Differentiation formula	*Integration formula*
$\frac{d}{dx}[C]=0$	$\int 0\,dx = C$
$\frac{d}{dx}[kx]=k$	$\int k\,dx = kx + C$
$\frac{d}{dx}[kf(x)]=kf'(x)$ a constant can be "factored out"	$\int kf(x)\,dx = k\int f(x)\,dx + C$ - factor out constant
$\frac{d}{dx}[f(x)\pm g(x)]=f'(x)\pm g'(x)$ the derivative of a sum is the sum of derivatives	$\int [f(x)\pm g(x)]\,dx = \int f(x)\,dx + \int g(x)\,dx + C$ integral of a sum is the sum of the integrals
$\frac{d}{dx}[x^n]=nx^{n-1}$ - the power rule	$\int x^n dx = \frac{x^{n+1}}{n+1} + C$ - the power rule reversed

Differentiation formula	**Integration formula**
$\frac{d}{dx}[\sin x]=\cos x$	$\int \cos x\,dx = \sin x + C$
$\frac{d}{dx}[\cos x]=-\sin x$	$\int \sin x\,dx = -\cos x + C$
$\frac{d}{dx}[\tan x]=\sec^2 x$	$\int \sec^2 x\,dx = \tan x + C$
$\frac{d}{dx}[\csc x]=-\csc x\cot x$	$\int \csc x\cot x\,dx = -\csc x + C$
$\frac{d}{dx}[\sec x]=\sec x\tan x$	$\int \sec x\tan x\,dx = \sec x + C$
$\frac{d}{dx}[\cot x]=-\csc^2 x$	$\int \csc^2\ dx = -\cot x + C$

So we have a new differentiation rule - the ln rule:

$\frac{d}{dx}[\ln x]=\frac{1}{x}, x>0$ $\quad\frac{d}{dx}[\ln u]=\frac{1}{u}\cdot\frac{du}{dx}=\frac{u'}{u}, u>0$ $\quad\frac{d}{dx}[\ln|u|]=\frac{1}{u}\cdot\frac{du}{dx}=\frac{u'}{u}, u\neq 0$

$\int \frac{1}{x}\,dx = \ln|x| + C$ and if u is a differentiable function of x, $\int \frac{1}{u}\,du = \ln|u| + C$

$\frac{d}{dx}\left[e^x\right] = e^x$ and if u is a differentiable function of x then $\frac{d}{dx}\left[e^u\right] = e^u \frac{du}{dx}$

$\int e^x dx = e^x + C$ and if u is a differentiable function of x then $\int e^u du = e^u + C$

$$\frac{d}{dx} a^x = a^x \cdot \ln a \qquad \text{and} \qquad \frac{d}{dx} a^u = a^u \cdot \ln a \cdot \frac{du}{dx}$$

The derivatives of the three inverse trig functions are as follows:

$$\frac{d}{dx}\left(\sin^{-1} u\right) = \frac{1}{\sqrt{1-u^2}} \frac{du}{dx}$$

$$\frac{d}{dx}\left(\cos^{-1} u\right) = \frac{-1}{\sqrt{1-u^2}} \frac{du}{dx}$$

$$\frac{d}{dx}\left(\tan^{-1} u\right) = \frac{1}{1+u^2} \frac{du}{dx}$$

If u is a differentiable function of x, and $a > 0$ then

$$\int \frac{du}{\sqrt{a^2 - u^2}} = \sin^{-1} \frac{u}{a} + C$$

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