$$\int a^x dx$$

$$\int a^x dx = \frac{a^x}{\ln a} + C$$

What are the restrictions on a?

a is constant

$a > 0$

$a \neq 1$

$$\int \csc x \cot x dx$$

$$\int \csc x \cot x \, dx = -\csc x + C$$

$$\int \cos x\,dx$$

$$\int \cos x \, dx = \sin x + C$$

$$\int \cot x\,dx$$

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

$= \ln|u| + C$

$$\int \cot x \, dx = \ln|\sin x| + C$$

or $-\ln|\csc x| + C$

$-\ln 5$ $\quad$ $3\ln 2$

$\ln 5^{-1} = \ln \frac{1}{5}$ $\quad$ $\ln 2^3$

$$\int \csc^2 x dx$$

$$= -\cot x + C$$

$$\int \sec x dx$$

$$= \ln|\sec x + \tan x| + C$$

$$\int \frac{1}{x}\,dx$$

$\ln|x| + C$

$$\int \frac{dx}{a^2 + x^2} = \frac{1}{a}\tan^{-1}\left(\frac{x}{a}\right) + C$$

What are the restrictions on a?

a is constant

$a \neq 0$

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

$\tan x + C$

$$\int \sin x dx$$

$-\cos x + C$

$$\int e^x dx$$

$e^x + C$

$$\int \csc x dx$$

$-\ln|\csc x + \cot x| + C$

$$\int \frac{dx}{\sqrt{a^2 - x^2}} = \sin^{-1}\left(\frac{x}{a}\right) + C$$

What are the restrictions on a?

a is constant

$a \neq 0$

$$\int \tan x \, dx$$

$$-\ln|\cos x| + C$$

or $\ln|\sec x| + C$

$$\int x^n dx =$$

What are the restrictions on n?

$$\int x^n \, dx = \frac{x^{n+1}}{n+1} + C$$

$n \neq -1$

n is constant

$$\int x^{-1} dx = \int \frac{1}{x} dx$$
$$= \ln|x| + C$$

$$\int \frac{dx}{x\sqrt{x^2 - a^2}} = \frac{1}{a} \sec^{-1}\left(\frac{x}{a}\right) + C$$

a constant

$a \neq 0$

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

What formula is the key? $= -\cot x - x + C$

$$\frac{\sin^2 x}{\sin^2 x} + \frac{\cos^2 x}{\sin^2 x} = \frac{1}{\sin^2 x}$$

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

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

$= \tan x - x + C$

What formula is the key?

$$\frac{\sin^2 x}{\cos^2 x} + \frac{\cos^2 x}{\cos^2 x} = \frac{1}{\cos^2 x}$$

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

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

What formula is the key to this? $= \frac{1}{2}\left[x + \frac{1}{2} \sin(2x) \right] + C$

$\cos(2x) = 2\cos^2 x - 1$

$\frac{d}{dx}[\sin(2x)] = \cos(2x) \cdot 2$

$1 + \cos(2x) = 2\cos^2 x$

$\int e^{3x+1} dx$

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

$\int \sec x \tan x dx$

$\sec x + C$

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

$$= \frac{1}{2}\left[x - \frac{1}{2}\sin(2x)\right] + C$$

What formula is the key to this?

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

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

$$\int_0^4 \underline{x^2}\, \underline{\underline{e^{x^3}}}\, \underline{dx} = \int_0^{64} e^u \cdot \underline{\frac{1}{3}du} = \frac{1}{3}e^u\Big|_0^{64}$$

$$= \frac{e^{64}}{3} - \frac{e^0}{3}$$

$$= \frac{e^{64}-1}{3}$$

$u = x^3$ $x=0, u=0$; $x=4, u=64$

What is a u-substitution and what must u remember?

$du = \underline{3x^2 dx}$

$\frac{1}{3}du = x^2 dx$

1. u = expression
2. du
3. All pieces, limits also, must be changed to new variable - no mixing!!!
4. Indefinite → original var.

$\int x^2 e^{x^3} dx$

$= \int e^u \cdot \frac{1}{3} du$

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

What type of u-substitution may be evaluated without converting completely to the new variable?

$\int \sec^2(5x-1)\,dx$

$u = 5x-1$

$du = 5dx$

$\frac{1}{5}du = dx$

$\boxed{\begin{array}{l} u = \underline{\text{linear}} \\ \frac{1}{m} \text{ outside} \end{array}}$

$\frac{1}{5}\tan(5x-1) + C$

What are the ranges of the arcsine, arctangent, and arcsecant function?

$\sin^{-1}$ & $\tan^{-1}$ Q I, $\underline{\text{IV}}^{(-)}$

$\sec^{-1}$ Q I, $\overline{\underline{\text{II}}}$

$y = \frac{x^3}{3} + C$

$5 = 0 + C$

$y = x^3/3 + 5$

$dy = x^2 dx \leftarrow \frac{dy}{dx} = x^2$ $(0, 5)$

$y = \int x^2 dx$

$y = \frac{x^3}{3} + C \rightarrow$ Find $y = f(x)$

What type of differential equation do we solve and what is the technique called?

ordered pair on curve

What is an initial condition and how is it used?

First Order Separable