Derivatives Table

Derivatives of common functions. Here a and n are constants, c is a constant and x is in radians for trigonometric functions.

Constants, powers and roots

f(x)	f′(x)	Valid for
c (constant)	0	all x
x	1	all x
x^n	$n \cdot x^{n-1}$	where x^{n-1} is defined
$\sqrt{x}$	$1/(2\sqrt{x})$	$x > 0$
$\sqrt[3]{x}$	$1/(3\sqrt[3]{(x^2)})$	$x \neq 0$
$1/x$	$-1/x^2$	$x \neq 0$
$1/x^n$	$-n/x^{n+1}$	$x \neq 0$

Exponentials and logarithms

f(x)	f′(x)	Valid for
e^x	e^x	all x
a^x $(a > 0)$	$a^x \cdot \ln a$	all x
$\ln x$	$1/x$	$x > 0$
$\ln\lvert x\rvert$	$1/x$	$x \neq 0$
$\log_a x$ $(a > 0, a \neq 1)$	$1/(x \cdot \ln a)$	$x > 0$
x^x	$x^x(1 + \ln x)$	$x > 0$

Trigonometric (x in radians)

f(x)	f′(x)	Valid for
$\sin x$	$\cos x$	all x
$\cos x$	$-\sin x$	all x
$\tan x$	$\sec^2 x$	$x \neq \pi/2 + k\pi$
$\cot x$	$-\csc^2 x$	$x \neq k\pi$
$\sec x$	$\sec x \cdot \tan x$	$x \neq \pi/2 + k\pi$
$\csc x$	$-\csc x \cdot \cot x$	$x \neq k\pi$

Inverse trigonometric

f(x)	f′(x)	Valid for
$\arcsin x$	$1/\sqrt{(1 - x^2)}$	$-1 < x < 1$
$\arccos x$	$-1/\sqrt{(1 - x^2)}$	$-1 < x < 1$
$\arctan x$	$1/(1 + x^2)$	all x
$\operatorname{arccot} x$	$-1/(1 + x^2)$	all x
$\operatorname{arcsec} x$	$1/(\lvert x\rvert \cdot \sqrt{(x^2 - 1)})$	$\lvert x\rvert > 1$
$\operatorname{arccsc} x$	$-1/(\lvert x\rvert \cdot \sqrt{(x^2 - 1)})$	$\lvert x\rvert > 1$

Hyperbolic

f(x)	f′(x)	Valid for
sinh x	cosh x	all x
cosh x	sinh x	all x
tanh x	$\operatorname{sech}^2 x$	all x
coth x	$-\operatorname{csch}^2 x$	$x \neq 0$
sech x	$-\operatorname{sech} x \cdot \tanh x$	all x
csch x	$-\operatorname{csch} x \cdot \coth x$	$x \neq 0$

Inverse hyperbolic

f(x)	f′(x)	Valid for
arsinh x	$1/\sqrt{(x^2+1)}$	all x
arcosh x	$1/\sqrt{(x^2-1)}$	$x > 1$
artanh x	$1/(1-x^2)$	$\lvert x\rvert < 1$

Differentiation rules

Rule	Formula
Constant multiple	$(c \cdot f)' = c \cdot f'$
Sum and difference	$(f \pm g)' = f' \pm g'$
Product	$(f \cdot g)' = f' \cdot g + f \cdot g'$
Quotient	$(f/g)' = (f' \cdot g - f \cdot g') \,/\, g^2$
Chain	$(f(g(x)))' = f'(g(x)) \cdot g'(x)$
Power	$(x^n)' = n \cdot x^{n-1}$
Variable exponent	$(u^v)' = u^v \cdot (v' \cdot \ln u + v \cdot u'/u)$
Inverse function	$(f^{-1})'(y) = 1 \,/\, f'(x)$, where $y = f(x)$