

## Answer on Question#37695-Math-Geometry

### Question

A cylindrical glass has a radius of 4 centimetres and a height of 6 centimetres. A large cylindrical jar full of water is a similar shape to the glass. The glass can be filled with water from the jar exactly 216 times. Work out the radius and height of the jar.

### Solution

Volume of the glass

$$V_g = \pi \cdot R_g^2 \cdot H_g = 3.1416 \cdot 4^2 \cdot 6 = 302 \text{ cm}^3$$

Volume of the jar

$$V_j = 216 \cdot V_g = 216 \cdot 302 = 65232 \text{ cm}^3$$

Since the jar is a similar shape to the glass, we know that

$$\frac{R_j}{H_j} = \frac{R_g}{H_g} = \frac{4}{6} = \frac{2}{3}$$

or

$$H_j = 1.5 \cdot R_j$$

Volume of the jar

$$V_j = \pi \cdot R_j^2 \cdot H_j = 65232 \text{ cm}^3$$

Let us design  $R_j = x$  and  $H_j = y$ .

Thus, we have a set of two equations with two unknown values:

$$\begin{cases} y = 1.5 \cdot x \\ 3.1416 \cdot x^2 \cdot y = 65232 \end{cases}$$

$$3.1416 \cdot x^2 \cdot (1.5 \cdot x) = 65232$$

$$x^3 = \frac{65232}{3.1416 \cdot 1.5} = 13843$$

$$x = \sqrt[3]{13843} = 24$$

$$y = 1.5 \cdot x = 1.5 \cdot 24 = 36$$

So, the radius of the jar  $R_j = 24 \text{ cm}$  and the height of the jar  $H_j = 36 \text{ cm}$ .

**Answer:** the **radius** of the jar is 24 cm and the **height** of the jar is 36 cm