

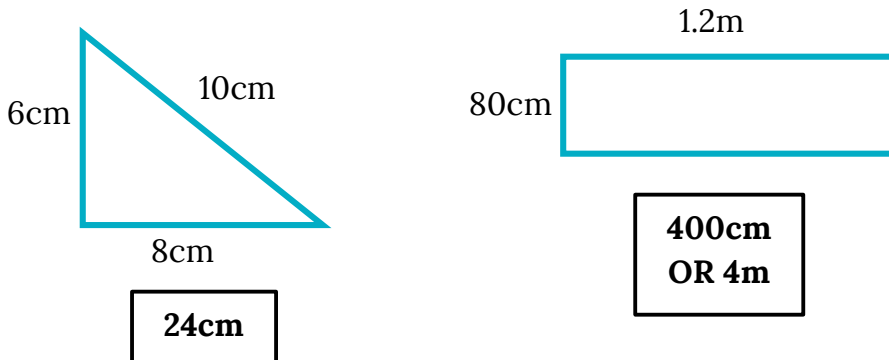
# Perimeter, Area & Volume – Level Two

## How to Guide - ANSWERS

If you use 3.1 or 3.14 to calculate pi instead of the  $\pi$  button, then you may find your answer are one or two decimal places different from the ones here. Your answers would be marked correct.

### Question 1

a) Label the perimeters of the shapes below.



$$6 + 10 + 8 = 24\text{cm}$$

Convert all measurements to cm

$$120 + 120 + 80 + 80 = 400\text{cm}$$

OR

Convert all measurements to metres

$$1.2 + 1.2 + 0.8 + 0.8 = 4\text{m}$$

b) What is the perimeter of a regular hexagon of sides 4.5cm? **27cm**

Hexagons have six sides so

$$4.5 + 4.5 + 4.5 + 4.5 + 4.5 + 4.5 = 27\text{cm}$$

OR

$$4.5 \times 6 = 27\text{cm}$$

c) What is the perimeter of a square with sides 8.75mm? **35mm (Note: mm not cm)**

$$8.75 + 8.75 + 8.75 + 8.75 = 35$$

OR

$$8.75 \times 4 = 35$$

d) A builder is laying skirting board around a rectangular room. The length of the room is 4.2m and the width is 3.8m. The width of the doorway is 0.9m. How much skirting board should the builder buy? **15.1m**

Add up the sides

$$4.2 + 3.8 + 4.2 + 3.8 = 16$$

OR

$$4.2 \times 2 + 3.8 \times 2 = 16$$

Subtract the space for the doorway

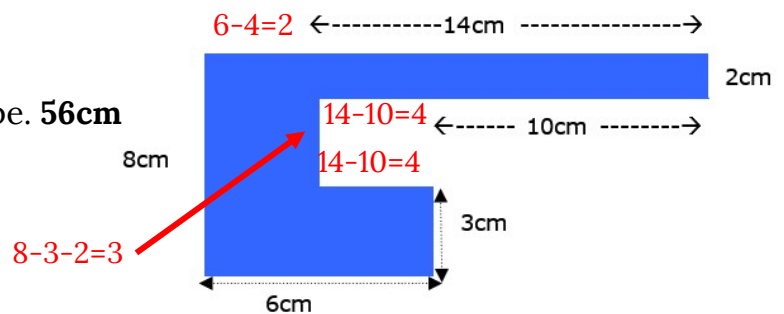
$$16 - 0.9 = 15.1$$

## Try it Out

### Question 2

a) Find the perimeter of this shape. **56cm**

Find and label the missing sides



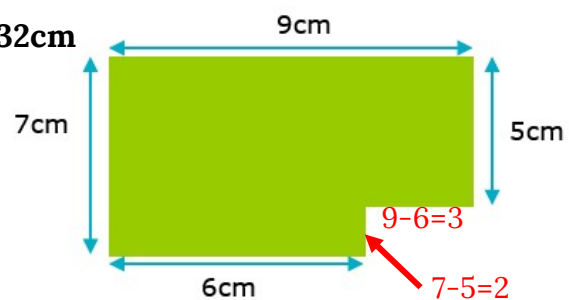
Add them all up using a logical sequence to avoid missing any sides

