Contents

Derivation for derivative of sine hyperbolic function

- $$y = sinhx = \frac{e^x - e^{-x}}{2}$$
- $$\frac{dy}{dx} = \frac{1}{2}\frac{d(e^x - e^{-x})}{dx} = \frac{e^x + e^{-x}}{2}$$
- $$\frac{d(sinhx)}{dx} = coshx$$

Derivation for derivative of tan hyperbolic function

- $$y = tanhx = \frac{sinhx}{coshx}$$
- $$\frac{dy}{dx} = \frac{coshx\frac{d(sinhx)}{dx} - sinhx\frac{d(coshx)}{dx}}{cosh^2(x)}$$
- $$= \frac{coshxcoshx - sinhxsinhx}{cosh^x}$$
- $$= \frac{1}{cosh^2x}$$
- $$\frac{d(tanhx)}{dx} = sech^2x$$

Expression for derivative of sine hyperbolic function

- $$\frac{d(sinhx)}{dx} = coshx$$

Expression for derivative of cosine hyperbolic function

$$\frac{d(coshx)}{dx} = sinhx$$

Expression for derivative of tan hyperbolic function

- $$\frac{d(tanhx)}{dx} = sech^2x$$

Expression for derivative of cotangent hyperbolic function

$$\frac{d(cothx)}{dx} = -cosech^2x$$

Expression for derivative of secant hyperbolic function

$$\frac{d(sechx)}{dx} = -sechx.tanhx$$

Expression for derivative of cosecant hyperbolic function

$$\frac{d(cosechx)}{dx} = -cosechx.cothx$$

Derivation for derivative of inverse sine hyperbolic function

- $$y = sinh^{-1}(x)$$
- $$x = sinhy$$
- $$\frac{dx}{dy} = coshy = \sqrt{1 + sinh^2y} = \sqrt{1 + x^2}$$
- $$\frac{dy}{dx} = \frac{1}{\sqrt{1 + x^2}}$$
- $$\frac{d(sinh^{-1}x)}{dx} = \frac{1}{\sqrt{1 + x^2}}$$

Expression for derivative of inverse sine hyperbolic function

- $$\frac{d(sinh^{-1}x)}{dx} = \frac{1}{\sqrt{1 + x^2}}$$

Expression for derivative of inverse cosine hyperbolic function

$$\frac{d(cosh^{-1}x)}{dx} = \frac{1}{\sqrt{x^2-1}}$$

Expression for derivative of inverse tangent hyperbolic function

$$\frac{d(tanh^{-1}x)}{dx} = \frac{1}{1-x^2}$$

Expression for derivative of inverse cosecant hyperbolic function

$$\frac{d(cosech^{-1}x)}{dx} = \frac{-1}{x\sqrt{x^2+1}}$$

Expression for derivative of inverse secant hyperbolic function

$$\frac{d(sech^{-1}x)}{dx} = \frac{-1}{x\sqrt{1-x^2}}$$

Expression for derivative of inverse cotangent hyperbolic function

$$\frac{d(coth^{-1}x)}{dx} = \frac{-1}{x^2-1}$$