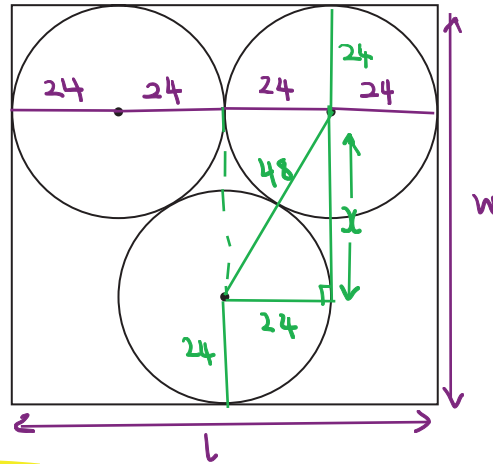


1. The diagram shows 3 identical circles inside a rectangle. Each circle touches the other two circles and the sides of the rectangle, as shown in the diagram.



The radius of each circle is 24 mm.

Work out the area of the rectangle.  $\rightarrow A = l \times w$

Give your answer correct to 3 significant figures.

$$\text{length} = 24 \times 4 = 96 \text{ mm} \quad (1)$$

$$\text{width} = 24 + (24\sqrt{3}) + 24 = 48 + 24\sqrt{3} \text{ mm} \quad (1)$$

$$\text{Area} = 96 \times (48 + 24\sqrt{3}) = 8598.645\dots \text{ mm}^2$$

$$\boxed{A = 8600 \text{ mm}^2} \quad (1)$$

$$a^2 + b^2 = c^2$$

$$24^2 + b^2 = 48^2$$

$$b^2 = 48^2 - 24^2$$

$$b = 24\sqrt{3} \text{ mm}$$

$$x = 24\sqrt{3} \text{ mm}$$

(1)

..... 8600 ..... mm<sup>2</sup>

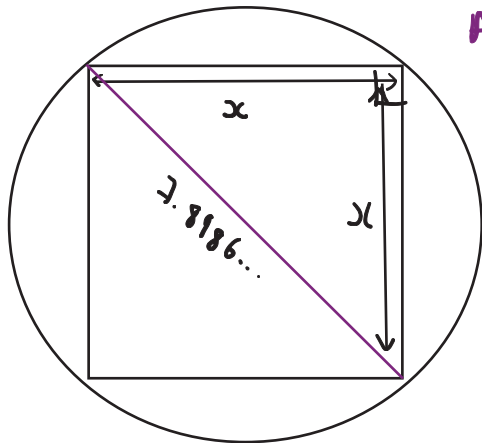
(Total for Question is 4 marks)

2. A square, with sides of length  $x$  cm, is inside a circle.  
Each vertex of the square is on the circumference of the circle.

The area of the circle is  $49 \text{ cm}^2$ .

Work out the value of  $x$ .

Give your answer correct to 3 significant figures.



$$A(\text{circle}) = 49 \text{ cm}^2$$

$$49 = \pi r^2$$

$$r^2 = \frac{49}{\pi} \quad r = \sqrt{\frac{49}{\pi}}$$

$$d = 2r = 2 \left( \sqrt{\frac{49}{\pi}} \right) \quad (1)$$

$$= 7.89865417 \text{ cm}$$

$$a^2 + b^2 = c^2 \quad x^2 + x^2 = (7.89865417 \dots)^2 \quad (1)$$

$$2x^2 = 62.38873769$$

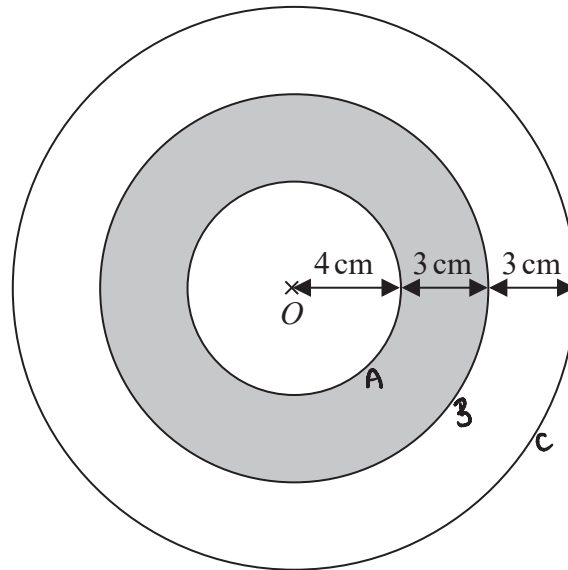
$$\therefore \downarrow \quad x^2 = 31.19436885 \quad \downarrow \times 2 \quad (1)$$

$$x = 5.585191926 \dots$$

$$x = 5.59 \text{ cm} \quad (1)$$

(Total for Question is 4 marks)

3. The diagram shows a logo made from three circles.



Each circle has centre  $O$ .

