Mathematics 1110H – Calculus I: Limits, Derivatives, and Integrals
TRENT UNIVERSITY, Summer 2026 (S62) [reading course]

Assignment #3
Due on Friday, 10 July.[*]

Please read Section 1.8.1 of *Sage for Undergraduates*, which gives the basics of the `solve` command.

Recall that the hyperbolic sine function is $\sinh(x) = \dfrac{e^x - e^{-x}}{2}$. We will call its inverse function $\operatorname{arcsinh}(x)$ and work out what it is in this assignment.

1. Plot $\sinh(x)$ for $-3 \leq x \leq 3$. On the basis of this graph, what should the domain of $\operatorname{arcsinh}(x)$ be? *[1.5]*

2. Use SageMath to work out $\operatorname{arcsinh}(x)$. *[4]*

HINT. Solve the equation $x = \dfrac{e^y - e^{-y}}{2}$ for y.

3. Work out $\operatorname{arcsinh}(x)$ by hand, showing all the principal steps. *[4]*

4. What is the domain of $\operatorname{arcsinh}(x)$? *[0.5]*

Sing me a song of the hydrogen light
Three degrees Kelvin illumine the night
Three degrees Kelvin, the infrared sky
Colors too deep for the unaided eye

Sing me a song of the hydrogen band
Whispering low since the cosmos began
Whispering low as the white light shifts red
Wavefronts of hydrogen sweeping ahead

Sing me a song of the hydrogen wall
Vector me out to that light bounding all
Vector me out in that glory to dwell
End of the universe, cosmic eggshell.

By John M. Ford, from his novel *Princes of the Air*.

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[*] You should submit your solutions via Blackboard's Assignments module, preferably as a single pdf. If that fails, please submit directly to the instructor on paper or via email to `sbilaniuk@trentu.ca` . You may work with others, use whatever tools you like, and look things up, so long as you write up your submission by yourself and give due credit to your collaborators and any tools or sources you actually used.