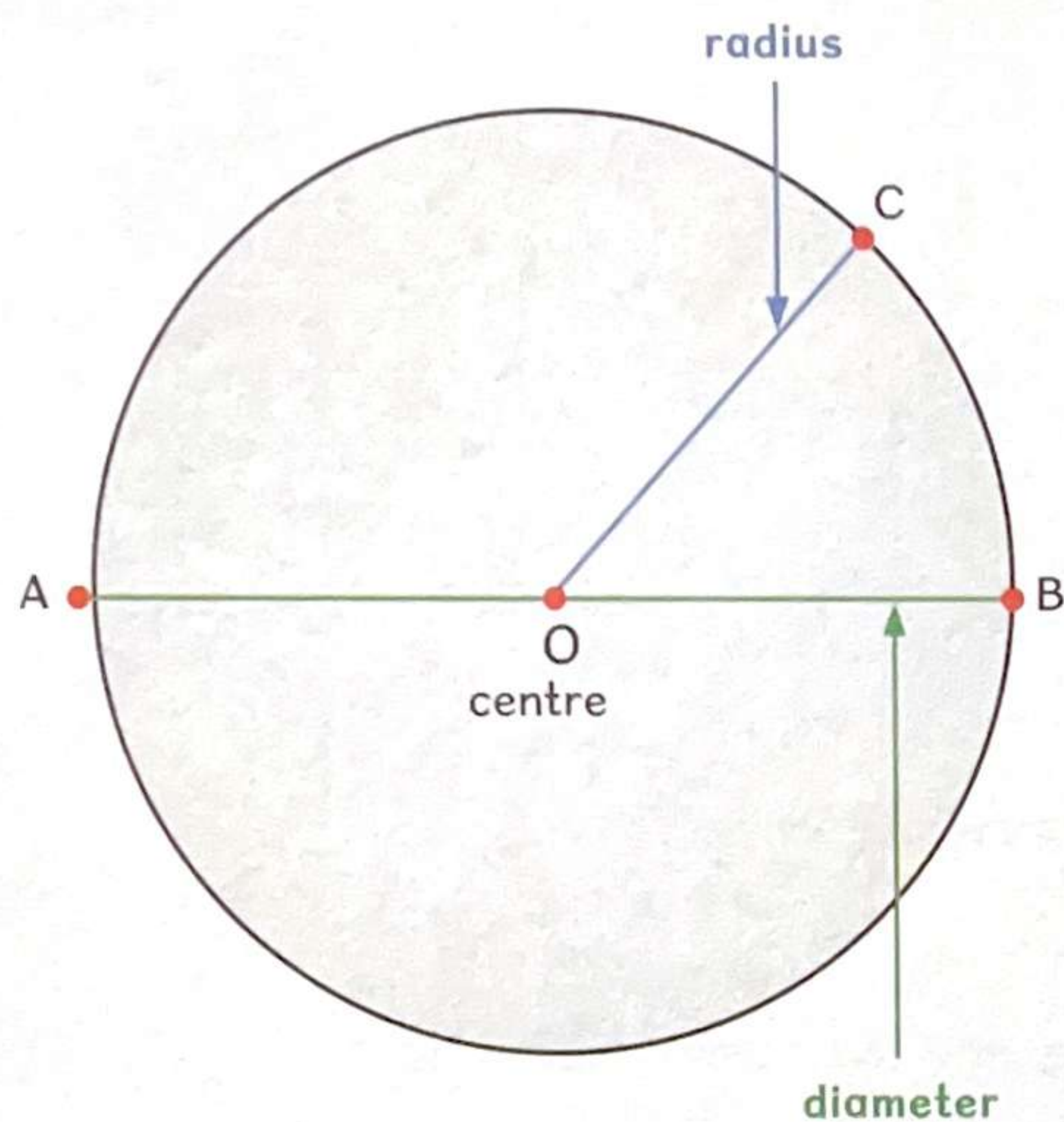


Raju draws a straight line, OC.

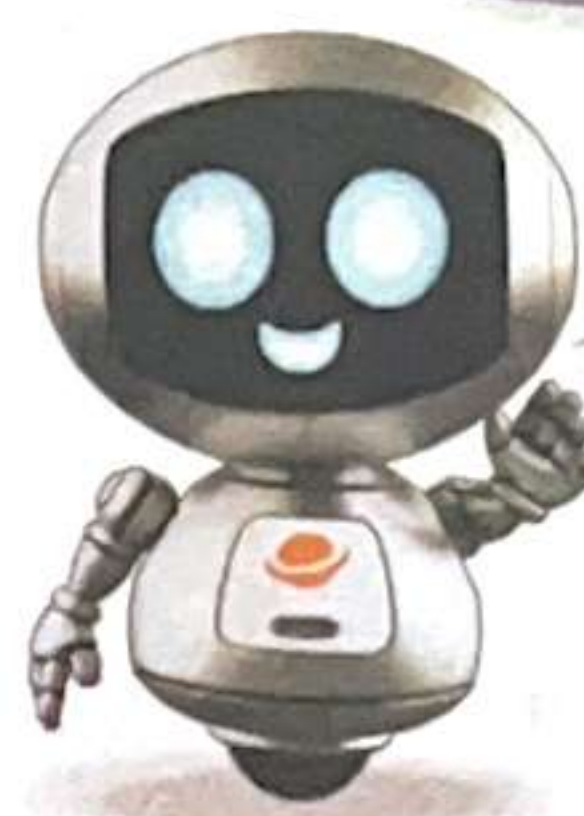
The line, OC, is the radius of the circle.

