Lesson 3

Non Calculator

3.1 Start Up

Use the table of *Squares and Cubes from 1 to 99* to determine;

(i)

$$\left(\frac{21}{26}\right)^2 = \frac{441}{\underline{\qquad}}$$

(ii)

$$\left(\frac{49}{34}\right)^2 = \frac{\underline{\qquad}}{1156}$$

(iii)

$$\left(\frac{32}{91}\right)^2 = \underline{\qquad}$$

(iv)

$$\left(\frac{17}{31}\right)^3 = \frac{4913}{\underline{\qquad}}$$

(v)

$$\left(\frac{7}{29}\right)^3 = \frac{\underline{\qquad}}{24389}$$

(vi)

$$\left(\frac{63}{50}\right)^3 = \underline{\qquad}$$

(vii)

$$\left(\frac{324}{625}\right)^{0.5} = \frac{18}{\underline{\qquad}}$$

(viii)

$$\left(\frac{196}{4356}\right)^{0.5} = \frac{\underline{\qquad}}{66}$$

(ix)

$$\left(\frac{6241}{9801}\right)^{0.5} = \underline{\qquad}$$

(x)

$$\left(\frac{81}{25}\right)^{\frac{1}{2}} = \underline{\qquad}$$

(xi)

$$\left(\frac{1}{100}\right)^{\frac{1}{2}} = \underline{\qquad}$$

(xii)

$$\left(\frac{2116}{2601}\right)^{\frac{1}{2}} = \underline{\qquad}$$

(xiii)

$$\left(\frac{8}{27}\right)^{\frac{1}{3}} = \underline{\qquad}$$

(xiv)

$$\left(\frac{4096}{24389}\right)^{\frac{1}{3}} = \underline{\qquad}$$

(xv)

$$\left(\frac{857375}{884736}\right)^{\frac{1}{3}} = \underline{\qquad}$$
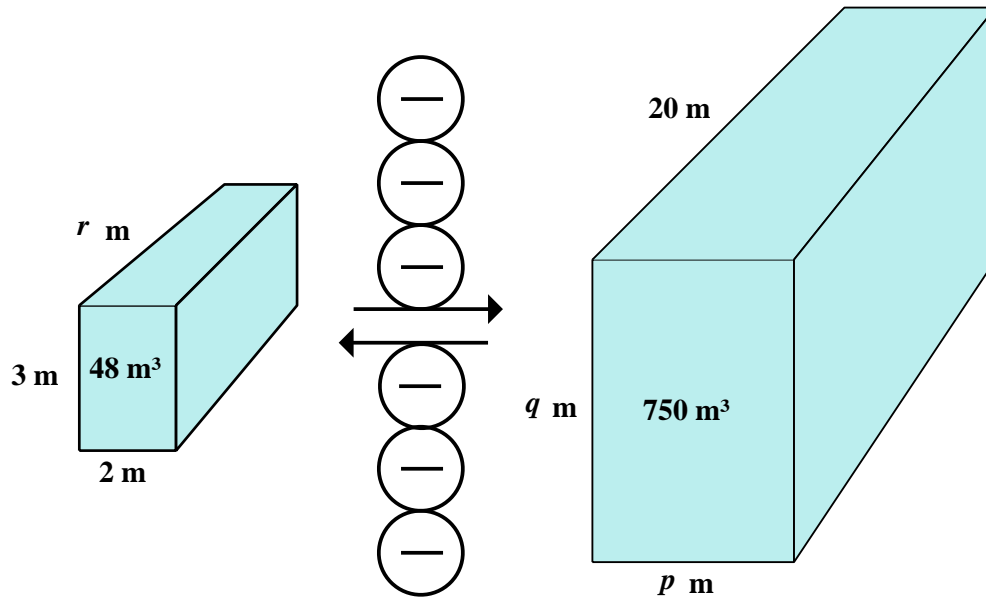
[15 marks]

3.2 Volume Scale Factor (*vsf*)

For any two similar solids:

$$volume\ scale\ factor\ =\ (\ length\ scale\ factor\ )^3$$

which can also be expressed as:

$$length\ scale\ factor\ =\ \sqrt[3]{volume\ scale\ factor}$$

3.3 Example

The above two similar cuboids are shown with the same orientation.

