Hyperbolic Functions: Derivatives and Integrals

$$\frac{d}{dx}[\sinh u] = (\cosh u)\frac{du}{dx} \qquad \int (\cosh u)u'\,dx = \sinh u + C$$

$$\frac{d}{dx}[\cosh u] = (\sinh u)\frac{du}{dx} \qquad \int (\sinh u)u'\,dx = \cosh u + C$$

$$\frac{d}{dx}[\tanh u] = (\operatorname{sech}^2 u)\frac{du}{dx} \qquad \int (\operatorname{sech}^2 u)u'\,dx = \tanh u + C$$

$$\frac{d}{dx}[\coth u] = -(\operatorname{csch}^2 u)\frac{du}{dx} \qquad \int (\operatorname{csch}^2 u)u'\,dx = -\coth u + C$$

$$\frac{d}{dx}[\operatorname{sech} u] = -(\operatorname{sech} u \tanh u)\frac{du}{dx} \qquad \int (\operatorname{sech} u \tanh u)u'\,dx = -\operatorname{sech} u + C$$

$$\frac{d}{dx}[\operatorname{csch} u] = -(\operatorname{csch} u \coth u)\frac{du}{dx} \qquad \int (\operatorname{csch} u \coth u)u'\,dx = -\operatorname{csch} u + C$$

Inverse Hyperbolic Functions

	Domain
Inverse hyperbolic sine: $\sinh^{-1} x = \ln(x + \sqrt{x^2+1})$	$(-\infty, \infty)$
Inverse hyperbolic cosine: $\cosh^{-1} x = \ln(x + \sqrt{x^2-1})$	$[1, \infty)$
Inverse hyperbolic tangent: $\tanh^{-1} x = \frac{1}{2}\ln\left(\frac{1+x}{1-x}\right)$	$(-1, 1)$
Inverse hyperbolic cotangent: $\coth^{-1} x = \frac{1}{2}\ln\left(\frac{x+1}{x-1}\right)$	$(-\infty, -1)$ and $(1, \infty)$
Inverse hyperbolic secant: $\operatorname{sech}^{-1} x = \ln\left(\frac{1}{x} + \sqrt{\frac{1-x^2}{x^2}}\right)$	$(0, 1]$
Inverse hyperbolic cosecant: $\operatorname{csch}^{-1} x = \ln\left(\frac{1}{x} + \sqrt{\frac{1+x^2}{x^2}}\right)$	$(-\infty, 0)$ and $(0, \infty)$

Inverse Hyperbolic Functions: Derivatives and Integrals

$$\frac{d}{dx}[\sinh^{-1} u] = \frac{1}{\sqrt{u^2+1}}\frac{du}{dx}$$

$$\frac{d}{dx}[\cosh^{-1} u] = \frac{1}{\sqrt{u^2-1}}\frac{du}{dx}$$

$$\int \frac{u'}{\sqrt{u^2 \pm a^2}}dx = \ln(u + \sqrt{u^2 \pm a^2}) + C$$

$$\frac{d}{dx}[\tanh^{-1} u] = \frac{1}{1-u^2}\frac{du}{dx}$$

$$\frac{d}{dx}[\coth^{-1} u] = \frac{1}{1-u^2}\frac{du}{dx}$$

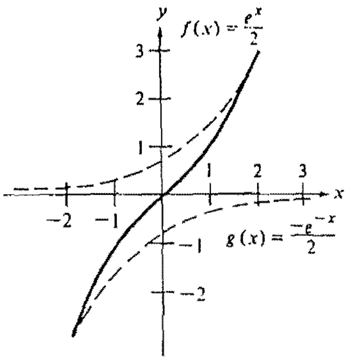
$$\int \frac{u'}{a^2-u^2}dx = \frac{1}{2a}\ln\left|\frac{a+u}{a-u}\right| + C$$

$$\frac{d}{dx}[\operatorname{sech}^{-1} u] = \frac{-1}{u\sqrt{1-u^2}}\frac{du}{dx}$$

$$\frac{d}{dx}[\operatorname{csch}^{-1} u] = \frac{-1}{|u|\sqrt{1+u^2}}\frac{du}{dx}$$

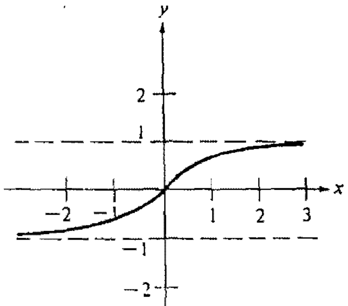
$$\int \frac{u'}{u\sqrt{a^2 \pm u^2}}dx = -\frac{1}{a}\ln\left(\frac{a + \sqrt{a^2 \pm u^2}}{|u|}\right) + C$$

Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$



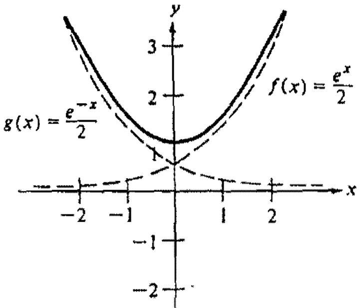
$y = \sinh x$

Domain: $(-\infty, \infty)$
Range: $(-1, 1)$



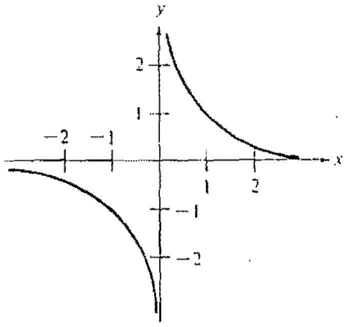
$y = \tanh x$

Domain: $(-\infty, \infty)$
Range: $[1, \infty)$



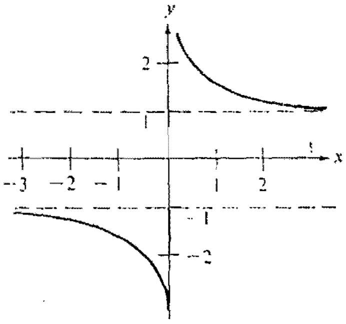
$y = \cosh x$

Domain: $(-\infty, 0)$ and $(0, \infty)$
Range: $(-\infty, 0)$ and $(0, \infty)$



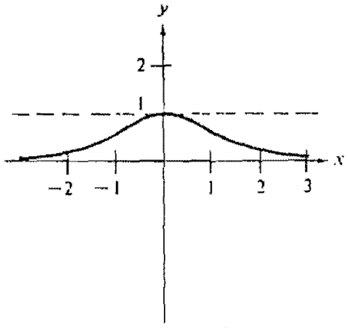
$y = \operatorname{csch} x = \frac{1}{\sinh x}$

Domain: $(-\infty, 0)$ and $(0, \infty)$
Range: $(-\infty, -1)$ and $(1, \infty)$



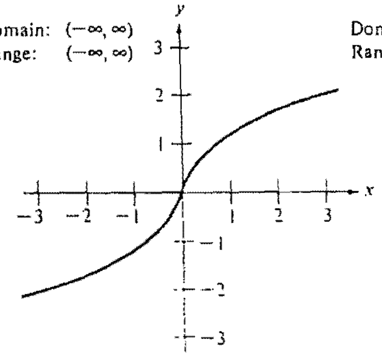
$y = \coth x = \frac{1}{\tanh x}$

Domain: $(-\infty, \infty)$
Range: $(0, 1]$



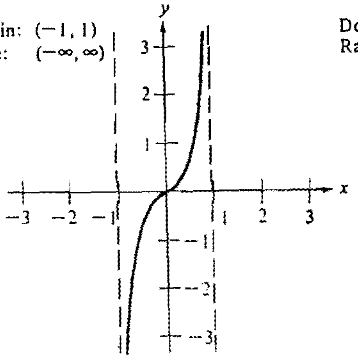
$y = \operatorname{sech} x = \frac{1}{\cosh x}$

Domain: $(-\infty, \infty)$
Range: $(-\infty, \infty)$



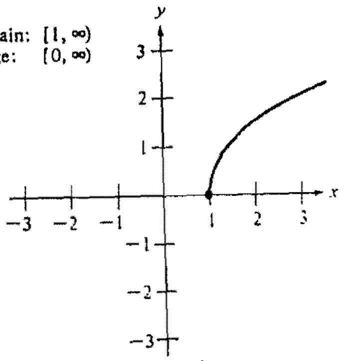
$y = \sinh^{-1} x$

Domain: $(-1, 1)$
Range: $(-\infty, \infty)$



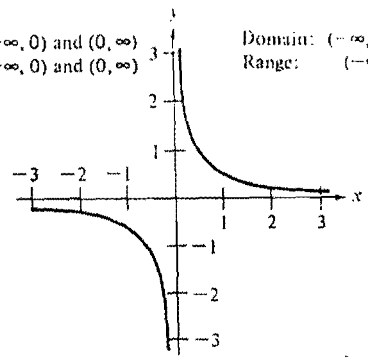
$y = \tanh^{-1} x$

Domain: $[1, \infty)$
Range: $[0, \infty)$



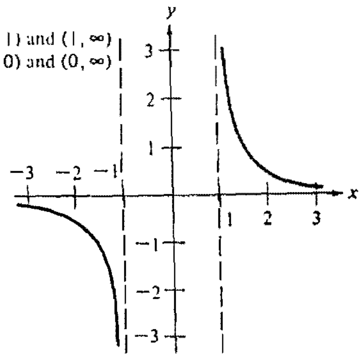
$y = \cosh^{-1} x$

Domain: $(-\infty, 0)$ and $(0, \infty)$
Range: $(-\infty, 0)$ and $(0, \infty)$



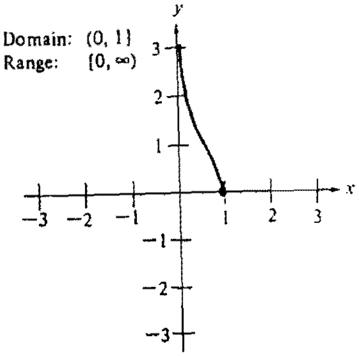
$y = \operatorname{csch}^{-1} x$

Domain: $(-\infty, -1)$ and $(1, \infty)$
Range: $(-\infty, 0)$ and $(0, \infty)$



$y = \coth^{-1} x$

Domain: $(0, 1]$
Range: $[0, \infty)$



$y = \operatorname{sech}^{-1} x$