MATH 5B - Single Variable Calculus II — Spring 2019

§6.7 Hyperbolic Functions

In-class Activity 6.7

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Activity 1:

Verify the following properties of hyperbolic functions:

(a) $\cosh(-x) = \cosh(x)$

(b) $\cosh^2(x) - \sinh^2(x) = 1$

Activity 2: test

(a) Verify the DR for $\cosh(x)$, i.e. show from the definition that $\dfrac{d}{dx}[\cosh(x)] = \sinh(x)$

(b) Verify the DR for $\tanh(x)$, i.e. show that $\dfrac{d}{dx}[\tanh(x)] = \operatorname{sech}^2(x)$

Activity 3: test

(a) Find y' given that $y = e^x \tanh(x)$

(b) If $s(t) = \cosh(\ln(t))$, what is $\dfrac{ds}{dt}$?

Activity 4:

Verify: $\cosh^{-1}(x) = \ln\left(x + \sqrt{x^2 - 1}\right), \quad x \in [1, \infty)$

Activity 5:

Verify DR1 $\frac{d}{dx}\left[\sinh^{-1}(x)\right] = \frac{1}{\sqrt{1+x^2}}$ in two ways:

(a) using "brute force" *(i.e. differentiate the formula given in Theorem 6 (a))*

(b) using an "elegant technique" *(i.e. switch* $y = \sinh^{-1}(x)$ *into the equivalent equation* $\sinh(y) = x$ *and use implicit differentiation)*

Activity 6:

Evaluate:

(a) $\dfrac{d}{dx}\left[\ln(\tanh^{-1}(x))\right]$

(b) $\displaystyle\int \frac{1}{1-x^2}\,dx$

(c) $\displaystyle\int_0^1 \frac{1}{\sqrt{1+x^2}}\,dx$