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

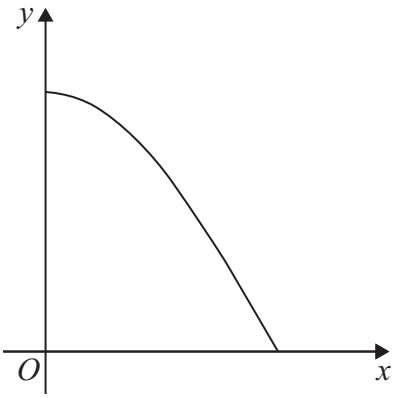


Figure 1

Figure 1 shows a sketch of the curve with equation

$$y = \cos 2x \qquad 0 \leqslant x \leqslant \frac{\pi}{4}$$

The curve is rotated through 2π radians about the x-axis.

(a) Show that the area of the curved surface generated is given by

$$S = 2\pi \int_0^{\frac{\pi}{4}} \cos 2x \sqrt{1 + 4\sin^2 2x}\, \mathrm{d}x$$

(2)

(b) Hence, using the substitution $2\sin 2x = \sinh\theta$, show that

$$S = \frac{\pi}{4}\left(\ln\left(a + \sqrt{b}\right) + a\sqrt{b}\right)$$

where a and b are integers to be determined.

(7)

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Question 7 continued

(Total for Question 7 is 9 marks)