1.7 Hyperbolic Functions: 10-minute Pack

EDEXCEL 9FM0 · Calculator allowed · about 10 minutes

Total Marks

Name: _____ Date: ____ / ____ / _____

Answer ALL questions. Show all your working.

1 This question concerns the graphs of the hyperbolic functions.

(a) Sketch the graph of y = cosh x, marking the y-intercept and stating the coordinates and nature of any turning point. **(3)**

(b) Sketch the graph of y = tanh x, stating the equations of its horizontal asymptotes. **(2)**

(c) With reference to the graph of y = sinh x, explain why the equation sinh x = k has exactly one real solution for every real number k. **(2)**

(Total for Question 1 is 7 marks)

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Mark scheme · 1.7 Hyperbolic Functions: 10-minute Pack

Question 1

(a) correct shape: even function, symmetrical about the y-axis, $y \geq 1$ for all x **B1**

(a) y-intercept marked at (0, 1) **B1**

(a) minimum turning point identified at (0, 1) **B1**

(a) Answer: U-shaped curve symmetrical about the y-axis, minimum at (0,1), y-intercept (0,1), no x-intercepts

(b) correct S-shaped, increasing, odd-function curve through the origin **B1**

(b) asymptotes $y = 1$ and $y = -1$ stated **B1**

(b) Answer: $y = 1$ and $y = -1$

(c) sinh x is a strictly increasing function for all real x, with range all of R **B1**

(c) hence the horizontal line $y = k$ meets the graph exactly once for any real k **B1**

(c) Answer: sinh x is a strictly increasing bijection from R to R, so $y = k$ meets the graph exactly once for every real k

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