FUNCTIONS DIFFERENTIATION	© Sukhotin A. M., design, 2009

$$(f)'_x \triangleq \frac{df}{dx} \triangleq \lim_{\Delta x\to 0}\frac{\Delta f}{\Delta x} \triangleq f'$$

$C'=0$	$(u+v)'=u'+v'$
$x'=1$	$(u\cdot v)'=u'\cdot v+v'\cdot u$

$(\sin x)'=\cos x \quad (e^x)'=e^x$

$(f(u(x)))'_x=(f(u))'_u\cdot(u)'_x$

$\left(\frac{u}{z}\right)'_x=\frac{u'_x\cdot z-u\cdot z'_x}{(z)^2}$	$(C\cdot x)'=C\cdot(x)'$	$\begin{cases}y(t)\\x(t)\end{cases}\Rightarrow y'_x=\frac{\dot y}{\dot x}$	$F(x,z)=0\Rightarrow(F(x,z))'_x=(0)'$ $\Rightarrow G\cdot z'_x-H=0\Rightarrow z'_x=\frac{H}{G}$

$(e^x)'=e^x$	$(x^2)'=2x$	$(\sin x)'=\cos x$	$(\arcsin x)'=\frac{1}{\sqrt{1-x^2}}$
$(a^x)'=a^x\ln a$	$(x^n)'=n\cdot x^{n-1}$	$(\cos x)'=-\sin x$	$(\arccos x)'=-\frac{1}{\sqrt{1-x^2}}$
$(\ln x)'=\frac{1}{x}$	$\left(\frac{1}{x}\right)'=-\frac{1}{(x)^2}$	$(\mathrm{tg}x)'=\frac{1}{(\cos x)^2}$	$(\mathrm{arctg}x)'=\frac{1}{1+x^2}$
$(\lg_a x)'=\frac{1}{x\cdot\ln a}$	$(\sqrt{x})'=\frac{1}{2\sqrt{x}}$	$(\mathrm{ctg}u)'_x=-\frac{u'}{(\sin u)^2}$	$(\mathrm{arcctg}x)'=\frac{-1}{1+x^2}$

$f=z^v\Rightarrow\ln f=v\cdot\ln z\Rightarrow\frac{f'}{f}=v'\cdot\ln z+\frac{v\cdot z'}{z}\Rightarrow\ldots$	$(z\cdot e^u)_x'=e^u\cdot(z'+z\cdot u')$	$h(g(x))\equiv x\Rightarrow h'_g=\frac{1}{g'_x}$

${}^x\!\int f(t)dt\triangleq\{F:(F(x))'=f(x)\}$	${}^x\!\int dt=x\quad{}^x\!\int dt=x$	${}^x\!\int C\cdot f(t)dt=C\cdot{}^x\!\int f(t)dt$
${}^x\!\int(g+f)dt={}^x\!\int g\,dt+{}^x\!\int f\,dt$	${}^x\!\int f(t)dt=\left(\begin{array}{c\|c}t=h(v)&dt=h'dv\\v=h^{-1}(t)&y=h^{-1}(x)\end{array}\right)={}^y\!\int f(h(v))h'(v)dv$	
${}^x\!\int g(t)\cdot z(t)dt=\left(\begin{array}{c\|c}z(t)=u&dz=u'dt\\dv=gdt&v(x)={}^x\!\int g\,dt\end{array}\right)=v(x)\cdot u(x)-{}^x\!\int v\cdot u'dt$		

${}^x\!\int dF=F(x)$	$\int t\,dt=\frac{t^2}{2}$	$\int\sin t\,dt=-\cos t$	$\int\frac{dt}{a^2+t^2}=\frac{1}{a}\mathrm{arctg}\frac{t}{a}$
$\int e^t dt=e^t$	$\int\frac{dt}{\sqrt{t}}=2\sqrt{t}$	$\int\cos t\,dt=\sin t$	$\int\frac{dt}{a^2-t^2}=\frac{1}{2a}\ln\left\|\frac{a+t}{a-t}\right\|$
$\int a^t dt=\frac{a^t}{\ln a}$	$\int\frac{dt}{t^2}=-\frac{1}{t}$	${}^x\!\int\frac{dt}{\cos^2 t}=\mathrm{tg}x$	$\int\frac{dt}{\sqrt{a^2-t^2}}=\arcsin\frac{t}{a}$
$\int\frac{dt}{t}=\ln\|t\|$	$\int t^k dt=\frac{t^{k+1}}{k+1}$	$\int\frac{dx}{\sin^2 x}=-\mathbf{ctg}x$	$\int\frac{dt}{\sqrt{b+t^2}}=\ln\left\|t+\sqrt{b+t^2}\right\|$
$\int\mathrm{ch}t\,dt=\mathrm{sh}t$	$\int\mathrm{sh}t\,dt=\mathrm{ch}t$	$\int\mathrm{tg}t\,dt=-\ln\|\cos t\|$	$\int\ln t\,dt=t(\ln t-1)$