5.

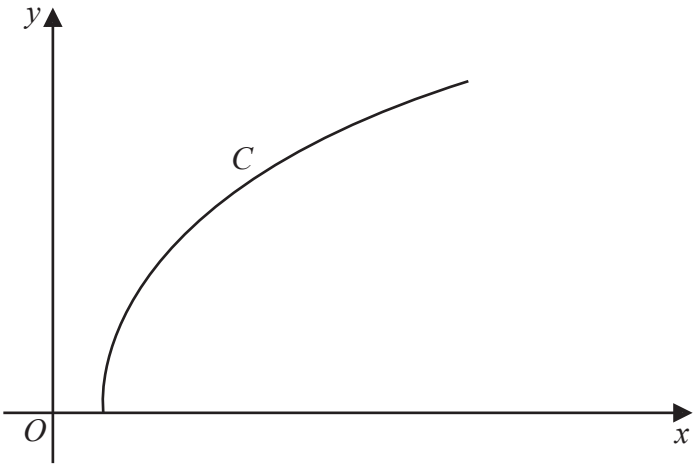


Figure 2

In this question you must show all stages of your working.
Solutions relying on calculator technology are not acceptable.

Figure 2 shows a sketch of the curve C defined by the parametric equations

$$x = \cosh 2t \qquad y = 4\sinh t \qquad 0 \leqslant t \leqslant \frac{3}{2}$$

(a) Show that

$$\left(\frac{\mathrm{d}x}{\mathrm{d}t}\right)^2 + \left(\frac{\mathrm{d}y}{\mathrm{d}t}\right)^2 = m\cosh^n t$$

where m and n are integers to be determined.

(5)

(b) Use algebraic integration to determine the exact length of C.

Give the answer in the form $a + \sinh b$ where a and b are integers to be found.

(3)

(c) Use algebraic integration to determine the exact area of the surface formed when C is rotated through $360°$ about the x-axis.

Give the answer in simplest form in terms of hyperbolic functions.

(4)

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Question 5 continued

(Total for Question 5 is 12 marks)

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