Summary of Derivative Rules

The derivative of $f(x)$ is defined as $\lim_{h\to 0}\frac{f(x+h)-f(x)}{h}$, provided this limit exists.

Note both u and v represent differentiable functions and c is a constant

Function	Derivative	Function	Derivative
$y = c$	$\frac{dy}{dx} = 0$	$y = \sin u$	$\frac{dy}{dx} = \cos u \ \frac{du}{dx}$
$y = cu$	$\frac{dy}{dx} = c\frac{du}{dx}$	$y = \cos u$	$y' = -\sin u \ du$
$y = u \pm v$	$\frac{dy}{dx} = \frac{du}{dx} \pm \frac{dv}{dx}$	$y = \tan u$	$y' = \sec^2 u \ du$
$y = u \cdot v$	$\frac{dy}{dx} = \frac{du}{dx}v + u\frac{dv}{dx}$	$y = \sec u$	$y' = \sec u \tan u \ du$
$y = \frac{u}{v}$	$\frac{dy}{dx} = \frac{\frac{du}{dx}v - u\frac{dv}{dx}}{v^2}$	$y = \arctan u$	$y' = \frac{du}{1+u^2}$
$y = f(u)$	$\frac{dy}{dx} = f'(u)\cdot\frac{du}{dx}$ or $f'(u)\,du$	$y = \arcsin u$	$y' = \frac{du}{\sqrt{1-u^2}}$
$y = u^n$	$\frac{dy}{dx} = nu^{n-1}\cdot\frac{du}{dx}$	$y = \operatorname{arcsec} u$	$y' = \frac{du}{\lvert u\rvert\sqrt{u^2-1}}$
$y = e^u$	$\frac{dy}{dx} = e^u\cdot\frac{du}{dx}$	$y = a^u$	$\frac{dy}{dx} = a^u \ln a \cdot\frac{du}{dx}$
$y = \ln u$	$\frac{dy}{dx} = \frac{du}{u}$ or $\frac{1}{u}du$	$y = \log_a u$	$f'(u) = \frac{du}{u\ln a}$

The derivative for the inverse cotangent, inverse cosine, and inverse cosecant are the negative of the reciprocal inverse trig function.

$$\frac{d(\arccos u)}{dx} = -\frac{d(\arcsin u)}{dx} = \frac{-\,du}{\sqrt{1-u^2}}$$

Other Trig Derivatives

$$\frac{d(\cot u)}{dx} = -\csc^2 u\,du \qquad \frac{d(\csc u)}{dx} = -\csc u \cot u \ du$$

Summary of Integral Formulas

Function	Derivative returns the rate of change	Multiply both sides by dx (Separation of variables)	Integral applied to a rate of change	The Intergal returns the function
$y = C$	$\frac{dy}{dx}$ =0	$dy = 0\,dx$	$\int dy = \int 0\,dx$	$y = C$
$y = kx + C$	$\frac{dy}{dx} = k$	$dy = k\,dx$	$\int dy = \int k\,dx$	$y = kx + C$
$y = x^2 + C$	$\frac{dy}{dx} = 2x$	$dy = 2x\,dx$	$\int dy = \int 2x\,dx$	$y = x^2 + C$

$y = u^n$	$\frac{dy}{dx} = nu^{n-1}\,du$
$y = e^u$	$\frac{dy}{dx} = e^u\,du$
$y = \ln u$	$\frac{dy}{dx} = \frac{du}{u}$
$y = \sin u$	$\frac{dy}{dx} = \cos u\;du$
$y = \cos u$	$\frac{dy}{dx} = -\sin u\;du$

$\int u^n\,du =$	$\frac{1}{n+1}u^{n+1} + C$
$\int e^u\,du =$	$e^u + C$
$\int \frac{1}{u}\,du = \int \frac{du}{u} =$	$\ln u + C$
$\int \cos u\;du =$	$\sin u + C$
$\int \sin u\;du =$	$-\cos u + C$

$y = \tan u$	$\frac{dy}{dx} = \sec^2 u\,du$
$y = \sec u$	$\frac{dy}{dx} = \sec u \tan u\;du$
$y = \arctan u$	$\frac{dy}{dx} = \frac{du}{1+u^2}$
$y = \arcsin u$	$\frac{dy}{dx} = \frac{du}{\sqrt{1-u^2}}$

$\int \sec^2 u\;du =$	$\tan u + C$
$\int \sec u \tan u\;du =$	$\sec u + C$
$\int \frac{du}{a^2+u^2} =$	$\frac{1}{a}\arctan\left(\frac{u}{a}\right) + C$
$\int \frac{du}{\sqrt{a^2-u^2}} =$	$\arcsin\left(\frac{u}{a}\right) + C$

Definite Integral $\int_a^b f'(x)\,dx = f(x)\Big|_a^b = f(b) - f(a)$

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