

1 Mathematically similar wooden blocks are made in a workshop.

There are small blocks and there are large blocks.

The volume of each small block is 300 cm^3

Given that

the surface area of each small block : the surface area of each large block = $25 : 36$

work out the volume of each large block.

Calculating scale factor for length of the block :

$$\begin{aligned} \text{small block} : \text{large block} &= \sqrt{25} : \sqrt{36} \\ &= 5 : 6 \quad (1) \end{aligned}$$

Finding volume of large block :

$$\left(\frac{6}{5}\right)^3 \times 300 = 518.4 \text{ cm}^3 \quad (1)$$

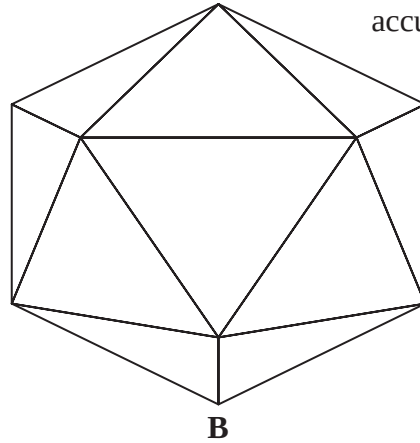
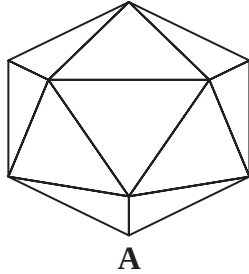
518.4

..... cm^3

(Total for Question 1 is 3 marks)

2 **A** and **B** are two similar solids.

Diagram **NOT**
accurately drawn



A has a volume of 1836 cm^3

B has a volume of 4352 cm^3

B has a total surface area of 1120 cm^2

Work out the total surface area of **A**.

Scale factor in terms of length :

$$\frac{B}{A} = \frac{\sqrt[3]{4352}}{\sqrt[3]{1836}} = \frac{4}{3} \quad (1)$$

Surface area of **A** :

$$\frac{x}{1120} = \left(\frac{3}{4}\right)^2$$

$$x = \left(\frac{3}{4}\right)^2 \times 1120 \quad (1)$$

$$= 630 \quad (1)$$

..... 630 cm^2

(Total for Question 2 is 3 marks)

3 The diagram shows two similar metal statues.



A



B

Diagram **NOT**
accurately drawn

The volume of statue **B** is 20% less than the volume of statue **A**

The surface area of statue **B** is $k\%$ less than the surface area of statue **A**

Work out the value of k

Give your answer correct to 3 significant figures.

$$\text{Volume of B} = 0.8 \text{ Volume of A}$$

$$\frac{\text{Volume of B}}{\text{Volume of A}} = 0.8$$

To find length scale factor:

$$\left(\frac{\text{Volume of B}}{\text{Volume of A}} \right)^{\frac{1}{3}} = \frac{\text{Length of B}}{\text{Length of A}} = (0.8)^{\frac{1}{3}} \quad (1)$$

To find area scale factor:

$$\begin{aligned} \frac{\text{Area of B}}{\text{Area of A}} &= (0.8^{\frac{1}{3}})^2 \\ &= 0.8^{\frac{2}{3}} = 0.8617 \dots \quad (1) \end{aligned}$$

$$\text{Surface Area of B} = 0.8617 \dots \times 100\% \text{ of Surface Area of A}$$

$$= 86.2\% \text{ of surface Area of A}$$

$$= \text{less than } (100 - 86.2)\% \text{ of A} \quad (1)$$

$$= \text{less than } 13.8\% \text{ of A}$$

$$k = \dots \quad 13.8$$

(Total for Question 3 is 4 marks)

4 The three solids **A**, **B** and **C** are similar such that

the surface area of **A** : the surface area of **B** = 4 : 9

and

the volume of **B** : the volume of **C** = 125 : 343

Work out the ratio

the height of **A** : the height of **C**

Give your ratio in its simplest form.

$$\begin{aligned} \text{length } A : B & : \sqrt{4} : \sqrt{9} \\ & : 2 : 3 \quad (1) \end{aligned}$$

$$\begin{aligned} \text{length } B : C & : \sqrt[3]{125} : \sqrt[3]{343} \\ & : 5 : 7 \quad (1) \end{aligned}$$

$$A : B : C$$

$$2 \times 5 : 3 \times 5$$

$$5 \times 3 : 7 \times 3$$

$$10 : 15 : 21 \quad (1)$$

$$10 : 21$$

$$A : C = 10 : 21 \quad (1)$$

(Total for Question 4 is 4 marks)

5 **A** and **B** are two similar vases.

