Hyperbolic Functions 2

Q1.

(a) Starting from the definitions of cosh and sinh in terms of exponentials, prove that

$$\cosh 2x = 2\sinh^2 x + 1. \qquad [3]$$

(b) Find the set of values of k for which $\cosh 2x = k\sinh x$ has two distinct real roots. [5]

Q2.

(a) Starting from the definitions of cosh and sinh in terms of exponentials, prove that

$$\cosh^2 x - \sinh^2 x = 1. \qquad [3]$$

Q3.

(a) Starting from the definitions of cosh and sinh in terms of exponentials, prove that

$$\cosh^2 x - \sinh^2 x = 1. \qquad [3]$$

(c) Sketch the graph of $y = \operatorname{sech} x$, stating the equation of the asymptote. [2]

Q4.

(a) Starting from the definitions of sech and tanh in terms of exponentials, prove that

$$1 - \operatorname{sech}^2 t = \tanh^2 t. \qquad [3]$$

Q5.

(a) Starting from the definitions of cosh and sinh in terms of exponentials, prove that

$$2\cosh^2 x = \cosh 2x + 1. \qquad [3]$$

Q6.

(a) Starting from the definitions of cosh and sinh in terms of exponentials, prove that

$$\sinh 2x = 2\sinh x \cosh x. \qquad [3]$$

Hyperbolic Functions 2

Q7.

(a) Starting from the definitions of cosh and sinh in terms of exponentials, prove that

$$2\sinh^2 A = \cosh 2A - 1. \qquad [3]$$