OA, OB and OC are drawn from the centre of the circle.

OA, OB and OC are the radii of the circle.



What do you notice about the lengths of OA, OB, and OC?



The diameter AB is twice the radius OC.

$$\text{Diameter} = 2 \times \text{Radius}$$

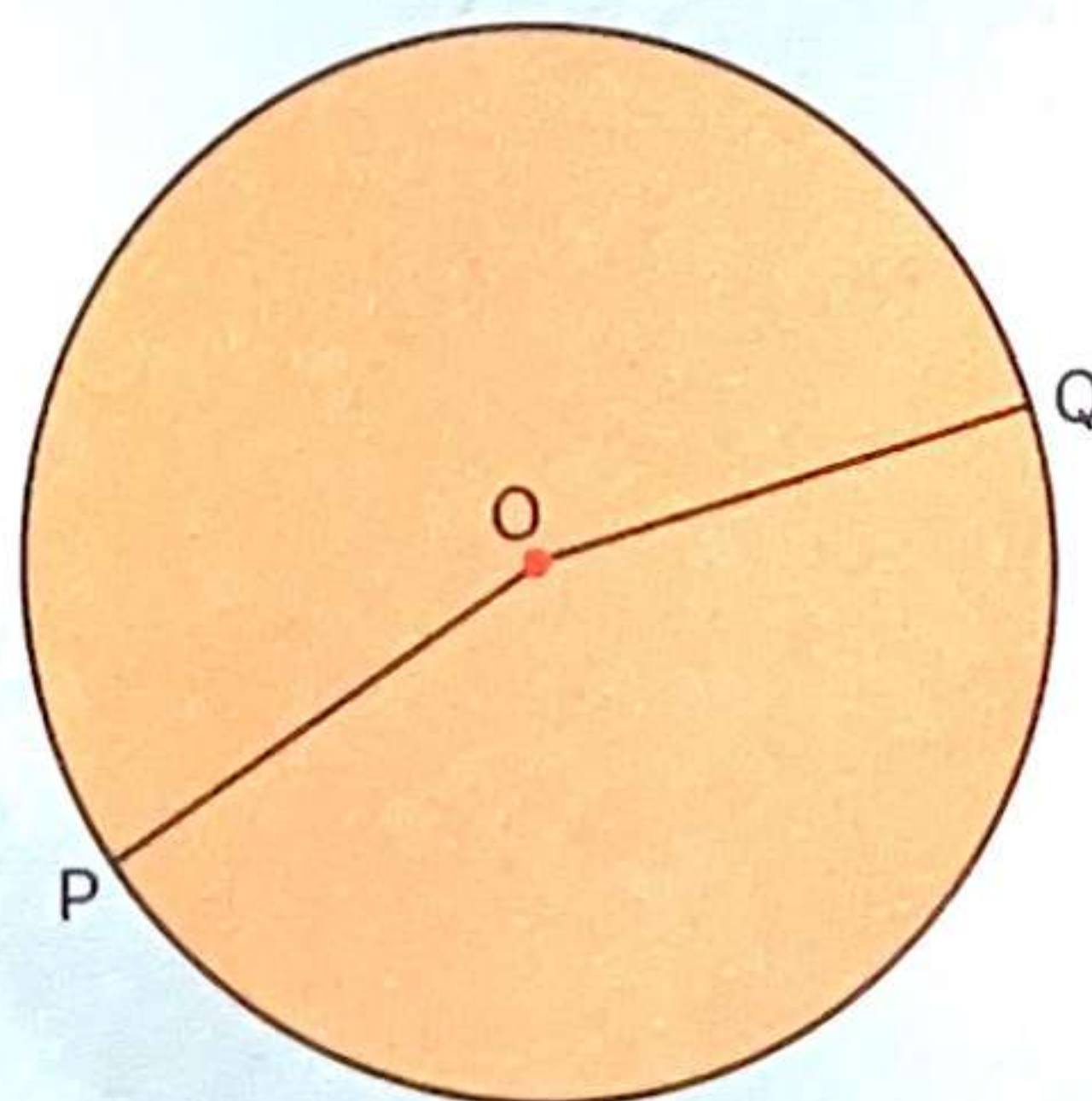
### Math Talk

In the figure below, O is the centre of the circle.

POQ is twice the length of the radius. So, POQ is the diameter of the circle.



