Question	Scheme	Marks
3a	$\sinh x + \operatorname{sech} x = \dfrac{e^x - e^{-x}}{2} + \dfrac{2}{e^x + e^{-x}}$	**B1**
	$= \dfrac{\left(e^x - e^{-x}\right)\left(e^x + e^{-x}\right) + 4}{2\left(e^x + e^{-x}\right)}$	**M1**
	$= \dfrac{e^{2x} - e^{-2x} + 4}{2e^x + 2e^{-x}} \times \dfrac{e^{2x}}{e^{2x}} = \cdots$	**M1**
	$= \dfrac{e^{4x} + 4e^{2x} - 1}{2e^{3x} + 2e^x}$ *	**A1***
		(4)
3b	$\sinh x + \operatorname{sech} x = \dfrac{1}{2}e^x \Rightarrow \dfrac{e^{4x} + 4e^{2x} - 1}{2e^{3x} + 2e^x} = \dfrac{1}{2}e^x \Rightarrow \cancel{e^{4x}} + 4e^{2x} - 1 = \cancel{e^{4x}} + e^{2x}$	**M1**
	$3e^{2x} = 1$	**A1**
	$\Rightarrow x = \dfrac{1}{2}\ln\dfrac{1}{3}$	**M1**
	$= -\dfrac{1}{2}\ln 3$	**A1**
		(4)
		(8 marks)

Notes:

(a)

B1: Correct expression in terms of exponentials given.

M1: Combines the terms over a common denominator.

M1: Expands and simplifies to a point where positive indices for the exponentials are evident.

A1*: Achieves the given answer with no incorrect work seen, and a step with the brackets all expanded before the final answer. Allow e.g. $e^{2x} - e^{-2x}$ for the expanded brackets.

Note: There may be variations using other identities, e.g. $\dfrac{\sinh x \cosh x + 1}{\cosh x} = \dfrac{\sinh 2x + 2}{2\cosh x}$ before applying identities. In such case the scheme can be followed – B1 for use of correct exponential identities when they are applied, M1 for combining the fraction (scored before the B mark here), then M1 for simplifying to positive indices in the exponents, A1 if all correct.

(b)

M1: Applies the result of (a) and cross multiplies to achieve an equation in e^{2x} only.

A1: Correct equation as shown or $e^{2x} = \dfrac{1}{3}$

M1: Solves the exponential equation of form $ae^{kx} = b$ to find a value for x

A1: cao.