

2 The curve C has parametric equations

$$x = \sinh t \quad \text{and} \quad y = t + \cosh t.$$

(a) Find $\frac{dy}{dx}$ in terms of t . [2]

[illegible]

(b) Show that $\frac{d^2y}{dx^2} = \frac{1 - \sinh t}{\cosh^3 t}$. [4]

This image shows a full page of white paper with horizontal dashed lines, typical of primary-ruled notebook paper. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

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- (c) Find the Maclaurin's series for y in terms of x up to and including the term in x^2 . [2]

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3 The variables x and y are such that $y = 2$ when $x = -1$ and

$$x^2y + (x+y)^3 = 3.$$

(a) Show that $\frac{dy}{dx} = \frac{1}{4}$ when $x = -1$. [3]

[illegible]

(b)

$$\frac{d^2y}{dx^2} \text{ when } x = -1.$$

[6]

[illegible]

7 (a) Show that $\frac{d}{dx}\left(\frac{1}{2}x\sqrt{4-x^2} + 2\sin^{-1}\left(\frac{1}{2}x\right)\right) = \sqrt{4-x^2}$.

[3]

[illegible]

(b) Find the solution of the differential equation

$$2\frac{dy}{dx} + \frac{y}{2+x} = 2\sqrt{2-x}$$

for which $y = \frac{1}{2}$ when $x = 1$. Give your answer in an exact form.

[8]

This image shows a blank sheet of white paper with ten horizontal dashed lines spaced evenly apart, resembling notebook paper. The lines are thin and black, extending across the full width of the page. There is no handwriting or other markings on the paper.

(b) Show that

$$\frac{d^2y}{dx^2} = \frac{a \cot t \operatorname{cosec} t (\operatorname{cosec}^2 t + 1)}{(b \operatorname{cosec} t + c \cot^2 t)^n},$$

where a, b, c and n are integers to be determined.

[5]

This image shows a full page of a handwriting practice worksheet. It consists of multiple rows of horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. The background is plain white, and there are no margins or additional markings.

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[5]

[illegible]