$$2 + 14 + 2 + 10 + 4 + 3 + 4 + 3 + 6 + 8 = 56$$

Trace your finger around the shape to check for missing sides

b) What's the perimeter of the shape below? **32cm**

Find and label the missing sides



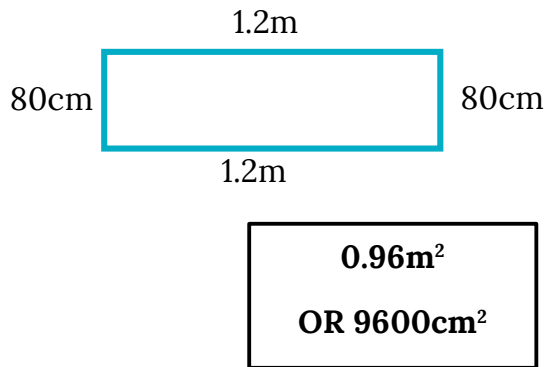
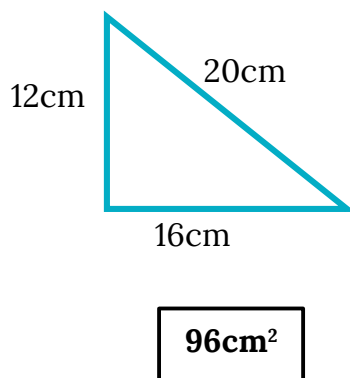
Find and label the missing sides

Add them all up using a logical sequence to avoid missing any sides

$$7 + 9 + 5 + 3 + 2 + 6 = 32$$

### Question 3

a) Label the area of the shapes below. (Not drawn to scale)



$$20 \times 16 = 192$$

$$192 \div 2 = 96$$

OR

Halve one of the sides first then multiply by the other

Convert all to metres

$$80\text{cm} = 0.8\text{m}$$

$$\text{Length} \times \text{width} = 0.8 \times 1.2 = 0.96\text{m}^2$$

OR

Convert all to cm

$$1.2\text{m} = 120\text{cm}$$

$$120 \times 80 = 9600\text{cm}^2$$

b) A painter is painting four walls of a room. Two walls are 4.6m by 3.2m and the other two are 6.2m by 3.2m. There is one door 2.4m by 0.9m. What is the area to be painted? **66.96m<sup>2</sup>**

Area of the walls

$$4.6\text{m by } 3.2\text{m} \rightarrow 4.6 \times 3.2 = 14.72$$

There are two of these walls so multiply by 2

$$14.72 \times 2 = 29.44$$

$$6.2\text{m by } 3.2\text{m} \rightarrow 6.2 \times 3.2 = 19.84$$

There are two of these walls so multiply by 2

$$39.68$$

$$\text{Add up the area of all the walls } 39.68 + 29.44 = 69.12$$

Remember the painter isn't painting the door so we subtract the area of the door

$$2.4\text{m by } 0.9\text{m} \rightarrow 2.4 \times 0.9 = 2.16$$

$$69.12 - 2.16 = 66.96$$

c) What is the area of a square with sides 8.75mm? **75.56mm<sup>2</sup>** (to 2 d.p.)

length x width

$$8.75 \times 8.75 = 76.5625$$

OR

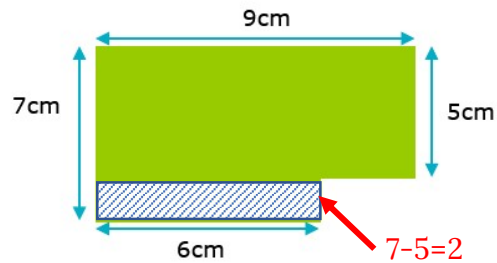
$$8.75^2 = 76.5625$$

#### Question 4

a) Find the area of this shape. **57cm<sup>2</sup>**

Split it into two rectangles

Find the missing side of the dashed rectangle



Area of dashed rectangle is  $6 \times 2 = 12$

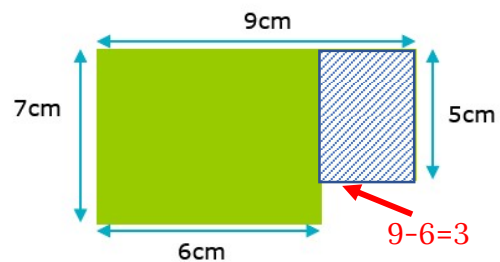
Area of shaded rectangle is  $9 \times 5 = 45$

