STEP/Hyperbolic Functions: Exercises - Overview
(16/6/23)

Q1

Simplify sinh $(cosh^{-1}2)$

Q2

Given that $artanhx = \frac{1}{2} ln\left(\frac{1+x}{1-x}\right)$ and $arcothx = \frac{1}{2} ln\left(\frac{1+x}{x-1}\right)$,

and also that $\frac{d}{dx}(artanhx) = \frac{d}{dx}(arcothx) = \frac{1}{1-x^2}$,

what is wrong with the following reasoning?

$\int \frac{1}{1-x^2}\, dx = artanhx + C = arcothx + C_1$,

so that $artanhx - arcothx = C_2$

But $artanhx - arcothx = \frac{1}{2} ln\left(\frac{\left(\frac{1+x}{1-x}\right)}{\left(\frac{1+x}{x-1}\right)}\right) = \frac{1}{2} ln\left(\frac{x-1}{1-x}\right) = \frac{1}{2}\ln(-1)$,

which isn't defined!

Q3

Simplify $sinh(arcoshx)$ & $cosh(arsinhx)$

Q4

Given that $sinhx = tany$, where $-\frac{\pi}{2} < y < \frac{\pi}{2}$, show that

(a) $tanhx = siny$ (b) $x = \ln(tany + secy)$