Jiahao

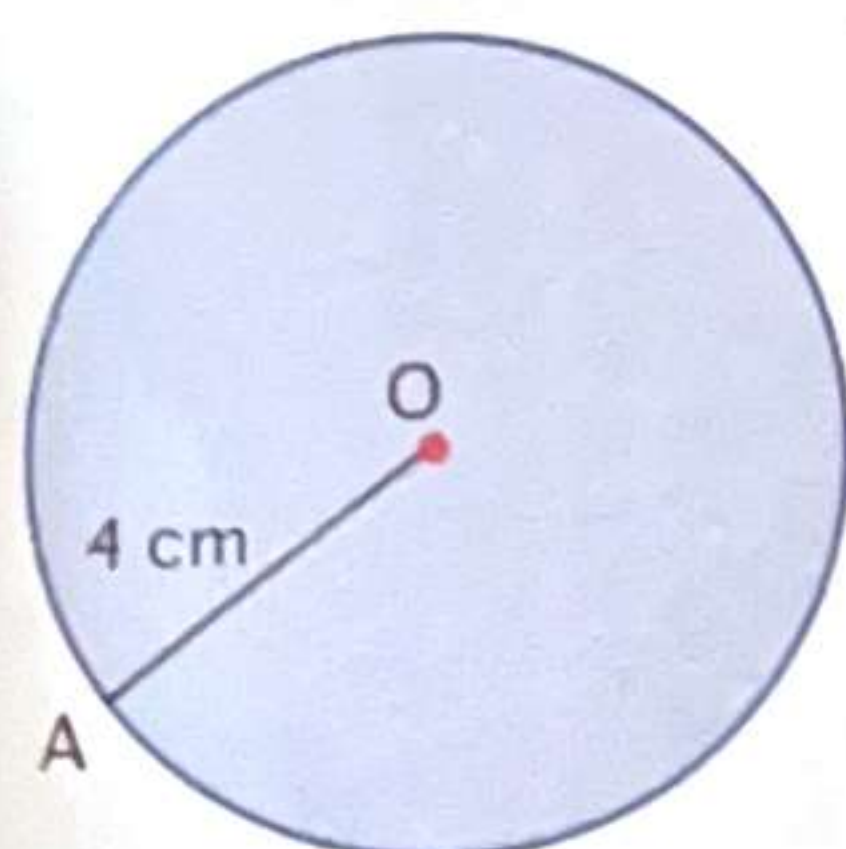


Is Jiahao correct?





The radius of a circle is 4 cm. Find its diameter.



