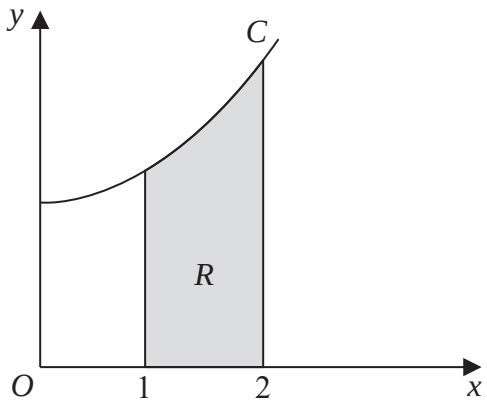
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Figure 3

Figure 3 shows part of the curve C with equation $y = x^2 + 4$. The shaded region R is bounded by C, the line with equation $x = 1$, the x-axis and the line with equation $x = 2$

The unit of length on each axis is one centimetre.

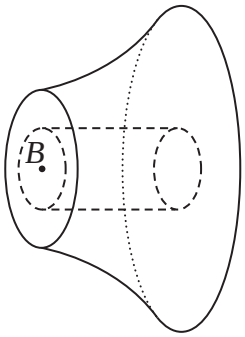
A uniform wooden solid, S, is made in the shape formed by rotating the region R through 360° about the x-axis.

(a) Using algebraic integration,

(i) show that the volume of S is $\frac{613\pi}{15}$ cm^3

(ii) find, to 3 significant figures, the distance of the centre of mass of S from O.

(8)



NOT to scale

Figure 4

A solid, S_1, is formed by removing a solid cylinder of radius 3 cm and length 1 cm from S. A metal cylinder, of radius 3 cm and length 1 cm is placed in the resulting hole to form a new solid T, as shown in Figure 4. The axis of the metal cylinder coincides with the axis of symmetry of S_1. The point B is the centre of the smaller plane face of T. The mass per unit volume of S_1 is M and the mass per unit volume of the metal cylinder is $5M$.

(b) Find the distance of the centre of mass of T from B.

(5)

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