

QT Similar Shapes (Area & Volume)



1. Cylinder x and cylinder y are mathematically similar.

The ratio of the surface area of cylinder x to the surface area of cylinder y is $1 : 4$

(a) Simon says

'The height of cylinder x is one quarter of the height of cylinder y .

Explain why Simon is wrong

4 is an area scale factor

height is a linear scale factor - should be $\sqrt{1} : \sqrt{4}$

$\therefore 1 : 2$, cylinder x is half the height of y . (1 mark)

(b) The volume of cylinder y is 95cm^3 . Calculate the volume of cylinder x .

linear SF $1 : 2$

Area SF $1 : 4$

Vol. SF $1^3 : 2^3 = 1 : 8$

Vol of $x = \frac{95}{8} = \underline{\underline{11.875\text{cm}^3}}$

(3 marks)

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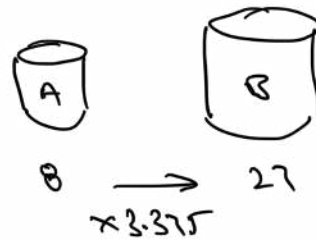
2. Prism A and prism B are mathematically similar.

The ratio of the surface area of prism A to the surface area of prism B is 4 : 9

The volume of prism B is 405cm^3

Show that the volume of prism A is 120cm^3

$$\begin{array}{l}
 \text{A : B} \\
 \text{Linear SF} \quad \sqrt{4} : \sqrt{9} \Rightarrow 2 : 3 \\
 \text{Area SF} \quad 4 : 9 \\
 \text{Vol SF} \quad 2^3 : 3^3 \Rightarrow 8 : 27 \\
 \text{Vol A} = \frac{405}{3 \cdot 375} = \underline{\underline{120}}
 \end{array}$$



(3 marks)

3. Three solid shapes x , y and z are mathematically similar.

The surface area of shape x is 4cm^2

The surface area of shape y is 25cm^2

The ratio of the volume of shape y to the volume of shape z is 27 : 64

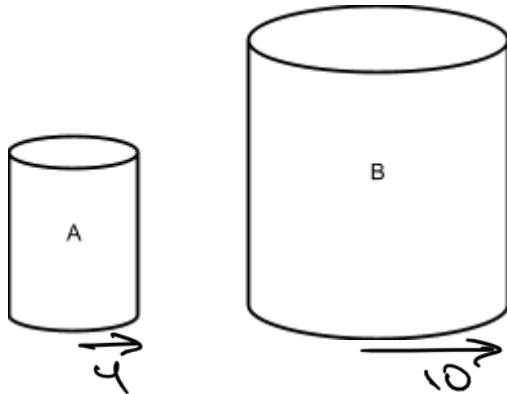
Work out the ratio of the length of shape x to the length of shape z . Give your answer in its simplest form.

$$\begin{array}{l}
 \text{Linear SF} \quad x : y : z \\
 \quad \quad \quad \underline{2} : \underline{5} \\
 \text{Area SF} \quad 4 : 25 \\
 \\
 \text{Linear SF} \quad 3 : 4 \\
 \quad \quad \quad \uparrow \quad \uparrow \\
 \quad \quad \quad \sqrt[3]{27} \quad \sqrt[3]{64} \\
 \text{Volume SF} \quad 27 : 64 \\
 \\
 \begin{array}{l}
 x : y : z \\
 2 : 5 \quad (x3) \\
 \quad \quad 3 : 4 \quad (x5) \\
 \hline
 6 : 15 \\
 \quad \quad 15 : 20 \\
 \hline
 6 : 15 : 20 \\
 \\
 \therefore \text{Scale } x : z \text{ linear} \\
 6 : 20 \\
 3 : 10 \quad (4 \text{ marks}) \\
 \hline
 \hline
 \end{array}
 \end{array}$$

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4. Two solid cylinders. A and B, are mathematically similar.



Cylinder A has a radius 4cm.
 Cylinder B has a radius 10cm.
 The surface area of cylinder A is 60cm^2

linear
 CF $4 : 10$
 $1 : 2.5$
 Area
 CF $1^2 : 2.5^2$
 Vol
 CF $1^3 : 2.5^3$

(a) Work out the surface area of cylinder B

$$\text{Cyl B} = 60 \times 2.5^2 = \underline{\underline{375\text{cm}^2}}$$

(2 marks)

The volume of cylinder B is 800cm^3

(b) Work out the volume of cylinder A

$$A = \frac{800}{2.5^3} = \underline{\underline{51.2\text{cm}^3}}$$

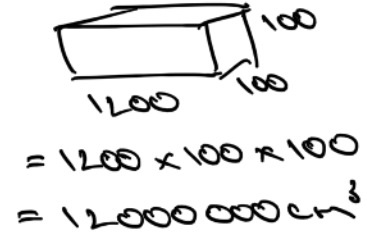
(2 marks)

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5. A motorhome has a volume of 12m^3 ← change cm^3
 Ahmed makes a model of this motorhome using a scale of 1 : 72 ← linear SF
 Work out the volume of the motorhome model, giving your answer in cm^3

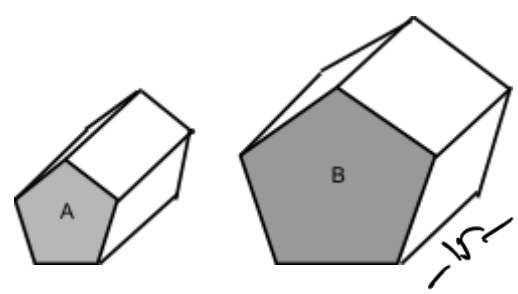
Linear SF 1 : 72
 Area SF 1² : 72²
 Vol SF 1³ : 72³



$$\begin{aligned} \text{Vol model} &= \frac{12000000}{72^3} \\ &= \underline{\underline{32.15 \text{ cm}^3}} \end{aligned}$$

(4 marks)

6. Prism A and prism B are mathematically similar.
 The cross sections are shaded.
 Area of the cross section of A : area of the cross section of B = 4 : 9



Linear SF $\sqrt{4} : \sqrt{9} = 2 : 3$
 Area SF 4 : 9
 Vol SF $2^3 : 3^3 = 8 : 27$

Prism A has a volume of 240cm^3 .
 Prism B has a length of 15cm.
 Work out the area of the cross section of prism B.

$$\begin{aligned} \text{Vol of B} &= 240 \times 27 \\ &= 7290 \text{ cm}^3 \end{aligned}$$

$$\begin{aligned} \text{Vol} &= \text{Area} \times \text{length} \\ 7290 &= \text{Area} \times 15 \\ 486 &= \text{Area} \end{aligned} \quad \underline{\underline{486 \text{ cm}^2}}$$