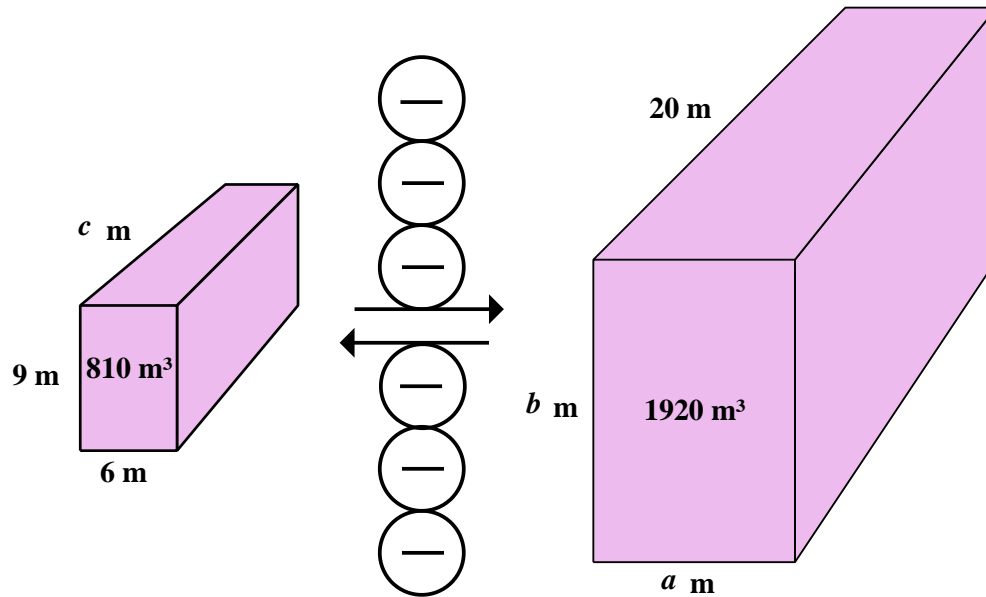(**i**)   Find the lengths marked *p, q* and *r*.

[3 marks]

(**ii**)   How many times more surface area has the larger cuboid than the smaller ?

[1 mark]

3.4 Exercise

Question 1

The above two similar cuboids are shown with the same orientation.

(**i**)   Find the lengths marked *a, b* and *c*.

[3 marks]

(**ii**)   How many times more surface area has the larger cuboid than the smaller ?

[2 marks]

Question 2
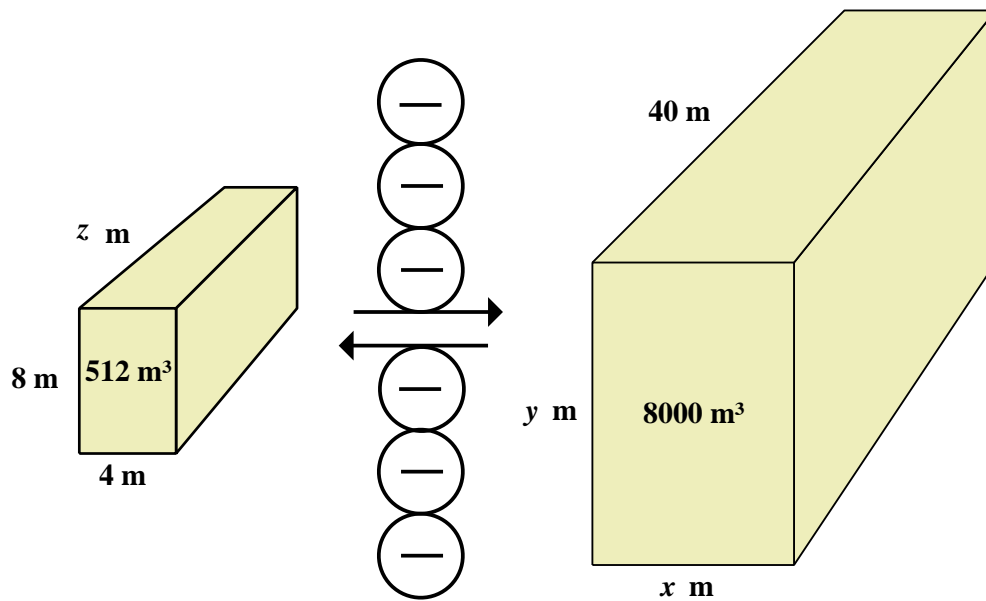
The above two similar cuboids are shown with the same orientation.

