*Similarity - Lesson 2*

# Similar Areas and Volumes

LI

- Know what Area and Volume Scale Factors are.
- Know how ASF and VSF are linked to Length Scale Factor (k).
- Find missing areas and volumes in similar shapes.

SC

- ÷ and x numbers.

Mar 15-08:05

Length Scale Factor (LSF) = $k$

Area Scale Factor (ASF) = $k^2$, tells us how big (or small) the area of one shape is compared to a similar shape

Volume Scale Factor (VSF) = $k^3$, tells us how big (or small) the volume of one shape is compared to a similar shape

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## Strategy for Finding Missing Areas or Volumes

- Get scale factor $k$.
- Work out $k^2$ (area) or $k^3$ (volume).
- Multiply $k^2$ by given area (or multiply $k^3$ by given volume).

Length Scale Factor $= k$

$$A_{NEW} = k^2 \times A_{OLD}$$

$$V_{NEW} = k^3 \times V_{OLD}$$

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## Example 1

Two dolphin-shaped fridge magnets are mathematically similar :


If the area of the smaller magnet is $18\ cm^2$, find the area of the larger magnet.

Enlargement

$$k = \frac{10}{4} = \frac{5}{2} \Rightarrow k^2 = \frac{25}{4}$$

$$A_{NEW} = k^2 \times A_{OLD}$$

$$A_{NEW} = \frac{25}{4} \times 18$$

$$\boxed{A_{NEW} = 112.5\ cm^2}$$

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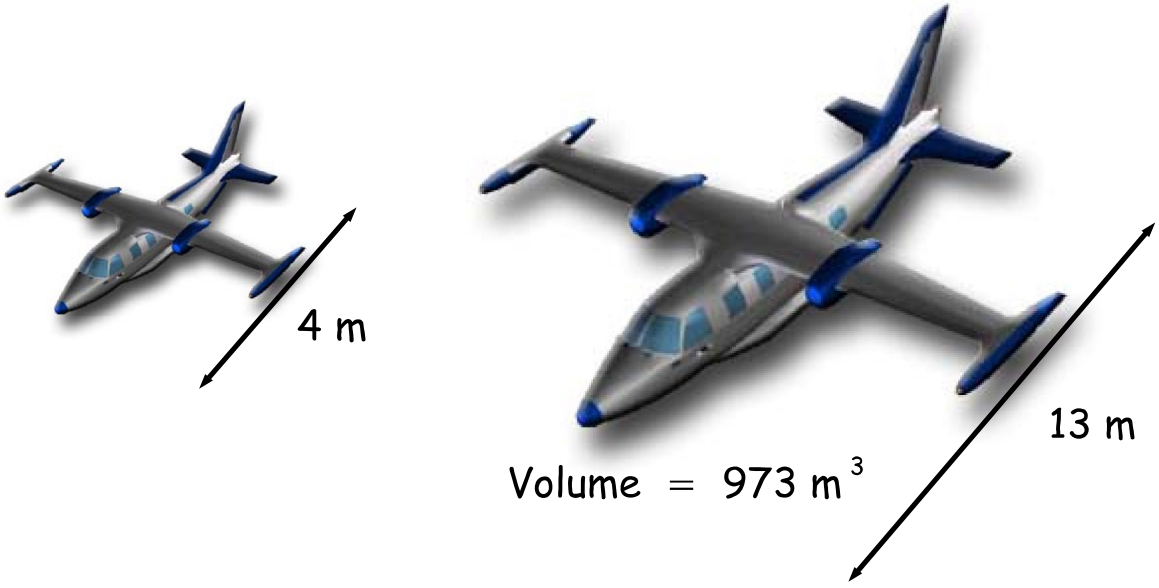
## Example 2

Two model aeroplanes are mathematically similar :




Find the volume of the smaller plane (to 1 d.p.).

Reduction

$$k = \frac{4}{13} \Rightarrow k^3 = \frac{4^3}{13^3} \approx 0.029\,130\,6\ldots$$

$$V_{NEW} = k^3 \times V_{OLD}$$

$$V_{NEW} = \frac{4^3}{13^3} \times 973$$

$$V_{NEW} = 28.34\ldots$$

$$\therefore \quad \boxed{V_{NEW} = 28.3\ \text{m}^3 \ (1\ \text{d.p.})}$$

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## Example 3

The following two vases are mathematically similar :

12 . 4 cm

19 . 3 cm

The cost of each vase is proportional to the volume of each vase. If the small vase costs £ 3 . 07, find the cost of the larger vase (to the nearest pence).

Enlargement

$$k = \frac{19.3}{12.4} \Rightarrow k^3 = \frac{19.3^3}{12.4^3} \approx 3.770\,568\ldots$$

$$Cost_{NEW} = k^3 \times Cost_{OLD}$$

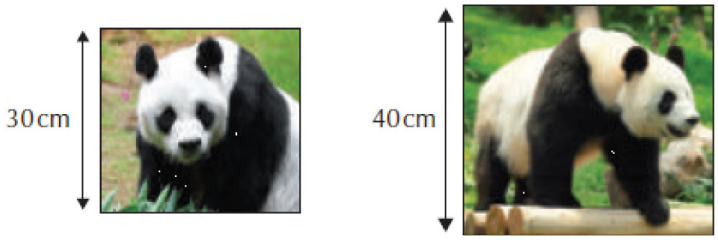
$$Cost_{NEW} = \frac{19.3^3}{12.4^3} \times 3.07$$

$$Cost_{NEW} = 11.575\ldots$$

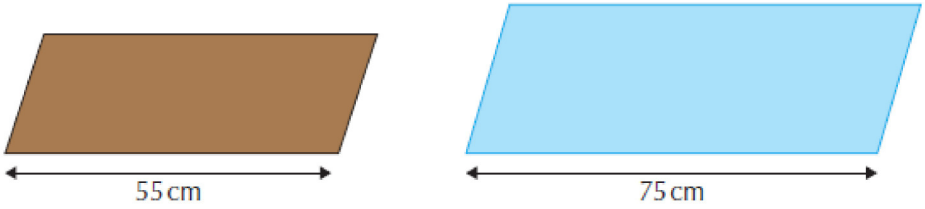
$$\therefore \quad \boxed{Cost_{NEW} = £\,11.58}$$

