1) $f'(a) = \lim_{h\to 0} \frac{f(a+h)-f(a)}{h} = \lim_{x\to a} \frac{f(x)-f(a)}{x-a}$

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

3) $\frac{d}{dx}\left(\frac{u}{v}\right) = \frac{v\frac{du}{dx} - u\frac{dv}{dx}}{v^2}$

4) $y = [f(x)]^{g(x)}$ then $\frac{dy}{dx} = [f(x)]^{g(x)}\left[g(x)\frac{f'(x)}{f(x)} + \log f(x)\cdot g'(x)\right]$

5) $f''(x) = \lim_{h\to 0} \frac{f'(x+h)-f'(x)}{h}$

Function	Derivative
constant	0
x^n	nx^{n-1}
e^x	e^x
$\log x$	$\frac{1}{x}$
a^x	$a^x \log a$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$
$\sin^{-1} x$	$\frac{1}{\sqrt{1-x^2}}$
$\cos^{-1} x$	$\frac{-1}{\sqrt{1-x^2}}$
$\tan^{-1} x$	$\frac{1}{1+x^2}$
$\cot^{-1} x$	$\frac{-1}{1+x^2}$
$\sec^{-1} x$	$\frac{1}{\lvert x\rvert\sqrt{x^2-1}}$
$\operatorname{cosec}^{-1} x$	$\frac{-1}{\lvert x\rvert\sqrt{x^2-1}}$

Function	Derivative
$\sinh x$	$\cosh x$
$\cosh x$	$\sinh x$
$\tanh x$	$\operatorname{sech}^2 x$
$\coth x$	$-\operatorname{cosech}^2 x$
$\operatorname{sech} x$	$-\operatorname{sech} x \cdot \tanh x$
$\operatorname{cosech} x$	$-\operatorname{cosech} x \cdot \coth x$
$\sinh^{-1} x$	$\frac{1}{\sqrt{1+x^2}}$
$\cosh^{-1} x$	$\frac{1}{\sqrt{x^2-1}}$
$\tanh^{-1} x$	$\frac{1}{1-x^2}$
$\coth^{-1} x$	$\frac{1}{1-x^2}$
$\operatorname{sech}^{-1} x$	$\frac{-1}{\lvert x\rvert\sqrt{1-x^2}}$
$\operatorname{cosech}^{-1} x$	$\frac{-1}{\lvert x\rvert\sqrt{1+x^2}}$

$\sinh x = \frac{e^x - e^{-x}}{2}$

$\cosh x = \frac{e^x + e^{-x}}{2}$

$\cosh^2 x - \sinh^2 x = 1$

$1 - \tanh^2 x = \operatorname{sech}^2 x$

$\coth^2 x - 1 = \operatorname{cosech}^2 x$

$\int f'(x)\,dx = f(x)+c$

$\frac{d}{dx}\left(\int f(x)dx\right) = f(x)$

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

$\int \frac{1}{x}\,dx = \log x + c$

$\int a^x\,dx = \frac{a^x}{\log_e a} + c$

$\int e^x\,dx = e^x + c$

$\int \sin x\,dx = -\cos x + c$

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

$\int \sec^2 x\,dx = \tan x + c$

$\int \operatorname{cosec}^2 x\,dx = -\cot x + c$

$\int \sec x \tan x\,dx = \sec x + c$

$\int \operatorname{cosec} x \cot x\,dx = -\operatorname{cosec} x + c$

$\int \frac{1}{\sqrt{1-x^2}}\cdot dx = \sin^{-1} x + c$
$= -\cos^{-1} x + c$

$\int \frac{1}{1+x^2}\cdot dx = \tan^{-1} x + c$
$= -\cot^{-1} x + c$

$\int \frac{1}{|x|\sqrt{x^2-1}}\cdot dx = \sec^{-1} x + c$
$= -\operatorname{cosec}^{-1} x + c$

$\int \sinh x = \cosh x + c$

$\int \cosh x = \sinh x + c$

$\int \operatorname{sech}^2 x = \tanh x + c$

$\int \operatorname{cosech}^2 x = -\coth x + c$

$\int \operatorname{sech} x \tanh x = -\operatorname{sech} x + c$

$\int \operatorname{cosech} x \cdot \coth x = -\operatorname{cosech} x + c$

$\int \frac{1}{1+x^2}\cdot dx = \sinh^{-1} x + c$
$= \log(x + \sqrt{x^2-1})$

$\int \frac{1}{\sqrt{x^2-1}}\,dx = \cosh^{-1} x + c$ on $(1,\infty)$
$= -\cosh^{-1}(-x) + c$ on $(-\infty,-1)$
$= \log(x + \sqrt{x^2-1}) + c$ on $(1,\infty)$
$= -\log_e(x + \sqrt{x^2-1}) + c$ on $(-\infty,-1)$
$= \log|x + \sqrt{x^2-1}| + c$ on $I \subset R\setminus[-1,1]$

$\int f(ax+b)\,dx = \frac{1}{a}F(ax+b) + c$

$\int \frac{f'(x)}{f(x)}\,dx = \log|f(x)| + c$

$\int [f(x)]^\alpha f'(x)\,dx = \frac{[f(x)]^{\alpha+1}}{\alpha+1} + c$

$\int \frac{f'(x)}{\sqrt{f(x)}}\cdot dx = 2\sqrt{f(x)} + c$

$\int f'(ax+b)\,dx = \frac{1}{a}f(ax+b) + c$

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

$\int \frac{1}{x^2-a^2}\cdot dx = \frac{1}{2a}\log\left|\frac{x-a}{x+a}\right| + c$

$\int \frac{1}{\sqrt{a^2+x^2}}\,dx = \sinh^{-1}\left(\frac{x}{a}\right) = \log\left(\frac{x+\sqrt{x^2+a^2}}{2}\right) + c$

$\int \frac{1}{\sqrt{a^2-x^2}}\,dx = \cosh^{-1}\left(\frac{x}{a}\right) = \log\frac{|x+\sqrt{x^2-a^2}|}{a} + c$

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

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

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