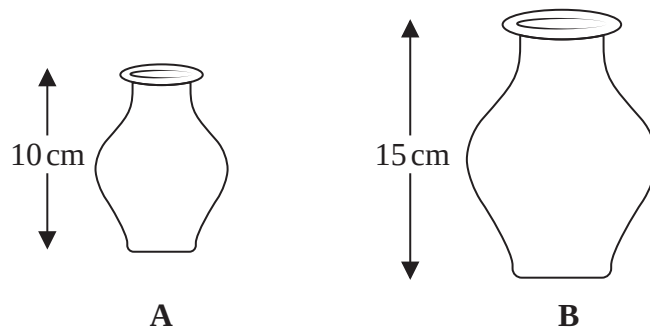


Diagram **NOT**
accurately drawn

Vase **A** has height 10 cm.

Vase **B** has height 15 cm.

The difference between the volume of vase **A** and the volume of vase **B** is 1197 cm^3

Calculate the volume of vase **A**

$$\begin{aligned} \text{Volume A} : \text{Volume B} &= 10^3 : 15^3 \\ &= 1000 : 3375 \quad (1) \end{aligned}$$

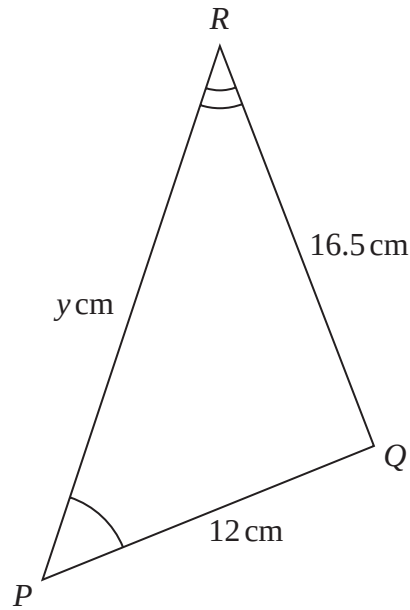
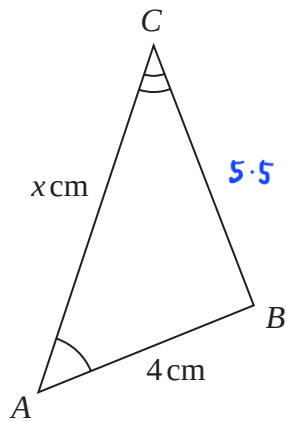
$$\begin{aligned} \frac{1197}{3375 - 1000} &= \frac{1197}{2375} \\ (1) &= 0.504 \end{aligned}$$

$$\begin{aligned} 0.504 \times 1000 &= 504 \\ (1) & \quad (1) \end{aligned}$$

504 cm^3

(Total for Question 5 is 4 marks)

6

Diagram **NOT**
accurately drawnTriangle ABC is similar to triangle PQR

$$AB = 4 \text{ cm} \quad PQ = 12 \text{ cm} \quad RQ = 16.5 \text{ cm} \quad AC = x \text{ cm} \quad PR = y \text{ cm}$$

(a) Calculate the length of BC

$$BC = \frac{4}{12} \times 16.5 \text{ cm} \quad (1)$$

$$= 5.5 \text{ cm} \quad (1)$$

$$\frac{5.5}{(2)} \text{ cm}$$

(Total for Question 6 is 2 marks)

7 A statue and a model of the statue are mathematically similar.

The statue has a total surface area of 3600 cm^2

The model has a total surface area of 625 cm^2

The volume of the model is 750 cm^3

Work out the volume of the statue.

length scale factor :

$$\sqrt{\frac{3600}{625}} = \frac{60}{25} = \frac{12}{5} \quad (1)$$

$$\text{volume of statue} = \left(\frac{12}{5}\right)^3 \times 750 \quad (1)$$

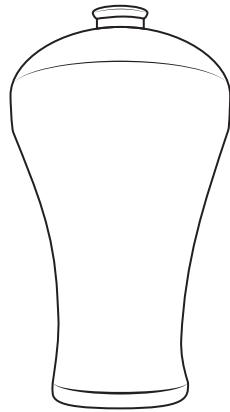
$$= \frac{1728}{125} \times 750$$

$$= 10\,368 \quad (1)$$

10 368 cm^3

(Total for Question 7 is 3 marks)

8 **A** and **B** are two similar vases.



A



B

Diagram **NOT**
accurately drawn

The vases are such that

$$\text{surface area of vase B} = \frac{25}{64} \times \text{surface area of vase A}$$

and that

$$\text{volume of vase A} - \text{volume of vase B} = 541.8 \text{ cm}^3$$

Calculate the volume of vase **B**

$$\text{scale factor of length : } B = \sqrt{\frac{25}{64}} A$$

$$B = \frac{5}{8} A \quad (1)$$

$$\text{Volume : } \left(\frac{8}{5}\right)^3 B - B = 541.8$$

$$\frac{512}{125} B - B = 541.8 \quad (1)$$

$$B \left(\frac{512}{125} - 1 \right) = 541.8$$

$$B (3.096) = 541.8 \quad (1)$$

$$B = 175 \quad (1)$$

$$\dots\dots\dots 175 \text{ cm}^3$$

(Total for Question 8 is 4 marks)