



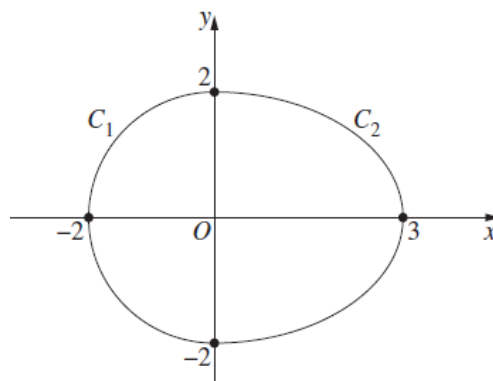
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- 2016 15** The diagram shows two curves C_1 and C_2 .
a The curve C_1 is the semicircle $x^2 + y^2 = 4$,
 $-2 \leq x \leq 2$.

The curve C_2 has equation $\frac{x^2}{9} + \frac{y^2}{4} = 1$,

$$0 \leq x \leq 3.$$

An egg is modelled by rotating the curves about the x -axis to form a solid of revolution. Find the exact value of the volume of the solid of revolution.



4

Consider two volumes:

For C_1 , rotated around x -axis, use $y^2 = 4 - x^2$. The solid is a hemisphere with radius 2.

For C_2 , rotated around x -axis, use $\frac{y^2}{4} = 1 - \frac{x^2}{9}$, i.e. $y^2 = 4 - \frac{4x^2}{9}$.

$$\begin{aligned} \text{Total volume} &= \frac{1}{2} \times \frac{4}{3} \times \pi \times 2^3 + \pi \int_0^3 \left(4 - \frac{4x^2}{9} \right) dx \\ &= \frac{16\pi}{3} + \pi \left[4x - \frac{4x^3}{27} \right]_0^3 \\ &= \frac{16\pi}{3} + \pi \left[4(3) - \frac{4(3)^3}{27} - (4(0) - \frac{4(0)^3}{27}) \right] \\ &= \frac{16\pi}{3} + \pi[12 - 4] \\ &= \frac{16\pi}{3} + 8\pi \\ &= \frac{40\pi}{3} \end{aligned}$$

\therefore the volume is $\frac{40\pi}{3}$ units³.

State Mean:
2.30

* These solutions have been provided by [projectmaths](#) and are not supplied or endorsed by BOSTES.

BOSTES: Notes from the Marking Centre

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