# Questions

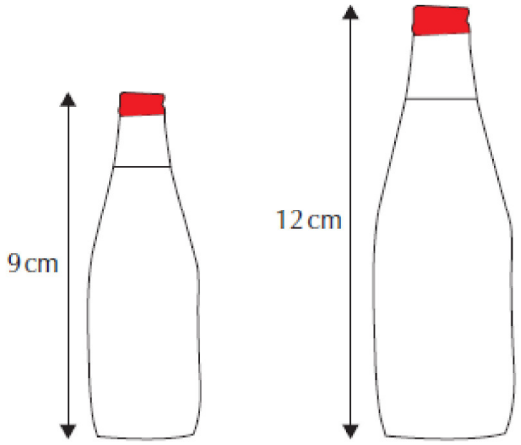
**1** The following photographs are mathematically similar. The area of the smaller photograph is 450 cm². Calculate the area of the larger photograph. Give your answer to 3 significant figures.



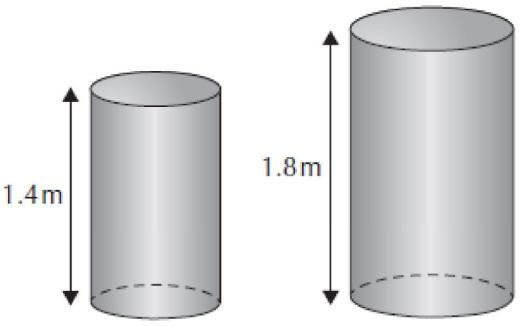

**2** Two tabletops are similar in shape. The area of the large tabletop is 8000 cm². Calculate the area of the small tabletop, correct to the nearest $cm^2$.



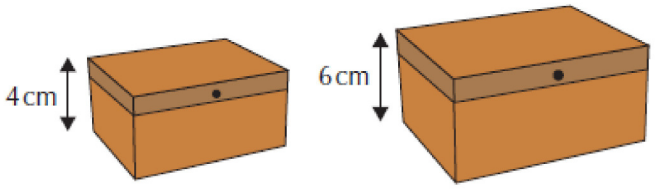

**3** The two bottles shown are similar in shape. The volume of the small bottle is 250 ml. Calculate the volume of the large bottle. Give your answer to the nearest 10 ml.



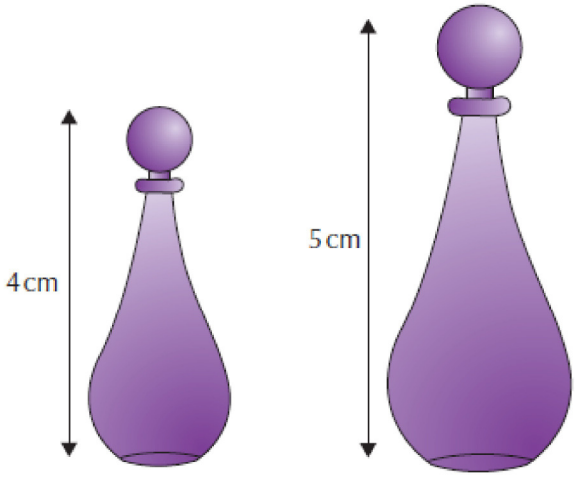

**4** Two cylindrical tanks are similar in shape. The volume of the large tank is 240 litres. Calculate the volume of the small tank. Give your answer to the nearest litre



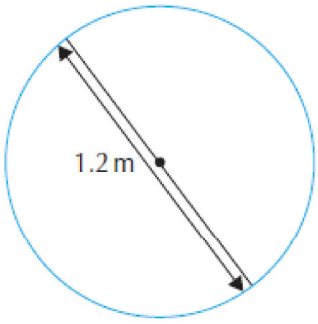
**5** Two metal boxes are similar in shape. The surface area of the large box is 140 cm². Calculate the surface area of the small box, correct to the nearest $cm^2$.



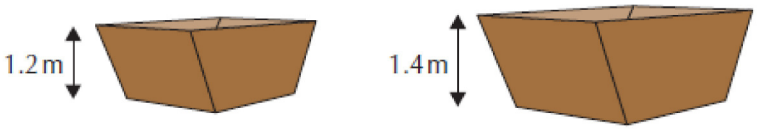

**6** A shop sells bottles of perfume in similar-sized bottles. The prices of the bottles are proportional to their volume. The price of the small bottle is £25. Calculate the price of the large bottle.




**7** The price of a rug is proportional to its area. A circular rug with diameter 1.2 m costs £80. How much would a similar rug with diameter 1.5 m cost?




**8** A company rents out skips. The cost is based on the volume of the skip. Two skips which are similar in shape are shown.




The rental price of the small skip is £80. How much would it cost to rent the large skip?

## Answers

1 $800\,cm^2$

2 $4302\,cm^2$

3 590ml

4 113 litres

5 $62\,cm^2$

6 £48.83

7 £125

8 £127