Question Number	Scheme	Notes	Marks
1.	"...show all stages of your working. Solutions relying entirely on calculator technology are not acceptable."		
	Move to the alternative scheme if they use exponentials		
	$\cosh 2x - 7\sinh x = 5 \Rightarrow 1 + 2\sinh^2 x - 7\sinh x = 5$ Replaces cosh2x with $1+2\sinh^2 x$. Or $\cosh 2x$ with $2\cosh^2 x - 1$ or $\cosh^2 x + \sinh^2 x$ **and then** $\cosh^2 x$ with $1+\sinh^2 x$. There must be no incorrect identities used.		**M1**
	$2\sinh^2 x - 7\sinh x - 4 = 0$	Correct 3TQ (implied by a correct solution for sinh x)	**A1**
	$(2\sinh x + 1)(\sinh x - 4) = 0 \Rightarrow \sinh x =$	Attempt to solve 3TQ in sinh$x$ (usual rules) Solving method must be seen - note that e.g., 1100111 is a possible mark profile	**M1**
	$\sinh x = -\frac{1}{2}, 4$	Both correct values	**A1**
	$x = \ln\left(-\frac{1}{2} + \sqrt{\left(-\frac{1}{2}\right)^2 + 1}\right), \quad \ln\left(4 + \sqrt{(4)^2 + 1}\right)$ Obtains at least one **correct** exact log form of x for one of their real values of sinh x. This mark may also be gained by using the correct exponential form of sinh$x$ and solving appropriately (may be slips but must reach 3TQ in e^x - does not have to be written in =0 form). Then solved by usual rules but allow if consistent calculator answer - and must take lns)		**M1**
	$x = \ln\left(-\frac{1}{2} + \sqrt{\frac{5}{4}}\right)$ or e.g., $\ln\frac{-1+\sqrt{5}}{2}, \quad \ln\left(4+\sqrt{17}\right)$ A1: One correct exact value of x. Allow equivalent processed exact answers. A1: Both values correct and exact and no additional incorrect answers. Allow equivalent processed exact answers. **Condone missing brackets.**		**A1** **A1** **(7)**
			Total 7

	Alternative by exponential definitions (<u>in most cases</u> will score a max of 2/7)		
	e.g., $\left(\frac{e^{2x}+e^{-2x}}{2}\right) - 7\left(\frac{e^x - e^{-x}}{2}\right) = 5$	Uses correct identities	**M1**
	$e^{4x} - 7e^{3x} - 10e^{2x} + 7e^x + 1 = 0$	Correct quartic in e^x (any multiple - terms may not all be on one side but must be collected)	**A1**
	$(e^{2x} + e^x - 1)(e^{2x} - 8e^x - 1) = 0 \Rightarrow e^x = \ldots \quad \frac{-1+\sqrt{5}}{2}, \ 4+\sqrt{17}$ M1: Solves their quartic as far as $e^x = \ldots$ A1: Both correct exact values There must be a recognisable attempt to write a 5 term quartic as the product of two 3TQs in e^x (factorisation for the constant and for e^{4x} can have sign errors only) **followed by** an explicit method (usual rules) on at least one 3TQ.		**M1** **A1**
	$\Rightarrow x = \ldots$ Converts correctly to give at least one value for x as a valid exact natural logarithm. This mark requires a recognisable attempt to write a 5 term quartic as the product of two 3TQs in e^x as before but condone no explicit method on 3TQ		**M1**
	$x = \ln\left(-\frac{1}{2} + \sqrt{\frac{5}{4}}\right)$ or e.g., $\ln\frac{-1+\sqrt{5}}{2}, \quad \ln\left(4+\sqrt{17}\right)$ A1: One correct exact value of x. Allow equivalent processed exact answers A1: Both values correct and exact and no additional incorrect answers. Allow equivalent exact answers. **Condone missing brackets**.		**A1** **A1** **(7)**