Add both rectangles together  $12 + 45 = 57$

OR

Split it into two different rectangles

Find the missing side of the dashed rectangle



Area of dashed rectangle is  $5 \times 3 = 15$

Area of shaded rectangle is  $6 \times 7 = 42$

Add both rectangles together  $15 + 42 = 57$

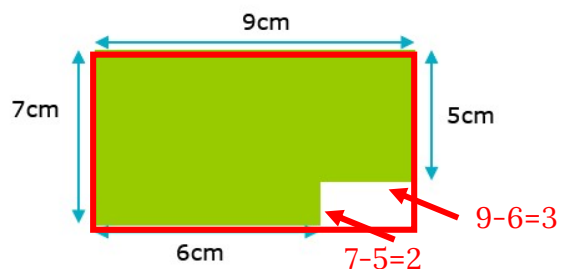
OR

Make one big rectangle

Find the area of that rectangle

$$9 \times 7 = 63$$

Now find the area of the unshaded/white part



$$3 \times 2 = 6$$

Subtract that from the big shape

$$63 - 6 = 57$$

b) Find the area of this shape. **56cm<sup>2</sup>**

Split it into three rectangles

Area of rectangle with little squares

$$6 \times 3 = 18$$

Area of shaded rectangle

Find the missing sides (remember 8 is the whole width and we just need the middle part)

$$3 \times 2 = 6$$

Area of dashed rectangle

$$(14 + 2) \times 2 = 32$$

Add them all up

$$18 + 6 + 32 = 56$$

OR

Split it into three different rectangles

Find the relevant missing sides

Area of shaded rectangle

$$8 \times 2 = 16$$

Area of dashed rectangle

$$14 \times 2 = 28$$

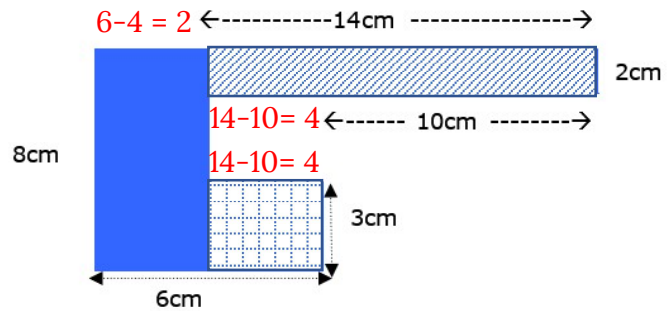
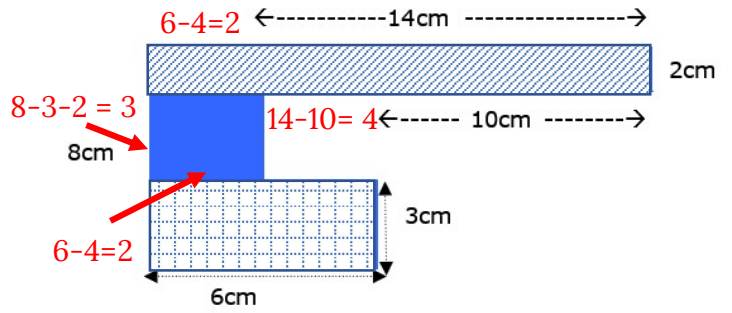
Area of rectangle with little squares

$$4 \times 3 = 12$$

Add them all up

$$16 + 28 + 12 = 56$$

You could use the method of making one big rectangle, but it would be quite long because you would have to split the unshaded space into two rectangles and subtract them from the whole.