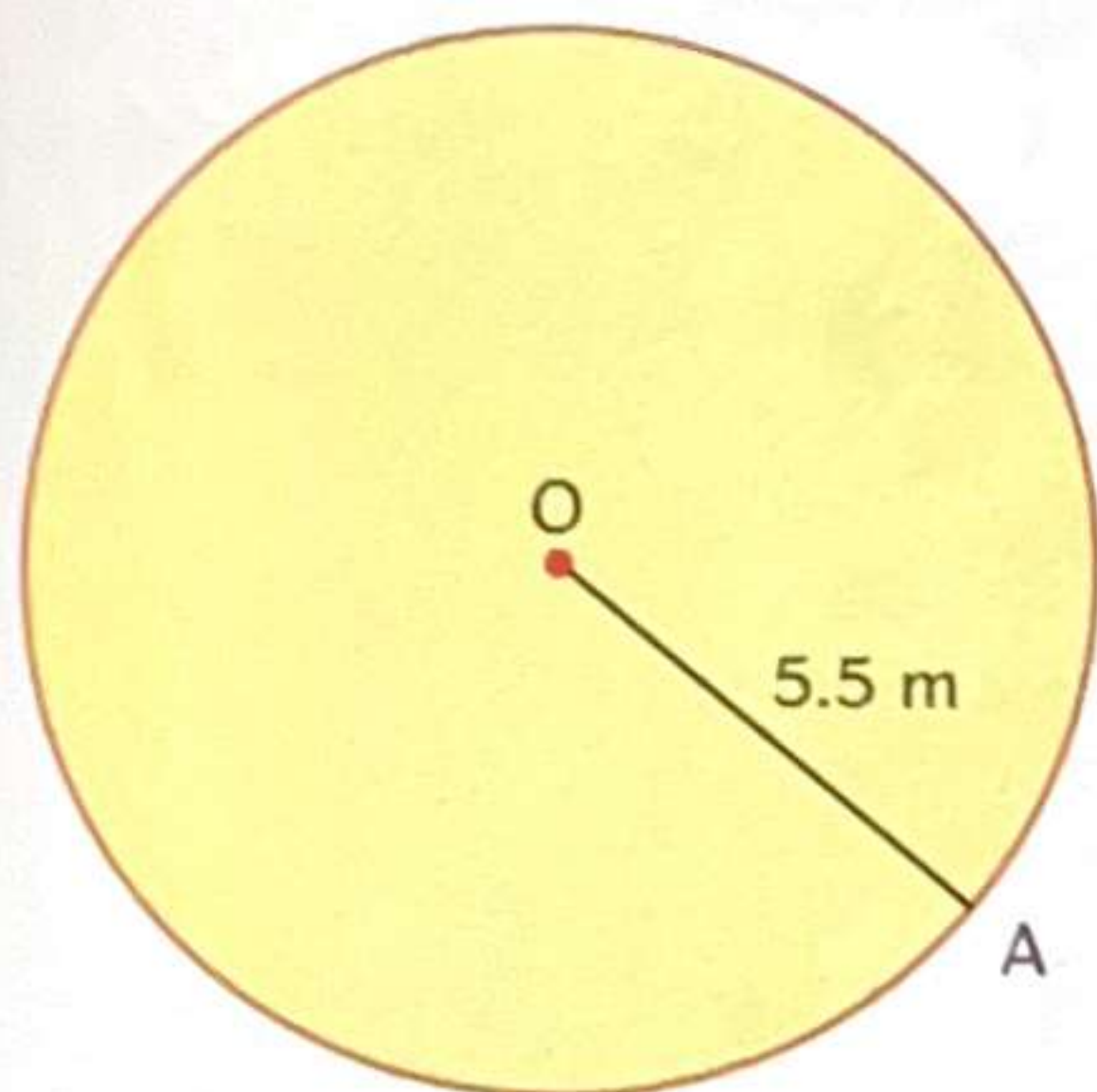
$$\text{Radius} = 4 \text{ cm}$$

$$\begin{aligned} \text{Diameter} &= 2 \times 4 \text{ cm} \\ &= 8 \text{ cm} \end{aligned}$$

$$\text{Diameter} = 2 \times \text{Radius}$$



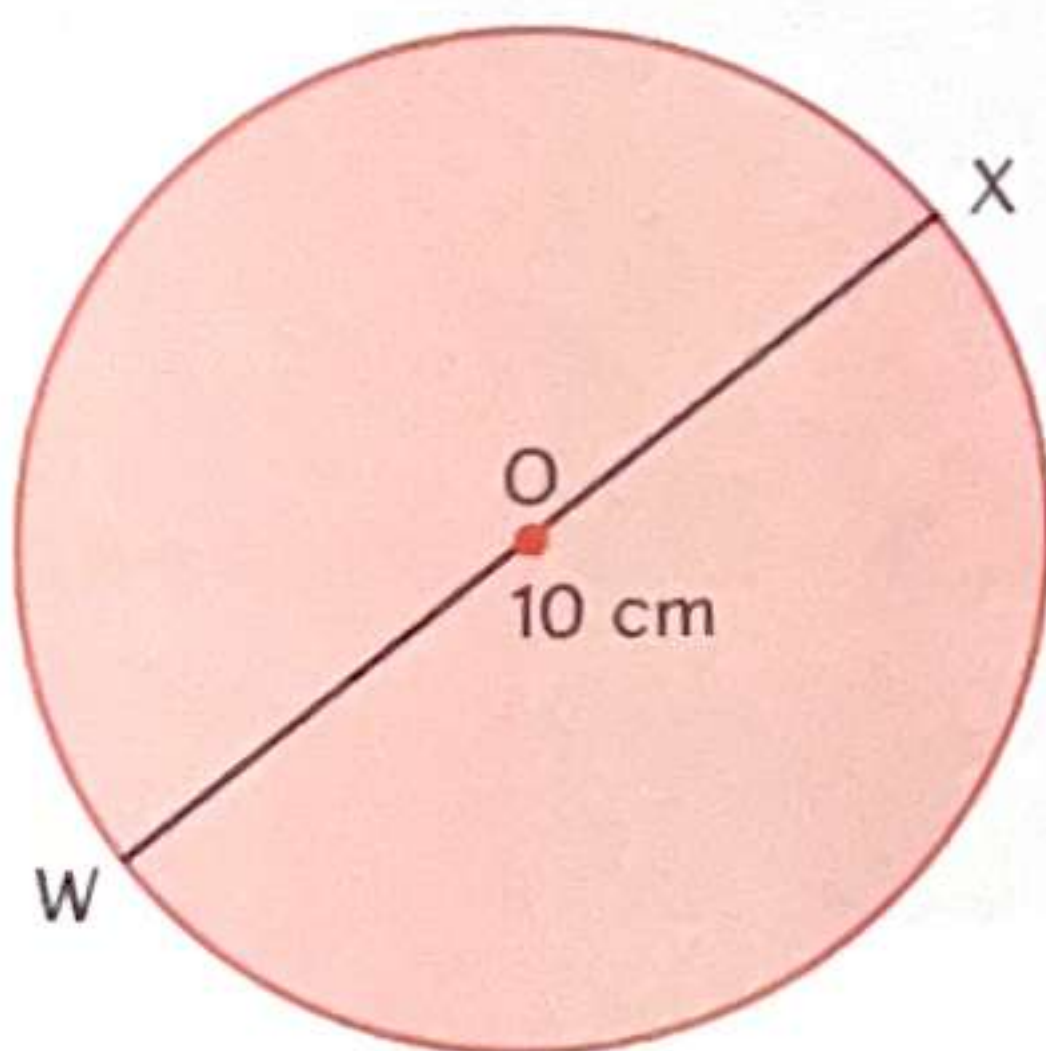
The radius of a circle is 5.5 m. Find its diameter.



$$\text{Radius} = 5.5 \text{ m}$$

$$\begin{aligned} \text{Diameter} &= 2 \times 5.5 \text{ m} \\ &= 11 \text{ m} \end{aligned}$$

The diameter of a circle is 10 cm. Find its radius.



