



MATH135 S115  
Mathematics IA  
Assignment 2

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Tutorial Group: D2, Wed 15:00, C5C 238

Tutor: Audrey Markowskei

MACQUARIE  
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Department of  
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Due 14:00, 07/05 2015

*Please sign the declaration below, and staple this sheet to the front of your solutions. Your assignment must be submitted at the Science Centre, E7A Level 1.*

**Your assignment must be STAPLED, please do not put it in a plastic sleeve.**

**PLAGIARISM** Plagiarism involves using the work of another person and presenting it as one's own. For this assignment, the following acts constitute plagiarism:

- a) Copying or summarizing another person's work.
- b) Where there was collaborative preparatory work, submitting substantially the same final version of any material as another student.

Encouraging or assisting another person to commit plagiarism is a form of improper collusion and may attract the same penalties.

**STATEMENT TO BE SIGNED BY STUDENT**

- 1. I have read the definition of plagiarism that appears above.
- 2. In my assignment I have carefully acknowledged the source of any material which is not my own work.
- 3. I am aware that the penalties for plagiarism can be very severe.
- 4. If I have discussed the assignment with another student, I have written the solutions independently.

**SIGNATURE** .....

FEEDBACK		
Work	Presentation	Total

1. Given is the function  $f$  determined by  $f(x) = \cosh x = \frac{e^x + e^{-x}}{2}$ .
  - (a) Find the natural domain  $D$  of the given functional expression.
  - (b) Look at potential symmetry properties of the function.
  - (c) Find the roots of the function, that is, the points  $x \in D$  where  $f(x) = 0$ .
  - (d) Asymptotic analysis: check for the existence of horizontal and vertical asymptotes.
  - (e) Investigate the behaviour of the first derivative.
  - (f) Investigate the behaviour of the second derivative.
  - (g) Collect the results in a table, and determine the type of the critical points.
  - (h) Finally, sketch the graph of  $f$ , using the previous table as a guideline.
2. The function  $\operatorname{arcsinh}$  is the inverse function of  $\sinh$ .
  - (a) Find the derivative of the function given by  $x \mapsto \sinh x = \frac{e^x - e^{-x}}{2}$ . Show that the derivative is everywhere (strictly) positive. Infer that  $\sinh$  is injective. What is the range of this function?
  - (b) Use the definition of  $\cosh x$  and  $\sinh x$  to show that  $\cosh^2 x - \sinh^2 x = 1$ .
  - (c) Use the chain rule to find the derivative of the function determined by  $x \mapsto \operatorname{arcsinh} x$ .
3. Hughes-Hallett *et al*, 2013. Chapter 3, Section 9, Problem 20.
4. Hughes-Hallett *et al*, 2013. Chapter 4, Section 3, Problem 42.