c) Find the area of this shape. **210cm<sup>2</sup>**

Split it into a rectangle and a triangle

Area of rectangle

$$11 \times 15 = 165$$

Area of triangle

Multiply the base by the height and divide the answer by 2

The base is 15 because it has the same base as the rectangle

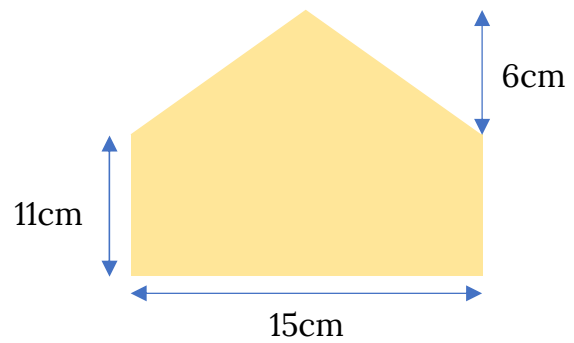
The height is 6

$$15 \times 6 = 90$$

$$90 \div 2 = 45$$

Add the two areas together

$$45 + 165 = 210$$



d) Find the area of the shaded part of the shape. **341cm<sup>2</sup>**

Pretend it's one big rectangle

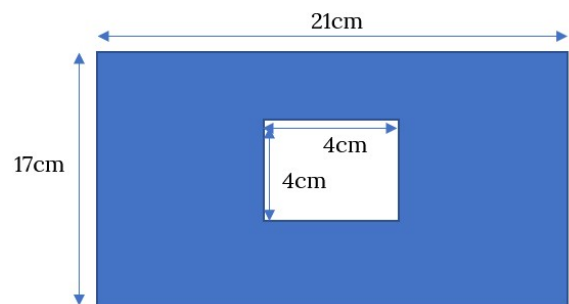
$$21 \times 17 = 357$$

Find the area of the unshaded square in the middle

$$4 \times 4 = 16$$

Take this away to leave just the shaded part

$$357 - 16 = 341$$



### Question 5

a) Find the area of a circle with radius 2.5cm. **19.63cm<sup>2</sup>**

$$\text{Area of a circle} \rightarrow A = \pi r^2 \rightarrow \pi \times r^2 \rightarrow \pi \times 2.5^2 = 19.63$$

b) Find the circumference and area of the circle.

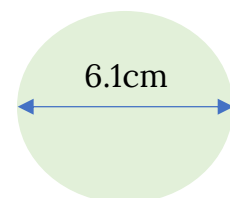
$$\text{Area} = 29.22\text{cm}^2$$

$$\text{Circumference} = 19.16\text{cm}$$

We have diameter but need radius so halve  $6.1 = 3.05$

$$\text{Area} \rightarrow A = \pi r^2 \rightarrow \pi \times r^2 \rightarrow \pi \times 3.05^2 = 29.22$$

Perimeter/circumference of a circle



$$C = \pi d \rightarrow \pi \times d = \pi \times 6.1 = 19.16$$

Note: if you are using 3.1 or 3.14 instead of the  $\pi$  button your answers will be slightly smaller. Ask a teacher to check if you are unsure.

c) Find the area and perimeter of a circle with diameter 10cm.

$$\text{Area} = 78.53\text{cm}^2$$

$$\text{Circumference} = 31.41\text{cm}$$

We have diameter but need radius so halve  $10 = 5$

$$\text{Area} \rightarrow A = \pi r^2 \rightarrow \pi \times r^2 \rightarrow \pi \times 5^2 = 78.53$$

Perimeter/circumference of a circle

$$C = \pi d \rightarrow \pi \times d = \pi \times 10 = 31.41$$

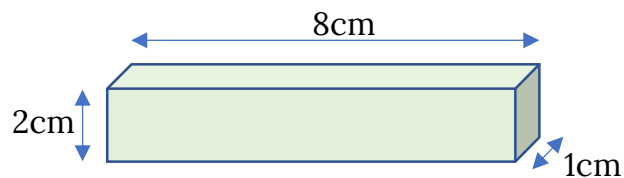
### Question 6

a) Find the surface area of a cube with sides 9.8cm. **576.24cm<sup>2</sup>**

$9.8 \times 9.8 = 96.04$  gives the area of one side

$96.04 \times 6$  for all six sides = 576.24

b) Find the surface area of this cuboid. **52cm<sup>2</sup>**



Find the area of each side

$8 \times 2 = 16$  then double it as there are two sides of these dimensions = 32