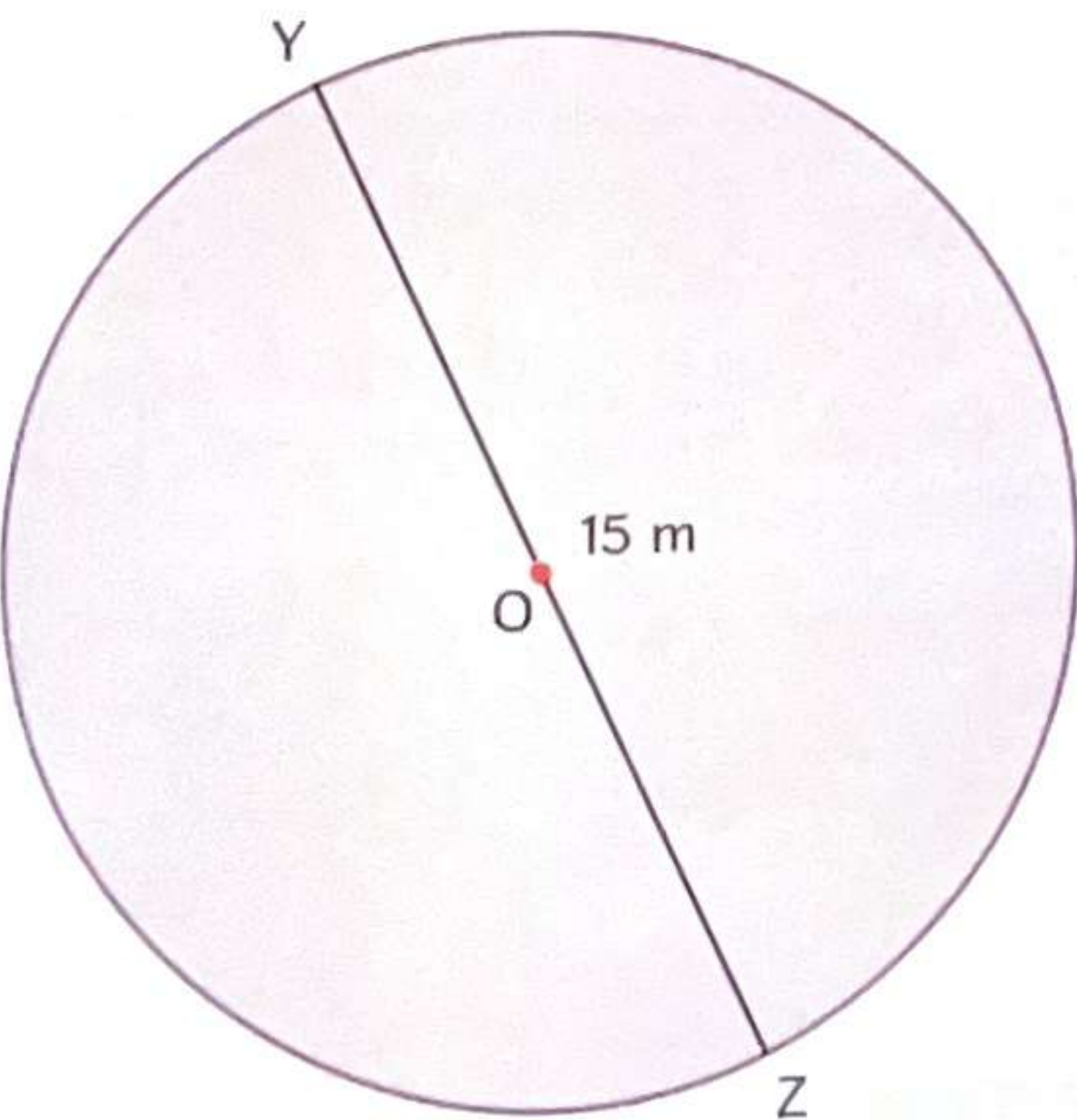
$$\text{Diameter} = 10 \text{ cm}$$

$$\begin{aligned} \text{Radius} &= 10 \text{ cm} \div 2 \\ &= 5 \text{ cm} \end{aligned}$$

$$\text{Radius} = \text{Diameter} \div 2$$



The diameter of a circle is 15 m. Find its radius.



