Integrals Involving Powers of Sine and Cosine

1. If the power of the **sine is odd and positive**, save one sine factor to be the du and convert the remaining factors to cosine. Then, expand and integrate.

2. If the power of the **cosine is odd and positive**, save one cosine factor to be the du and convert the remaining factors to sine Then, expand and integrate.

3. If the **powers of both the sine and cosine are even and nonnegative**, make repeated use of the half angle identities.

Integrals involving Secants and Tangents

1. If the power of the **secant is even and positive**, save a secant squared factor to be the du and convert the remaining factors to tangents. Then, expand and integrate.

2. If the power of the **tangent is odd and positive,** and there is a secant factor, save a secant-tangent factor to be the du and convert the remaining factors to secants. Then, expand and integrate.

$$\int tan^3 x \, sec\, x \, dx$$

If there is no secant factor, convert a tangent squared factor to a secant squared factor; then expand and repeat if necessary.

$$\int tan^3 x\,dx$$

3. If there are **no secant factors** and the **power of the tangent is even and positive**, convert a tangent squared factor to a secant squared factor; then expand and repeat if necessary.

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

4. If the integral is of the form $\int sec^{m} x \, dx$ where **m is odd and positive**, use integration by parts.

$$\int sec^{3} x \, dx$$

5. If **none of the first four cases applies**, try converting to sines and cosines.

$$\int \frac{sec\,x}{tan^2\,x}\,dx$$

Integrals involving Sine-Cosine Products with Different Angles

Use the product-to-sum identities.

$$\sin A \sin B = \frac{1}{2}\left(\cos\left(A - B\right) - \cos\left(A + B\right)\right)$$

$$\sin A \cos B = \frac{1}{2}\left(\sin\left(A - B\right) + \sin\left(A + B\right)\right)$$

$$\cos A \cos B = \frac{1}{2}\left(\cos\left(A - B\right) + \cos\left(A + B\right)\right)$$

Where the product to sum formula comes from and why it may be needed:

Example:

$$\int sin(Ax)\,sin(Bx)\,dx$$

Recall

$$cos(A+B) = cos A\,cos B - sin A\,sin B$$

$$cos(A-B) = cos A\,cos B + sin A\,sin B$$

So,

$$sin A\,sin B = \frac{1}{2}\left(cos(A-B) - cos(A+B)\right)$$

Start of Review for Exam 1 (all mixed up)

$$arcsin\left(sin\frac{-\pi}{6}\right)=$$

$$arctan\left(tan\frac{-\pi}{4}\right)=$$

$$cos\left(arcsin\frac{3}{5}\right)=$$

$$sec\left(arctan\frac{4}{3}\right)=$$

$$\tan\left(\operatorname{arcsec}\frac{5}{3}\right)=$$

$$\tan\left(\arcsin\frac{2}{7}\right)=$$

$$y=(\sinh ax)(\cosh ax)$$
$$y'=$$

$$\frac{d}{dx}(\cos x)^{x^2+1}=$$

$$\frac{d}{dx}\left(3x^{2}+1\right)^{4x+2}$$

$$\int e^{2x}\,dx=$$

$$\int 3^{5x}\,dx=$$

$$\frac{d}{dx}e^{x^{2}+3x}=$$

$$\frac{d}{dx} 5^{x^2+3x} =$$

$$\frac{d}{dx} 3^{2x} =$$

$$\frac{d}{dx} \ln x =$$

$$\int \frac{\sec^2 x}{\tan x + 1} dx$$

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

$$\frac{d}{dx}\arctan(5x) =$$

$$\frac{d}{dx}\arcsin(3x^2) =$$

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

$$\int \frac{1}{a^2 + u^2} du =$$

$$\int \frac{u}{a^2 + u^2} du =$$

$$\int \frac{2}{\sqrt{a^2 - u^2}} du =$$

$$\int \frac{5u}{\sqrt{a^2 - u^2}}\,du =$$

$$\int \frac{7}{225 + (3x-1)^2}\,dx =$$

$$\int \frac{2e^{\frac{1}{x}}}{x^2}\,dx$$

$$\int \frac{3}{\sqrt{7 - x^2}}\,dx =$$

$$\int x^2 \, ln\, x \, dx =$$

$$\int 2x\sqrt{2x-3}\, dx =$$

$$\int x \, cos\, 2x \, dx =$$