(i) Find the lengths marked x, y and z.

[**3 marks**]

(ii) How many times more surface area has the larger cuboid than the smaller ?

[**2 marks**]

Question 3

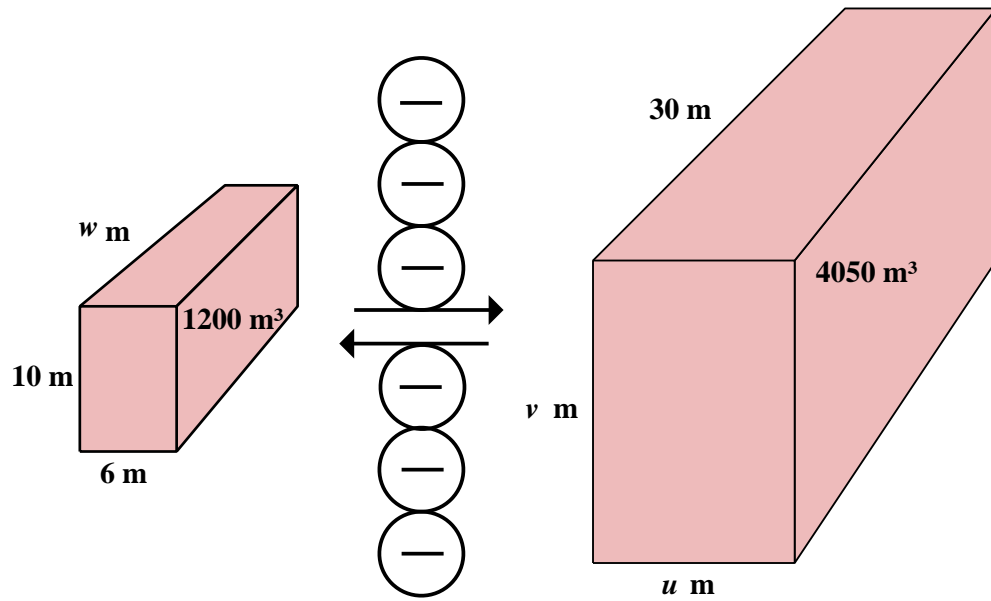The above two similar cuboids are shown with the same orientation.

(**i**)   Find the lengths marked *u, v* and *w*.

[**3 marks**]

(**ii**)   How many times more surface area has the larger cuboid than the smaller ?

[**2 marks**]

Question 4

(i)   Are all squares similar ?   YES / NO

          In other words, *Are all squares the same shape* ?

                                                                        [1 mark]

(ii)   A smaller square has an area of 27cm³.

          A larger square has a side $\frac{5}{3}$ times greater than the small square.

          What is the area of the larger square ?

          Hint : $lsf = \dfrac{5}{3}$ $asf = (lsf)^2$ $A_{BIG} = A_{SMALL} \times asf$

                                                                              [3 marks]

Question 5

Cuboid *G* measures 14cm by 21cm by 28cm.

