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6. Three **consecutive** terms in a sequence of real numbers are given by

$$k,\ 1 + 2k \text{ and } 3 + 3k$$

where k is a constant.

Use proof by contradiction to show that this sequence is not a geometric sequence.

(5)

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Question 6 continued

Q6

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7.

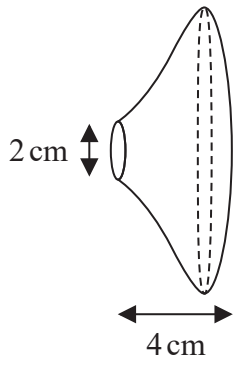


Figure 3

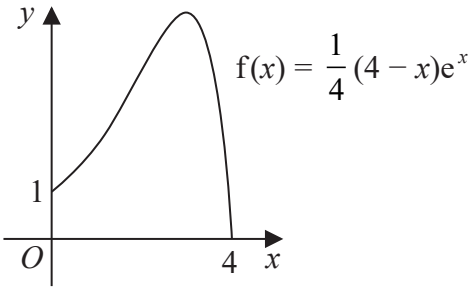


Figure 4

Figure 3 shows the design of a doorknob.

The shape of the doorknob is formed by rotating the curve shown in Figure 4 through 360° about the x-axis, where the units are centimetres.

The equation of the curve is given by

$$\mathrm{f}(x) = \frac{1}{4}(4 - x)\mathrm{e}^{x} \qquad 0 \leqslant x \leqslant 4$$

(a) Show that the volume, $V\,\text{cm}^3$, of the doorknob is given by

$$V = K\int_0^4 \left(x^2 - 8x + 16\right)\mathrm{e}^{2x}\,\mathrm{d}x$$

where K is a constant to be found.

(3)

(b) Hence, find the exact value of the volume of the doorknob.

Give your answer in the form $p\pi(\mathrm{e}^q + r)\,\text{cm}^3$ where p, q and r are simplified rational numbers to be found.

(5)

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