Factsheet: List of derivatives

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Summary

A list of common (and some uncommon) derivatives of functions.

Throughout, a, k are real numbers.

Derivatives of polynomial, exponential and logarithmic functions

function	derivative w.r.t x	notes
c	0	$c \in \mathbb{R}$
$mx + c$	m	$m, c \in \mathbb{R}$
x^α	$\alpha x^{\alpha-1}$	$\alpha \in \mathbb{R}, \alpha \neq 0$
ae^{kx}	ake^{kx}	
$a\ln(kx)$	$\frac{a}{x}$	
ac^{kx}	$akc^{kx}\ln(b)$	$c \in \mathbb{R}, c > 0$ constant
$a\log_c(kx)$	$\frac{a}{x\ln(c)}$	$c \in \mathbb{R}, c > 1$ constant

Derivatives of trigonometric functions

function	derivative w.r.t x
$a\sin(kx)$	$ak\cos(kx)$
$a\cos(kx)$	$-ak\sin(kx)$
$a\tan(kx)$	$ak\sec^2(kx)$
$a\cot(kx)$	$-ak\csc^2(kx)$

function	derivative w.r.t x
$a\sec(kx)$	$ak\sec(kx)\tan(kx)$
$a\csc(kx)$	$-ak\csc(kx)\cot(kx)$

Derivatives of inverse trigonometric functions

function	derivative w.r.t x	notes
$a\sin^{-1}(kx)$	$\frac{ak}{\sqrt{1-k^2x^2}}$	valid for $x \in \left(-\frac{1}{k}, \frac{1}{k}\right)$
$a\cos^{-1}(kx)$	$\frac{-ak}{\sqrt{1-k^2x^2}}$	valid for $x \in \left(-\frac{1}{k}, \frac{1}{k}\right)$
$a\tan^{-1}(kx)$	$\frac{ak}{1+k^2x^2}$	valid for $x \in \mathbb{R}$
$a\cot^{-1}(kx)$	$\frac{-ak}{1+k^2x^2}$	valid for $x \in \mathbb{R}$
$a\sec^{-1}(kx)$	$\frac{a}{\lvert x\rvert\sqrt{k^2x^2-1}}$	valid for $x \in \mathbb{R} \setminus \left(-\frac{1}{k}, \frac{1}{k}\right)$
$a\csc^{-1}(kx)$	$\frac{-a}{\lvert x\rvert\sqrt{k^2x^2-1}}$	valid for $x \in \mathbb{R} \setminus \left(-\frac{1}{k}, \frac{1}{k}\right)$

Derivatives of hyperbolic functions

function	derivative w.r.t x
$a\sinh(kx)$	$ak\cosh(kx)$
$a\cosh(kx)$	$ak\sinh(kx)$
$a\tanh(kx)$	$ak\,\mathrm{sech}^2(kx)$
$a\coth(kx)$	$-ak\,\mathrm{csch}^2(kx)$
$a\,\mathrm{sech}(kx)$	$-ak\,\mathrm{sech}(kx)\tanh(kx)$
$a\,\mathrm{csch}(kx)$	$-ak\,\mathrm{csch}(kx)\coth(kx)$

Derivatives of inverse hyperbolic functions

Throughout, a, k are real numbers.

function	derivative w.r.t x	notes
$a\sinh^{-1}(kx)$	$\dfrac{ak}{\sqrt{1+k^2x^2}}$	
$a\cosh^{-1}(kx)$	$\dfrac{ak}{\sqrt{k^2x^2-1}}$	a, k, x positive
$a\tanh^{-1}(kx)$	$\dfrac{ak}{1-k^2x^2}$	
$a\coth^{-1}(kx)$	$\dfrac{ak}{1-k^2x^2}$	
$a\,\mathrm{sech}^{-1}(kx)$	$-\dfrac{ak}{x\sqrt{1-k^2x^2}}$	a, k, x positive
$a\,\mathrm{csch}^{-1}(kx)$	$-\dfrac{ak}{\lvert x\rvert\sqrt{k^2x^2+1}}$	

Further reading

For more about where these came from, please see Guide: Introduction to differentiation and the derivative and [Proof: Derivatives of other common functions].

Version history

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