Cuboid *H* measures 4cm by 6cm by 8cm.

(i)   Complete the following to show that the two cuboids similar.

$$\frac{14}{\rule{2cm}{0.4pt}} = \frac{\rule{1cm}{0.4pt}}{6} = \frac{\rule{1cm}{0.4pt}}{\rule{1cm}{0.4pt}} \qquad \text{All cancel down to} \quad \frac{\rule{1cm}{0.4pt}}{\rule{1cm}{0.4pt}}$$

                                                                            [2 marks]

(ii)   What is the ***length scale factor***, greater than 1, of the similarity ?

          $lsf = \frac{\rule{1cm}{0.4pt}}{\rule{1cm}{0.4pt}}$

                                                                             [1 mark]

(iii)   What is the ***area scale factor*** of, greater than 1, of the similarity ?

          $asf = \frac{\rule{1cm}{0.4pt}}{\rule{1cm}{0.4pt}}$

                                                                             [1 mark]

(iv)   What is the ***volume scale factor***, greater than 1, of the similarity ?

          $vsf = \frac{\rule{1cm}{0.4pt}}{\rule{1cm}{0.4pt}}$

                                                                              [1 mark]

(v)   Calculate;

          (a) V_{BIG}

                                                                              [1 mark]

          (b) V_{SMALL}

                                                                                [1 mark]

          (c) $V_{SMALL} \times vsf$

                                                                              [1 mark]

          (d)   Comment

                                                                              [1 mark]

Question 6

Are all rectangles similar ?   YES / NO

In other words, *Are all rectangles the same shape* ?

[**1 mark**]

Question 7

(**i**)   Are all spheres similar ?   YES / NO

[**1 mark**]

(**ii**)   A smaller sphere has a volume of 32cm³.

A larger sphere has a radius $\frac{5}{2}$ times greater than the small sphere.

What is the volume of the larger sphere ?

Hint : $lsf = \dfrac{5}{2}$ $vsf = (lsf)^3$ $V_{BIG} = V_{SMALL} \times vsf$

[**3 marks**]

Question 8

A larger cuboid has lengths that are $\frac{4}{3}$ times longer than a similar smaller cuboid.

The smaller cuboid measures 60cm by 66cm by 42cm.

What are the measurements of the larger cuboid ?

_____ by _____ by _____

[**2 marks**]

Question 9

A larger cuboid has lengths that are $\frac{7}{4}$ times longer than a similar smaller cuboid.

The smaller cuboid measures 8 cm by 40 cm by 44 cm.

What are the measurements of the larger cuboid ?

_____ by _____ by _____

[**2 marks**]

Question 10

(**i**)   Are all triangles similar ?   YES / NO

[**1 mark**]

(**ii**)   Are all right angled triangles similar ?   YES / NO

[**1 mark**]

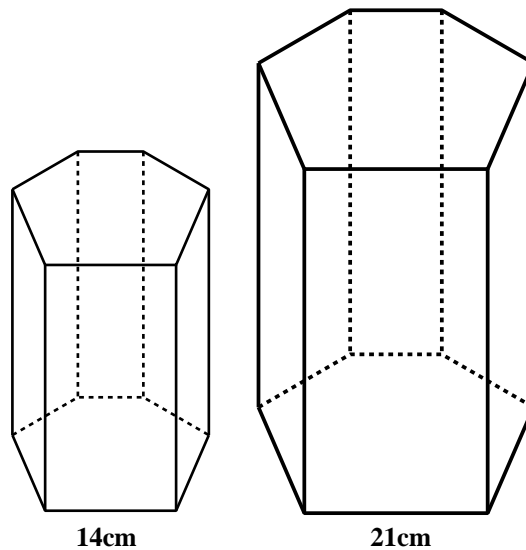(**iii**)   Are all equilateral triangles similar ?   YES / NO

[**1 mark**]

Question 11

Two similar hexagonal prisms are shown below.

