Mathematics 1110H – Calculus I: Limits, derivatives, and Integrals
TRENT UNIVERSITY, Fall 2020

Assignment #6
Solving Equations
Due on Wednesday, 9 December.

Recall that the hyperbolic cosine function is given by $\cosh(x) = \dfrac{e^x + e^{-x}}{2}$ for all real numbers x. Your task in this assignment will be to find its inverse function $\operatorname{arccosh}(x)$. Since $\cosh(x)$ is an even function, *i.e.* $\cosh(x) = \cosh(-x)$ for all x, we cannot hope to invert it over its entire domain, so we will seek to invert it only for $x \geq 0$, on which $\cosh(x)$ is 1–1.

1. Derive an expression for $\operatorname{arccosh}(x)$ in terms of powers, roots, and the natural logarithm function. When does this expression make sense? *[6]*

NOTE. If we invert the part of $\cosh(x)$ for $x \geq 0$, the resulting function can only have output ≥ 0.

Hint: $y = \operatorname{arccosh}(x)$ exactly when $x = \cosh(y) = \dfrac{e^y + e^{-y}}{2}$. Solve the latter equation for y in terms of x. The quadratic formula is likely to be useful ...

2. Use `Maple` to find an expression for $\operatorname{arccosh}(x)$. Is this expression equivalent to the one you obtained in answering **1**? *[4]*

Hint: If using `Maple`'s worksheet mode, you'll want to look up the `solve` command.