5.

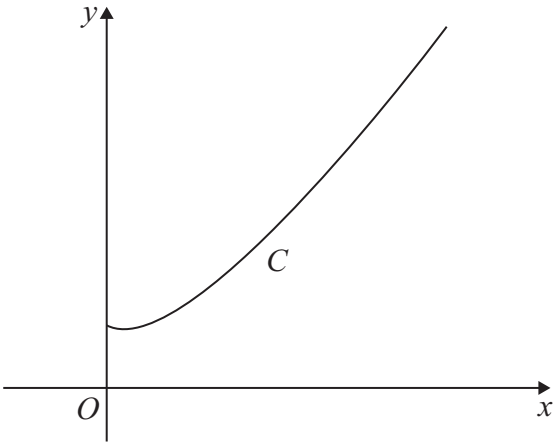


Figure 1

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

Figure 1 shows a sketch of the curve C defined by the parametric equations

$$x = (2t + 3)^{\frac{3}{2}} \qquad y = \frac{3}{2}t^2 + 3t + 6 \qquad -\frac{3}{2} \leqslant t \leqslant 3$$

(a) Show that

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

where a is an integer to be determined.

(4)

Hence, using algebraic integration, determine

(b) the exact length of C,

(3)

(c) the exact area of the surface generated when C is rotated through 360° about the x-axis, giving your answer in the form $k\pi$ where k is a rational number.

(4)

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Question 5 continued

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Question 5 continued

(Total for Question 5 is 11 marks)