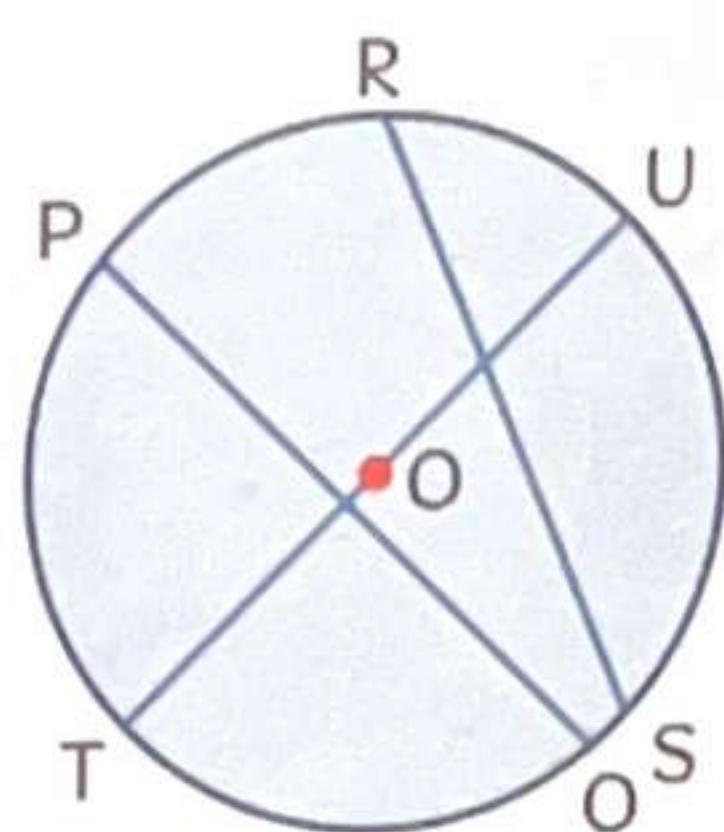
$$\text{Diameter} = 15 \text{ m}$$

$$\begin{aligned} \text{Radius} &= 15 \text{ m} \div 2 \\ &= 7.5 \text{ m} \end{aligned}$$



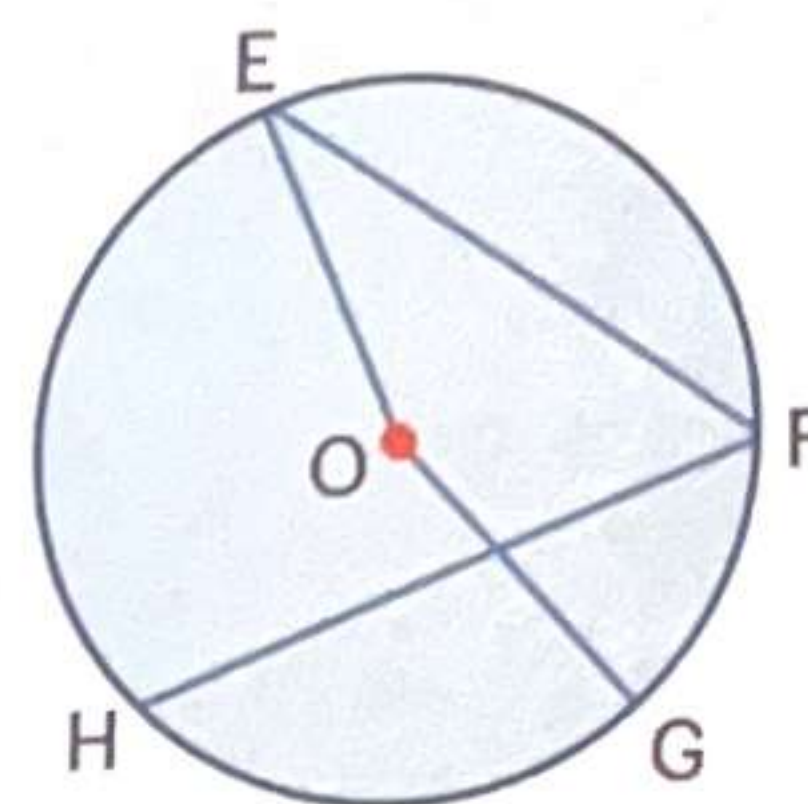
(a) In each circle, O is the centre.

(i) Name the diameter.



Diameter =

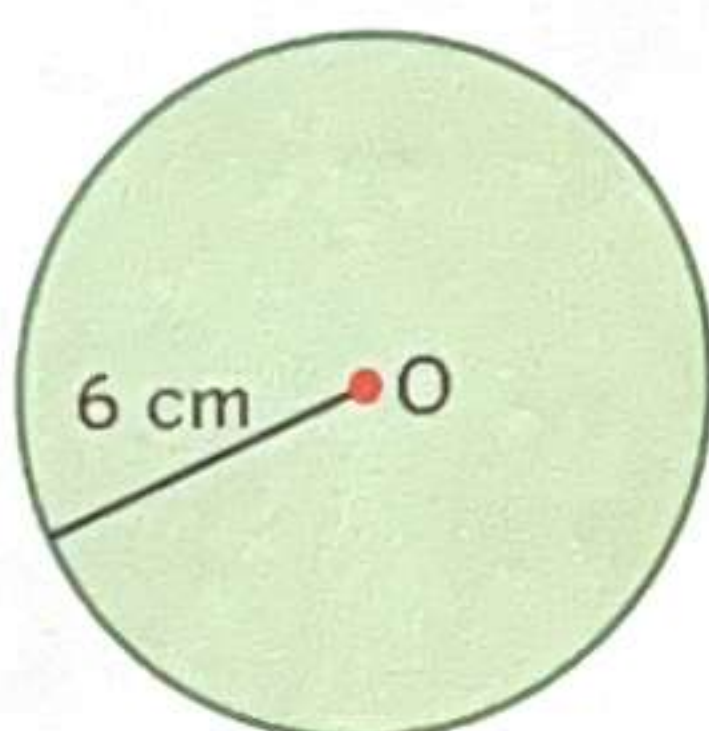
(ii) Name the radii.



