ETH Zürich | HS 2023
Dr. C. Busch | Mathematics

Let $f : \mathbb{R} \to \mathbb{R}$, $g : \mathbb{R} \to \mathbb{R}$, $h : \mathbb{R} \to \mathbb{R}$ be functions and $a, b \in \mathbb{R}$. We assume that the derivatives of f, g and h are defined.

Properties		
sum	$(f+g)' = f' + g'$	
constant factor	$(\lambda f)' = \lambda f'$	
product	$(fg)' = f'g + fg'$	
quotient	$\left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$	
chain rule	$(f \circ g)'(x) = f'(g(x)) \cdot g'(x)$	$\frac{dz}{dx} = \frac{dz}{dy} \cdot \frac{dy}{dx}$
inverse	$g'(y) = \frac{1}{f'(g(y))}$	$\frac{dx}{dy} = \left(\frac{dy}{dx}\right)^{-1}$

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Exponential functions, logarithm		
$f(x)$	$f'(x)$	Condition
c	0	c is a constant
x^n	nx^{n-1}	$n \in \mathbb{Z}$ and $x \neq 0$ if $n < 0$
x^a	ax^{a-1}	$a \in \mathbb{R}$ and $x > 0$
e^x	e^x	
a^x	$a^x \cdot \ln a$	$a > 0$
$\ln x$	$\frac{1}{x}$	$x > 0$

Trigonometric and hyperbolic functions			
$f(x)$	$f'(x)$	$f(x)$	$f'(x)$
$\sin x$	$\cos x$	$\sinh x$	$\cosh x$
$\cos x$	$-\sin x$	$\cosh x$	$\sinh x$
$\tan x$	$\frac{1}{\cos^2 x}$	$\tanh x$	$\frac{1}{\cosh^2 x}$
$\arcsin x$	$\frac{1}{\sqrt{1-x^2}}$	$\operatorname{arsinh} x$	$\frac{1}{\sqrt{1+x^2}}$
$\arccos x$	$\frac{-1}{\sqrt{1-x^2}}$	$\operatorname{arcosh} x$	$\frac{1}{\sqrt{x^2-1}}$
$\arctan x$	$\frac{1}{1+x^2}$	$\operatorname{artanh} x$	$\frac{1}{1-x^2}$