Derivative and Integral Formulas

Calculus I-IV ~ Prof. Sally J. Keely, M.S.

DERIVATIVE	FUNCTION	INTEGRAL
e^x	e^x	e^x
$b^x \ln b$	b^x	$\frac{b^x}{\ln b}$
$\frac{1}{x}$	$\ln x$	$x(\ln x - 1)$
$\frac{1}{x \ln b}$	$\log_b x$	$\frac{x}{\ln b}(\ln x - 1)$
$\cos x$	$\sin x$	$-\cos x$
$-\sin x$	$\cos x$	$\sin x$
$\sec^2 x$	$\tan x$	$\ln\lvert\sec x\rvert$
$-\csc^2 x$	$\cot x$	$-\ln\lvert\csc x\rvert = \ln\lvert\sin x\rvert$
$\sec x \tan x$	$\sec x$	$\ln\lvert\sec x + \tan x\rvert$
$-\csc x \cot x$	$\csc x$	$\ln\lvert\csc x - \cot x\rvert$
$\sin 2x$	$\sin^2 x$	$\frac{1}{2}x - \frac{1}{4}\sin 2x$
$-\sin 2x$	$\cos^2 x$	$\frac{1}{2}x + \frac{1}{4}\sin 2x$
$2 \tan x \sec^2 x$	$\tan^2 x$	$\tan x - x$
$-2 \cot x \csc^2 x$	$\cot^2 x$	$-\cot x - x$
$2 \tan x \sec^2 x$	$\sec^2 x$	$\tan x$
$-2 \cot x \csc^2 x$	$\csc^2 x$	$-\cot x$
$\cosh x$	$\sinh x$	$\cosh x$
$\sinh x$	$\cosh x$	$\sinh x$
$\operatorname{sech}^2 x$	$\tanh x$	$\ln(\cosh x)$
$-\operatorname{csch}^2 x$	$\coth x$	$\ln\lvert\sinh x\rvert$
$-\operatorname{sech} x \tanh x$	$\operatorname{sech} x$	$\arctan(\sinh x)$
$-\operatorname{csch} x \coth x$	$\operatorname{csch} x$	$\ln\lvert\tanh \frac{1}{2}x\rvert$

Derivative and Integral Formulas (Calc I version)

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DERIVATIVE	FUNCTION	INTEGRAL
$\frac{1}{\sqrt{1-x^2}}$	$\arcsin x$	$x\arcsin x+\sqrt{1-x^2}$
$\frac{-1}{\sqrt{1-x^2}}$	$\arccos x$	$x\arccos x-\sqrt{1-x^2}$
$\frac{1}{x^2+1}$	$\arctan x$	$x\arctan x-\frac{1}{2}\ln(x^2+1)$
$\frac{-1}{x^2+1}$	$\operatorname{arccot} x$	$x\operatorname{arccot} x+\frac{1}{2}\ln(x^2+1)$
$\frac{1}{x\sqrt{x^2-1}}$	$\operatorname{arcsec} x$	$x\operatorname{arcsec} x-\operatorname{arccosh} x$
$\frac{-1}{x\sqrt{x^2-1}}$	$\operatorname{arccsc} x$	$x\operatorname{arccsc} x+\operatorname{arccosh} x$
$\frac{1}{\sqrt{x^2+1}}$	$\operatorname{arcsinh} x$	$x\operatorname{arcsinh} x-\sqrt{x^2+1}$
$\frac{1}{\sqrt{x^2-1}}$	$\operatorname{arccosh} x$	$\begin{cases} x\operatorname{arccosh} x-\sqrt{x^2-1} & (\operatorname{arccosh} x>0) \\ x\operatorname{arccosh} x+\sqrt{x^2-1} & (\operatorname{arccosh} x<0) \end{cases}$
$\frac{1}{1-x^2}\quad (x^2<1)$	$\operatorname{arctanh} x$	$x\operatorname{arctanh} x+\frac{1}{2}\ln(1-x^2)$
$\frac{1}{1-x^2}\quad (x^2>1)$	$\operatorname{arccoth} x$	$x\operatorname{arccoth} x+\frac{1}{2}\ln(x^2-1)$
$\frac{-1}{x\sqrt{1-x^2}}$	$\operatorname{arcsech} x$	$x\operatorname{arcsech} x+\arcsin x$
$\frac{-1}{\lvert x\rvert\sqrt{x^2+1}}$ **	$\operatorname{arccsch} x$	$x\operatorname{arccsch} x+\frac{x}{\lvert x\rvert}\operatorname{arcsinh} x$