Radii =  and

(b) In each circle, O is the centre.  
Find the radius and the diameter of each circle.

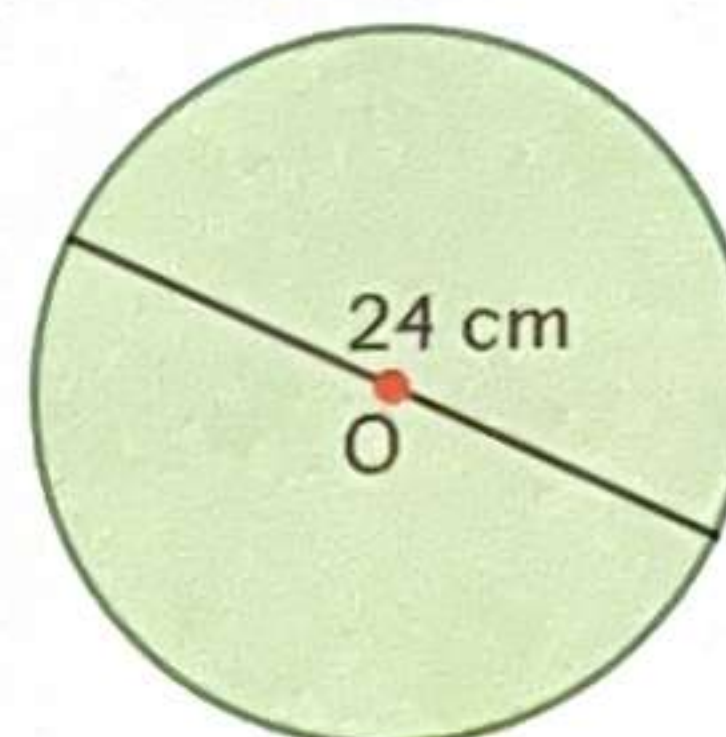
(i)



Radius =  cm

Diameter =  cm

(ii)



Radius =  cm

Diameter =  cm

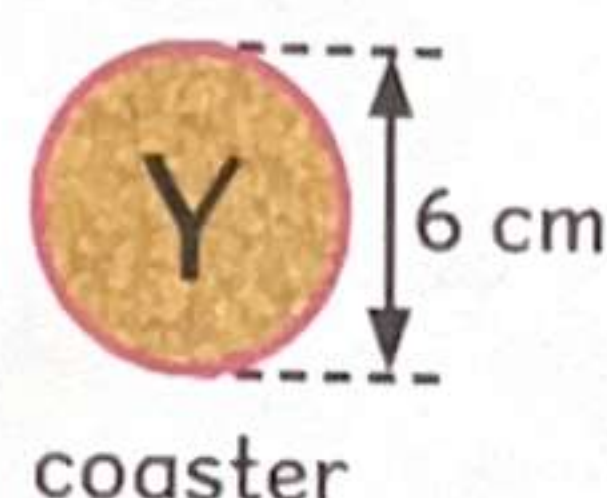
(c) What are the missing values in the table?

| Circle | Radius                  | Diameter                |
|--------|-------------------------|-------------------------|
| W      | 13 cm                   | <input type="text"/> cm |
| X      | <input type="text"/> cm | 13 cm                   |