An edge of 14cm on the smaller corresponds to an edge of length 21cm on the larger.

14cm   **21cm**

(**i**) What is the *length scale factor*, greater than 1, of the similarity ?

$lsf = $ ———

[1 mark]

(**ii**) What is the *area scale factor*, greater than 1, of the similarity ?

$asf = $ ———

[1 mark]

(**iii**) What is the *volume scale factor*, greater than 1, of the similarity ?
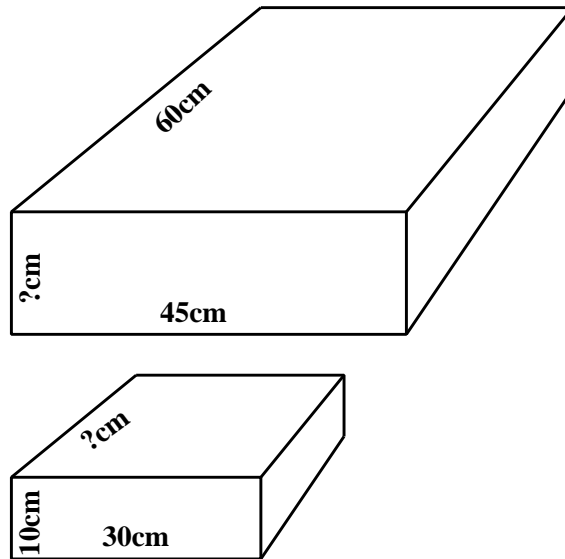
$vsf = $ ———

[1 mark]

(**iv**) The volume of the smaller hexagonal prism is 40 cm^3.

Calculate the volume of the larger hexagonal prism.

[2 marks]

Question 12

The two cuboids shown below are similar.

(**i**) What is the *length scale factor*, greater than 1, of the similarity ?

$lsf =$ ———

[**1 mark**]

(**ii**) Find the height of the upper cuboid, marked with a question mark.

[**1 mark**]

(**iii**) Find the missing length on the lower cuboid, marked with a question mark.

[**1 mark**]

Question 13

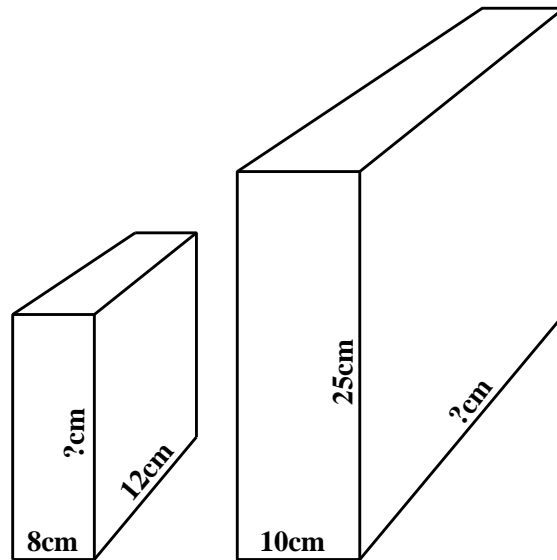Each face of a smaller cube has an area of 36 cm^2
A larger cube has edges that are 10 times longer.
What is the volume of the larger cube ?

[**3 marks**]

Question 14

The two cuboids shown below are similar.

(**i**)   What is the *length scale factor*, greater than 1, of the similarity ?

$lsf = \ \dfrac{\qquad}{\qquad}$

[1 mark]

(**ii**)   Find the unknown length of the right cuboid, marked with a question mark.

[1 mark]

(**iii**) Find the unknown height of the left cuboid, marked with a question mark.

[1 mark]

Question 15

A 250 ml can of coke is similar to a 500 ml can of coke.
Explain why radius of the larger can is NOT double that of the smaller.

[3 marks]