$1 \times 2 = 2$  then double it = 4

$8 \times 1 = 8$  then double it = 16

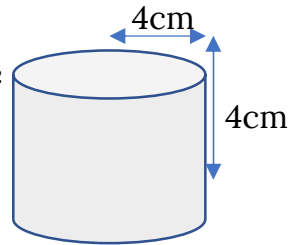
Add these all up  $32 + 4 + 16 = 52$

c) Find the surface area of this cylinder. **201.06cm<sup>2</sup>**

$$A = 2\pi rh + 2\pi r^2 \rightarrow 2 \times \pi \times r \times h + 2 \times \pi \times r^2$$

$$2 \times \pi \times 4 \times 4 + 2 \times \pi \times 4^2$$

$$= \mathbf{201.06cm^2}$$



OR

$$A = \pi dh + 2\pi r^2 \rightarrow \pi \times d \times h + 2 \times \pi \times r^2$$

$$\pi \times 8 \times 4 + 2 \times \pi \times 4^2$$

$$= \mathbf{201.06cm^2}$$

### Question 7

a) Find the volume of a cube with sides 5cm. **125cm<sup>3</sup>**

$$5 \times 5 \times 5 = 125$$

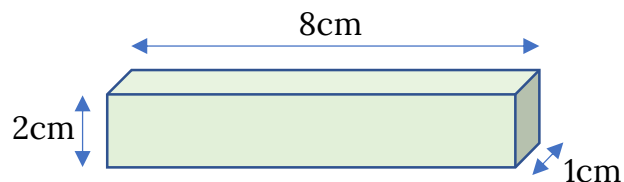
OR

$$5^3 = 125$$

b) Find the volume of a cuboid of sides 3cm, 6cm and 12cm. **216cm<sup>3</sup>**

$$3 \times 6 \times 12 = 216$$

c) Find the volume of this cuboid. **16cm<sup>3</sup>**



$$8 \times 2 \times 1 = 16$$

d) Find the volume of a cuboid of length 20cm, width 0.1m, height 0.05m.

**1000 cm<sup>3</sup> OR 0.001m<sup>3</sup>**

We need all the units to be the same

Convert all to cm

$$20 \times 10 \times 5 = 1000$$

OR

Convert all to m

$$0.2 \times 0.1 \times 0.05 = 0.001$$



e) Find the volume of a cuboid of length 13cm, width 6cm and height 9cm.  
**702cm<sup>3</sup>**

$$13 \times 6 \times 9 = 702\text{cm}^3$$

**Question 8 - use the formula above for questions a and b.**

a) Find the volume of a sphere which has a diameter of 55cm. **87113.7cm<sup>3</sup> OR 87113.75cm<sup>3</sup>**

Volume of a sphere

We need the radius but we are given the diameter so we should divide diameter by 2 to get radius  $\rightarrow 55 \div 2 = 27.5$

Remember when things touch/are together in a formula they times so all the part are multiplied together

$$V = \frac{4}{3}\pi r^3 \rightarrow \frac{4}{3}\pi \times 27.5^3$$

Don't forget to cube 27.5

Put this into your calculator to get  $V = 87113.74629$

Round to a suitable number of places - 1 or 2 d.p. is fine

b) Find the volume of the cone to the right which has radius of 3cm and a height of 9.5cm. **268.61cm<sup>3</sup>**



Volume of a cone

$$V = \frac{1}{3}\pi r^2 h$$

Replace the r with radius and the h with height

$$\frac{1}{3}\pi \times 3^2 \times 9.5$$

Don't forget to cube the 3

Put this into your calculator  $V = 268.61$  (to 2 d.p.)

