

Dr Oliver Mathematics

Worked Examples

Mensuration 1

From: IGCSE 2011 Paper 3H Q23: Calculator

1. The diagram shows a solid cylinder and a solid sphere.

(5)

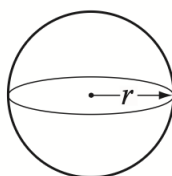
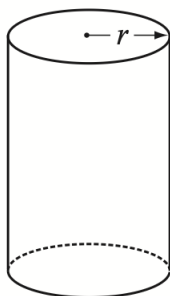


Diagram **NOT**
accurately drawn

- The cylinder has radius r .
- The sphere has radius r .

Given that

$$\frac{\text{Total surface area of cylinder}}{\text{Surface area of sphere}} = 2,$$

find the value of

$$\frac{\text{Volume of cylinder}}{\text{Volume of sphere}}.$$

Solution

Let the height of the cylinder be h . Then

$$\text{surface area of sphere} = 4\pi r^2$$

and

$$\text{total surface area of cylinder} = 2\pi r h + 2\pi r^2.$$

Now,

$$\begin{aligned}\frac{\text{Total surface area of cylinder}}{\text{Surface area of sphere}} &= 2 \Rightarrow \frac{2\pi rh + 2\pi r^2}{4\pi r^2} = 2 \\ &\Rightarrow \frac{\pi(2rh + 2r^2)}{4\pi r^2} = 2 \\ &\Rightarrow \frac{rh + r^2}{2r^2} = 2 \\ &\Rightarrow rh + r^2 = 4r^2 \\ &\Rightarrow rh = 3r^2 \\ &\Rightarrow h = 3r.\end{aligned}$$

Next,

$$\text{volume of sphere} = \frac{4}{3}\pi r^3$$

and

$$\text{volume of cylinder} = \pi r^2(3r) = 3\pi r^3.$$

Finally,

$$\begin{aligned}\frac{\text{volume of cylinder}}{\text{volume of sphere}} &= \frac{3\pi r^3}{\frac{4}{3}\pi r^3} \\ &= \underline{\underline{\frac{9}{4}}}.\end{aligned}$$