** Note: $\int \frac{-1}{x\sqrt{x^2+1}}\,dx=\operatorname{arccsch} x$

Derivative and Integral Formulas (Calc II version)

Calculus II-IV ~ Prof. Sally J. Keely, M.S.

DERIVATIVE	FUNCTION	INTEGRAL
$\frac{1}{\sqrt{a^2-x^2}}$	$\arcsin\frac{x}{a}$	$x\arcsin\left(\frac{x}{a}\right)+\sqrt{a^2-x^2}$
$\frac{-1}{\sqrt{a^2-x^2}}$	$\arccos\frac{x}{a}$	$x\arccos\left(\frac{x}{a}\right)-\sqrt{a^2-x^2}$
$\frac{a}{x^2+a^2}$	$\arctan\frac{x}{a}$	$x\arctan\left(\frac{x}{a}\right)-\frac{a}{2}\ln(x^2+a^2)$
$\frac{-a}{x^2+a^2}$	$\operatorname{arccot}\frac{x}{a}$	$x\operatorname{arccot}\left(\frac{x}{a}\right)+\frac{a}{2}\ln(x^2+a^2)$
$\frac{a}{x\sqrt{x^2-a^2}}$	$\operatorname{arcsec}\frac{x}{a}$	$x\operatorname{arcsec}\left(\frac{x}{a}\right)-a\operatorname{arccosh}\left(\frac{x}{a}\right)$
$\frac{-a}{x\sqrt{x^2-a^2}}$	$\operatorname{arccsc}\frac{x}{a}$	$x\operatorname{arccsc}\left(\frac{x}{a}\right)+a\operatorname{arccosh}\left(\frac{x}{a}\right)$
$\frac{1}{\sqrt{x^2+a^2}}$	$\operatorname{arcsinh}\frac{x}{a}$	$x\operatorname{arcsinh}\left(\frac{x}{a}\right)-\sqrt{x^2+a^2}$
$\frac{1}{\sqrt{x^2-a^2}}$	$\operatorname{arccosh}\frac{x}{a}$	$\begin{cases} x\operatorname{arccosh}\left(\frac{x}{a}\right)-\sqrt{x^2-a^2} & \left(\operatorname{arccosh}\frac{x}{a}>0\right) \\ x\operatorname{arccosh}\left(\frac{x}{a}\right)+\sqrt{x^2-a^2} & \left(\operatorname{arccosh}\frac{x}{a}<0\right) \end{cases}$
$\frac{a}{a^2-x^2}\quad(x^2<a^2)$	$\operatorname{arctanh}\frac{x}{a}$	$x\operatorname{arctanh}\left(\frac{x}{a}\right)+\frac{a}{2}\ln(a^2-x^2)$
$\frac{a}{a^2-x^2}\quad(x^2>a^2)$	$\operatorname{arccoth}\frac{x}{a}$	$x\operatorname{arccoth}\left(\frac{x}{a}\right)+\frac{a}{2}\ln(x^2-a^2)$
$\frac{-a}{x\sqrt{a^2-x^2}}$	$\operatorname{arcsech}\frac{x}{a}$	$x\operatorname{arcsech}\left(\frac{x}{a}\right)+a\cdot\arcsin\left(\frac{x}{a}\right)$
$\frac{-a}{\lvert x\rvert\sqrt{x^2+a^2}}$ **	$\operatorname{arccsch}\frac{x}{a}$	$x\operatorname{arccsch}\left(\frac{x}{a}\right)+\frac{ax}{\lvert x\rvert}\operatorname{arcsinh}\left(\frac{x}{a}\right)$

** Note: $\int\frac{-a}{x\sqrt{x^2+a^2}}dx=\operatorname{arccsch}\left(\frac{x}{a}\right)$