3. Using the definitions of $\sinh x$ and $\cosh x$ in terms of exponentials,

(a) prove that

$$\cosh^2 x - \sinh^2 x \equiv 1$$

(2)

(b) find algebraically the exact solutions of the equation

$$2 \sinh x + 7 \cosh x = 9$$

giving your answers as natural logarithms.

(5)

1. **In this question you must show all stages of your working.**

Solutions relying entirely on calculator technology are not acceptable.

Solve the equation

$$7\cosh x + 3\sinh x = 2e^x + 7$$

Give your answers as simplified natural logarithms.

(5)

3. Solve the equation

$$4\tanh x - \operatorname{sech} x = 1$$

giving your answer in the form $x = \ln k$ where k is a fully simplified rational number.

(6)

1. (a) Using the definitions of hyperbolic functions in terms of exponentials, show that

$$1 - \tanh^2 x \equiv \operatorname{sech}^2 x$$

(3)

(b) Solve the equation

$$2\operatorname{sech}^2 x + 3\tanh x = 3$$

giving your answer as an exact logarithm.

(3)

1: (a) Use the definition of $\cosh x$ in terms of exponentials to show that

$$2\cosh 5x \cosh x \equiv \cosh 6x + \cosh 4x$$

(2)

(b) Hence determine the exact values of x for which

$$\cosh 6x + \cosh 4x = 8\cosh x$$

giving your answers in terms of natural logarithms in simplest form.

(4)