evaluate $\int \sin^m x \cos^n\ dx$ for any m, n.

Example 1. $\int \cos^5 x\ dx$.

Example 2. $\int \sin^m x \cos x\ dx$.

Example 3. $\int \sin^m x \cos^3 x\ dx$.

Example 4. $\int \sin^m x \cos^5 x\ dx$.

1. Strategy for Evaluating $\int \sin^m x \cos^{2k+1} x\ dx$.

Example 5. (practice) $\int \cos^m x \sin^5 x\ dx$.

2. Strategy for Evaluating $\int \cos^m x \sin^{2k+1} x\ dx$.

Example 6. $\int \sin^2 x\ dx$.

Example 7. $\int \sin^4 x\ dx$.

Example 8. $\int \cos^2 x \sin^4 x\ dx$.

3. Strategy for Evaluating $\int \cos^{2m} x \sin^{2n} x\ dx$.

Part 2. Evaluate $\int \tan^m x \sec^n x\ dx$ for any m, n.

Example 9. $\int \tan^4 x \sec^4 x\ dx$.

Example 10. (practice) $\int \tan^6 x \sec^4 x\ dx$.

4. Strategy for Evaluating $\int \tan^m x \sec^{2k} x\ dx$.

Example 11. $\int \tan^3 x \sec^5 x\ dx$.

5. Strategy for Evaluating $\int \tan^{2k+1} x \sec^m x\ dx$.

Example 12. (practice) $\int \tan^5 x \sec^8 x\ dx$.

Example 13. $\int \tan^3 x\ dx$.