Derivative of Inverse Hyperbolic functions : Example

$$y = \tanh^{-1}(\sin 2x) + \cosh^{-1}(\operatorname{cosec} x) + \operatorname{cosech}\sqrt{x}$$

$$\frac{dy}{dx} = \frac{1}{1-\sin^2 2x} \cdot \frac{d}{dx}(\sin 2x) + \frac{1}{\sqrt{\operatorname{cosec}^2 x - 1}} \frac{d}{dx}(\operatorname{cosec} x)$$

$$+ \left(-\operatorname{cosech}\sqrt{x}\coth\sqrt{x}\right) \frac{d}{dx}(\sqrt{x})$$

$$= \frac{1}{\cos^2 2x} \cdot \cos 2x \,(2) + \frac{1}{\cot x} \cdot (-\operatorname{cosec} x \cot x)$$

$$- \operatorname{cosech}\sqrt{x} \cdot \coth\sqrt{x} \, \frac{1}{2\sqrt{x}}$$

$$= 2\sec 2x - \operatorname{Cosec} x - \frac{1}{2\sqrt{x}} (\operatorname{Cosech} \sqrt{x} \coth \sqrt{x})$$

Ans.