

Mathematics 1101Y – Calculus I: Functions and calculus of one variable

TRENT UNIVERSITY, 2012–2013

Assignment #2

Algebra and hyperbolic functions

Due on Friday, 9 November, 2012.

Before attempting the questions below, please read through Section 1.6 of the text book for the definitions of the various hyperbolic functions. It might also be useful to skim through *Getting started with Maple 10* by Gilberto E. Urroz – read those parts concerned with solving equations more closely! – and perhaps keep it handy as a reference. You can find links to both documents on the MATH 1101Y web page. Maple’s help facility may also come in handy, especially when trying to make out the intricacies of what the `solve` command and its options and variations do. Make use of the Maple labs, too, if possible.

1. Explain why every point on the parametric curve $x = \cosh(t)$ and $y = \sinh(t)$, $-\infty < t < \infty$, is on the hyperbola $x^2 - y^2 = 1$. What does t represent with respect to this hyperbola? [2]

HINT: To answer the question asked above, you might need to look up the hyperbolic functions somewhere other than the textbook.

We’ll probably see the very occasional use of $\cosh(x)$, $\sinh(x)$, and/or $\tanh(x)$ in this course, so most of the rest of this assignment will, just to be different, be about

$$\operatorname{csch}(x) = \frac{1}{\sinh(x)} = \frac{2}{e^x - e^{-x}}.$$

2. What are the domain and range of $\operatorname{csch}(x)$? Use Maple to plot the curve $y = \operatorname{csch}(x)$. [Please submit a printout of your worksheet.] On the basis of your plot, should (all of) $\operatorname{csch}(x)$ be invertible? [1]
3. Find an expression – by hand! – for $\operatorname{arccsch}(x)$ in terms of the natural logarithm function. [2]
4. Use Maple to find an expression for $\operatorname{arccsch}(x)$ in terms of the natural logarithm function. [Please submit a printout of your worksheet.] Is this the same as the one you obtained by hand? [2]
5. What are the domain and range of $\operatorname{arccsch}(x)$? [Your version of the expression, if it’s different from Maple’s.] [2]
6. Just for fun – and a mark too! – use Maple to find the roots of the general cubic equation, $ax^3 + bx^2 + cx + d = 0$. [Do not do this by hand, unless you have *way* too much time on your hands ...] [1]

REFERENCES

1. *Calculus: Early Transcendentals* (2nd Edition), by Jon Rogawski, W.H. Freeman, New York, 2012, ISBN-10: 1-4292-6009-2, ISBN-13: 978-1-4292-6009-1.
2. *Getting started with Maple 10*, by Gilberto E. Urroz (2005), which can found (pdf) at: <http://euclid.trentu.ca/math/sb/1101Y/2012-2013/GettingStartedMaple10.pdf>