c) Find the volume of the cylinder to the right. **201.06cm<sup>3</sup>**

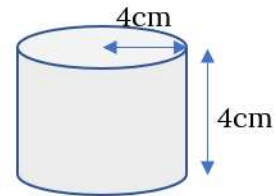
Volume of a cylinder

$$V = \pi r^2 h$$

We need r which is the radius and h which is the height

$$r = 4 \text{ and } h = 4$$

$$= \pi \times 4^2 \times 4 = 201.06$$



## Mixed Questions

a) The exterior of the building to the right is to be painted (excluding the ramp, steps and entrance shelter). The painter estimates that two thirds of the building is glass/windows and so will not be painted. The height of the building is 40m, the width is 12m and the length is 12m. What is the approximate area to be painted? **800m<sup>2</sup>**



We need to find the surface area of the whole building but only one third will be painted.

$$\text{Area of the top is } 12 \times 12 = 144$$

$$\text{Area of one side is } 40 \times 12 = 480$$

$$\text{There are four sides so } 480 \times 4 = 1920$$

Remember they won't be painting the base so you will only have 5 faces in total not the usual 6.

$$\text{Add up all the sides } 1920 + 480 = 2400$$

$$\text{Find one third of this, which is the area to be painted } 2400 \div 3 = 800$$

OR

Find two thirds and subtract

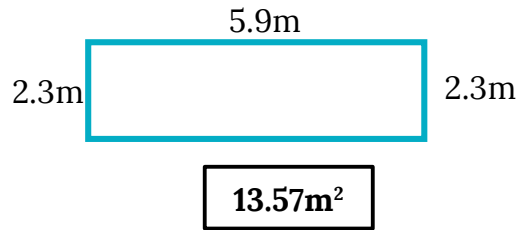
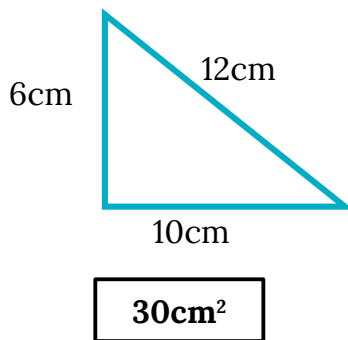
$$2400 \div 3 = 800 \text{ then } 800 \times 2 = 1600 \text{ and subtract from } 2400 \text{ leaves } 800$$

b) What is the perimeter of a square with sides 6.3cm? **25.3cm**

$$6.3 \times 4 = 25.2$$

$$6.3 + 6.3 + 6.3 + 6.3 = 25.2$$

c) Label the area of the shapes below. (Not drawn to scale)



Base x height divided by 2  $\rightarrow 10 \times 6 = 60$  then  $60 \div 2 = 30$

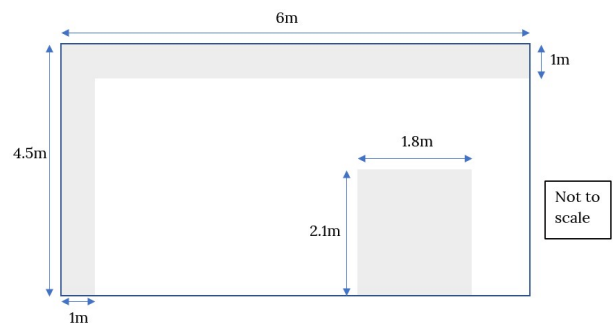
OR

Divide the base by 2 first then multiply by height

$10 \div 2 = 5$  then multiply by 6 = 30

Area of a rectangle is length x width  $\rightarrow 2.3 \times 5.9 = 13.57$

d) The diagram to the right shows a factory floor. A new piece of equipment states that there must be at least  $18\text{m}^2$  of area free on the floor before the equipment is installed. Free area is shown by the unshaded space.