Daisy says that exactly  $\frac{1}{3}$  of the logo is shaded.

Is Daisy correct?

You must show all your working.

$$\text{Area of circle} = \pi r^2$$

$$\begin{aligned} A & \pi \times 4^2 \\ & = 16\pi \end{aligned}$$

$$\begin{aligned} B & \pi \times 7^2 \\ & = 49\pi \end{aligned}$$

$$\begin{aligned} C & \pi \times 10^2 \\ & 100\pi \end{aligned}$$

$$\begin{aligned} \text{Shaded area} \\ B - A \end{aligned}$$

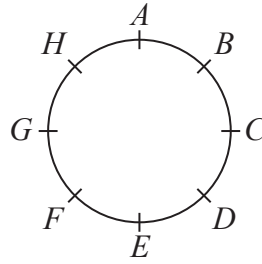
$$\begin{aligned} & = 49\pi - 16\pi \\ & = 33\pi \end{aligned}$$

$$\frac{33\pi}{100\pi}$$

$$= \frac{33}{100}$$

Daisy is not correct because  $\frac{33}{100} \neq \frac{1}{3}$

4. Hasmeet walks once round a circle with diameter 80 metres.



There are 8 points equally spaced on the circumference of the circle.

- (a) Find the distance Hasmeet walks between one point and the next point.

$$\text{circumference of circle} = \pi \times d$$

$$= \pi \times 80$$

$$= 80\pi \quad \checkmark$$

$$(\div 8)$$

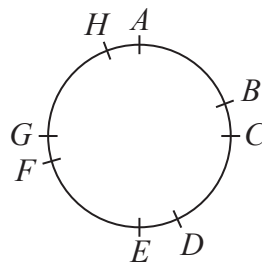
$$= 10\pi$$

$$= 31.42 \quad (2.d.p)$$

$$\underline{\quad 31.42 \quad \checkmark \quad} \text{ m}$$

(2)

Four of the points are moved, as shown in the diagram below.



Hasmeet walks once round the circle again.

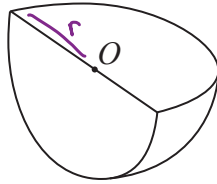
- (b) Has the mean distance that Hasmeet walks between one point and the next point changed? You must give a reason for your answer.

No, because the number of points and circumference of the circle has stayed the same

(1)

(Total for Question is 3 marks)

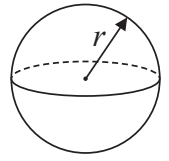
5. Shape S is one quarter of a solid sphere, centre O.



Shape S

$$\text{Volume of sphere} = \frac{4}{3}\pi r^3$$

$$\text{Surface area of sphere} = 4\pi r^2$$



The volume of S is  $576\pi \text{ cm}^3$

Find the surface area of S.

Give your answer correct to 3 significant figures.

You must show your working.

Finding  $r$ :

$$4 \times 576\pi = \frac{4}{3}\pi r^3 \quad \text{①} = 4 \times \text{volume of S}$$

*↖ volume of a whole sphere*

$$2304 = \frac{4}{3}r^3$$

$$r^3 = \frac{3 \times 2304}{4}$$

$$r = \sqrt[3]{1728}$$

$$r = 12 \text{ cm} \quad \text{①}$$

SA of curved (outer) face:

