A Level · Edexcel · Further Maths

21 mins 3 questions

4.1 Hyperbolic Functions

4.1.1 Hyperbolic Functions & Graphs / 4.1.2 Logarithmic Forms of Inverse Hyperbolic Functions / 4.1.3 Hyperbolic Identities & Equations / 4.1.4 Differentiating & Integrating Hyperbolic Functions

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Total Marks **/21**

1 $$y = \sin x \sinh x$$

Show that $\dfrac{\mathrm{d}^4 y}{\mathrm{d}x^4} = -4y$

(4 marks)

2 The curve C has equation

$$y = 31 \sinh x - 2 \sinh 2x \qquad x \in \mathbb{R}$$

Determine, in terms of natural logarithms, the exact x coordinates of the stationary points of C.

(7 marks)

3 (a) (a) Prove that

$$\tanh^{-1}(x) = \frac{1}{2}\ln\left(\frac{1+x}{1-x}\right) \quad -k < x < k$$

stating the value of the constant k.

(5 marks)

(b) (b) Hence, or otherwise, solve the equation

$$2x = \tanh\left(\ln\sqrt{2-3x}\right)$$

(5 marks)