Is there enough space for the equipment to be installed? **No there is only  $13.72\text{m}^2$  of free space**

Find the area of the whole rectangle  $6 \times 4.5 = 27$

Find the area of the shaded parts and subtract from the whole

$$1.8 \times 2.1 = 3.78$$

Split the other part into two rectangles – make sure they don't overlap in the corner or you will count the same area twice

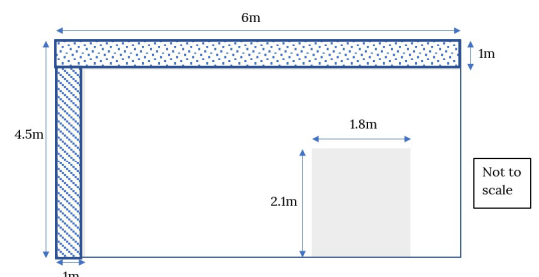
The dotted area is  $6 \times 1 = 6$

The striped area is  $4.5 - 1 = 3.5$  (to avoid the overlap)

$$3.5 \times 1 = 3.5$$

All the shaded parts are  $3.5 + 6 + 3.78 = 13.28$

Subtract from the whole  $27 - 13.28 = 13.72$



e) Sharon is putting a decorative ribbon around a round cake. The cake has a diameter of 18cm. What length of ribbon does she need? **56.55cm**

You need to find the circumference of the cake.

Perimeter/circumference of a circle

$$C = \pi d \rightarrow \pi \times d = \pi \times 18 = 56.55$$

f) What is the surface area of the tins of beans with a radius of 2cm and a height of 8cm? **125.66cm<sup>2</sup>**



Surface area of a cylinder

$$\begin{aligned} A &= 2\pi r h + 2\pi r^2 \rightarrow 2 \times \pi \times r \times h + 2 \times \pi \times r^2 \\ &2 \times \pi \times 2 \times 8 + 2 \times \pi \times 2^2 \\ &= \mathbf{125.66\text{cm}^2} \end{aligned}$$

OR

$$\begin{aligned} A &= \pi d h + 2\pi r^2 \rightarrow \pi \times d \times h + 2 \times \pi \times r^2 \\ &\pi \times 4 \times 8 + 2 \times \pi \times 2^2 \\ &= \mathbf{125.66\text{cm}^2} \end{aligned}$$

g) The volume of a cone is found by  $V = \frac{1}{3}\pi r^3 h$

What is the volume of a cone with diameter 8cm and height of 9cm? **603.19cm<sup>2</sup>**

Find the radius by dividing the diameter of 8 by 2 = 4

$$V = \frac{1}{3}\pi r^3 h \rightarrow V = \frac{1}{3} \times \pi \times r^3 \times h \rightarrow \frac{1}{3} \times \pi \times 4^3 \times 9 = 603.19$$

h) Find the circumference and area of the circle.

Circumference = **37.7cm**

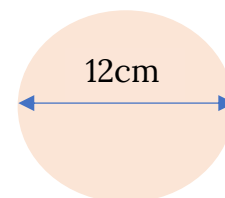
Area = **113.1cm<sup>2</sup>**

Find the radius by dividing the diameter of 12 by 2 = 6

$$\text{Area} \rightarrow A = \pi r^2 \rightarrow \pi \times r^2 \rightarrow \pi \times 6^2 = 113.1$$

Perimeter/circumference of a circle

$$C = \pi d \rightarrow \pi \times d = \pi \times 12 = 37.7$$



i) Find the volume of a cuboid of length 45cm, width 0.3m, height 0.02m.

**2700cm<sup>3</sup> OR 0.0027m<sup>3</sup>**

Make sure all the units are the same

Convert all to cm

0.3m → 30cm and 0.02m → 2cm

Multiply length by width by height

$$45 \times 30 \times 2 = 2700$$

Convert all to m

45cm → 0.45m

$$0.45 \times 0.3 \times 0.02 = 0.0027$$

j) Des is buying a rug to cover the shaded area of his workspace. The circular rug he is looking at has an area of 6m<sup>2</sup>. Can Des cover the shaded space with the rug? Des doesn't mind if the rug covers some of the unshaded space as well. **Yes, he can as the area of the space is 5.52m<sup>2</sup> and the rug is bigger than this.**

Need to find the area of the shaded space

To find the diameter subtract 1.95 from 4.6

$$4.6 - 1.95 = 2.65$$

Halve this to find the radius  $2.65 \div 2 = 1.325$

$$\text{Area} \rightarrow A = \pi r^2 \rightarrow \pi \times r^2 \rightarrow \pi \times 1.325^2 = 5.52$$

The area of his space is 5.25m<sup>2</sup>