$$\frac{1}{4} \times 4\pi r^2 = \pi r^2 \quad \text{①}$$

SA of other faces: ← half circles with radius  $r$

$$\frac{\pi r^2}{2} \times 2 = \pi r^2$$

$$\text{Total SA} = \pi r^2 + \pi r^2 = 2\pi r^2 \quad \text{①}$$

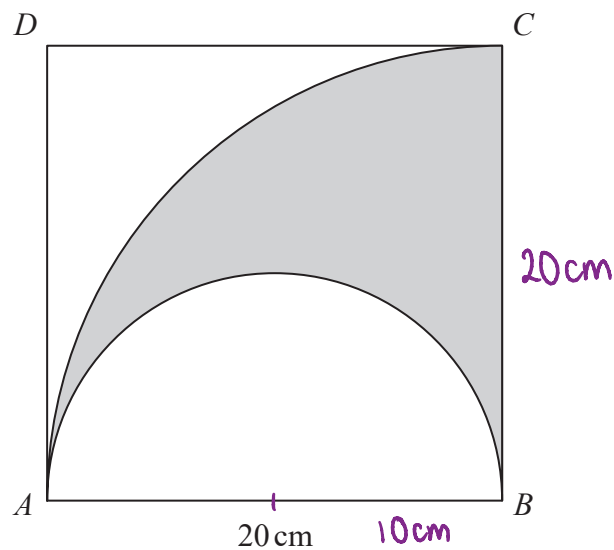
$$\begin{aligned} 2\pi r^2 &= 2 \times \pi \times 12^2 \\ &= 288\pi \\ &= 904.779\dots \end{aligned}$$

① to 3sf

.....905.....  $\text{cm}^2$

(Total for Question is 5 marks)

6. The diagram shows a square  $ABCD$  with sides of length 20 cm. It also shows a semicircle and an arc of a circle.



$AB$  is the diameter of the semicircle.  
 $AC$  is an arc of a circle with centre  $B$ .

Show that  $\frac{\text{area of shaded region}}{\text{area of square}} = \frac{\pi}{8}$

$$\text{Area of circle} = \pi r^2$$

$$\begin{aligned} \text{Area of } ACB &= \frac{\pi (20)^2}{4} \\ &= \frac{\pi \times 400}{4} \\ &= 100\pi \end{aligned}$$

$$100\pi - 50\pi = 50\pi$$

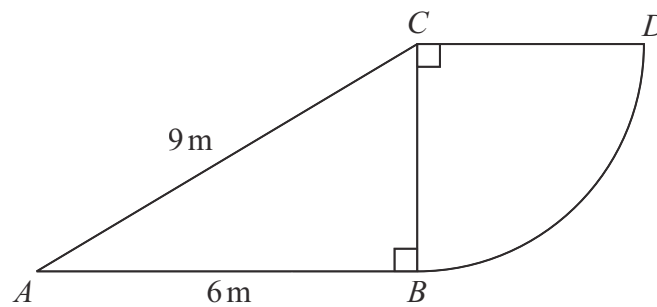
$$\begin{aligned} \text{Area of square} &= b \times h \\ &= 20 \times 20 \\ &= 400 \end{aligned}$$

$$\begin{aligned} \text{Area of semi-circle} &= \frac{\pi (10)^2}{2} \\ &= \frac{\pi \times 100}{2} \\ &= 50\pi \end{aligned}$$

$$\begin{aligned} \frac{\text{Area of shaded region}}{\text{Area of square}} &= \frac{50\pi}{400} \\ &= \frac{5\pi}{40} \\ &= \frac{\pi}{8} \end{aligned}$$

(Total for Question is 4 marks)

7. The diagram shows a right-angled triangle and a quarter circle.



$$\begin{aligned} a^2 + b^2 &= c^2 \\ \therefore b^2 &= c^2 - a^2 \\ b &= \sqrt{c^2 - a^2} \end{aligned}$$

The right-angled triangle  $ABC$  has angle  $ABC = 90^\circ$

The quarter circle has centre  $C$  and radius  $CB$ .

Work out the area of the quarter circle.

Give your answer correct to 3 significant figures.

You must show all your working.

$$\begin{aligned} CB &= \sqrt{9^2 - 6^2} \\ &= \sqrt{81 - 36} = \sqrt{45} \\ &= 3\sqrt{5} \end{aligned}$$

$$\text{Area of Circle} = \pi r^2$$

$$\text{Area of quarter circle} = \frac{1}{4} \pi r^2 = \frac{1}{4} \pi (3\sqrt{5})^2$$

$$= 35.342\dots$$

$$\approx 35.3 \text{ m}^2$$

..... 35.3 ..... m<sup>2</sup>

(Total for Question is 4 marks)