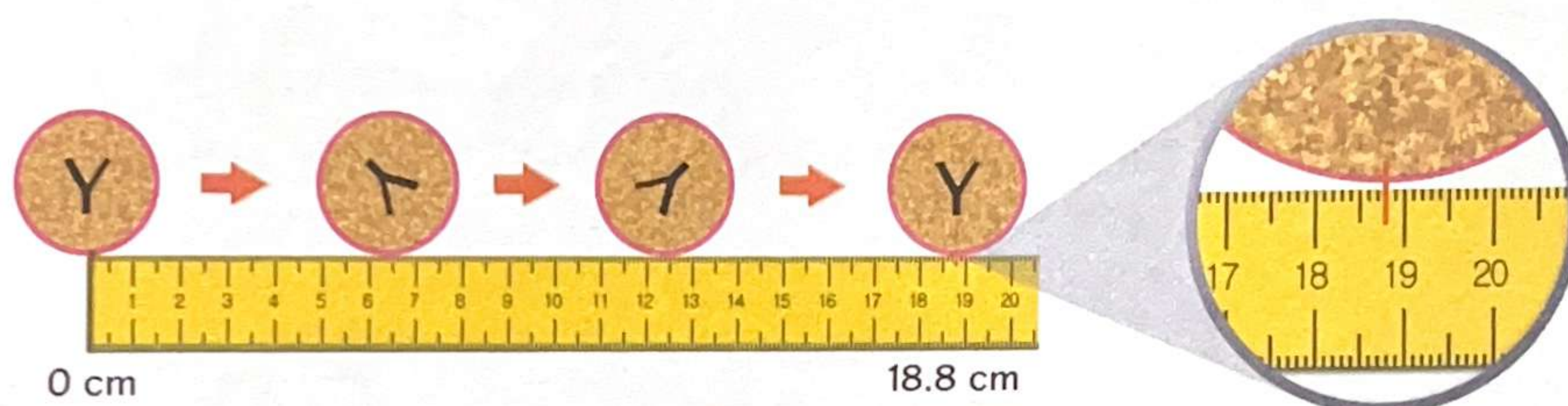
# Circumference of a Circle

The coaster below has the shape of a circle.

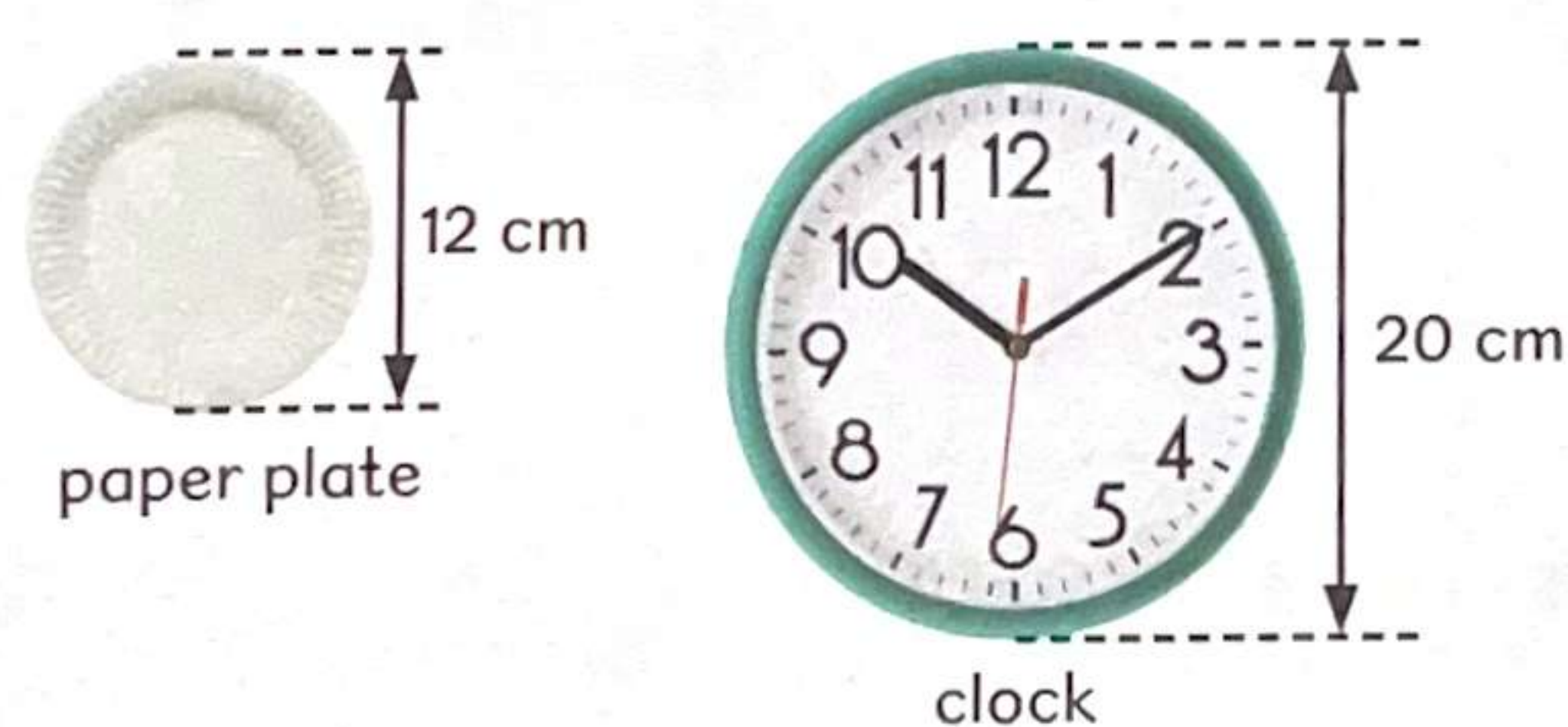


The distance around the coaster is its **circumference**.

To find the circumference of the coaster, Raju rolls the coaster one complete round on the metre ruler, starting at the 0-cm mark.



He does the same way to measure the circumference of a paper plate and a clock.



The table shows the results.

| Object      | Circumference (cm) | Diameter (cm) | Circumference ÷ Diameter (correct to 2 decimal places) |
|-------------|--------------------|---------------|--|
| Coaster     | 18.8               | 6             | 3.13   |
| Paper plate | 37.7               | 12            | 3.14   |
| Clock       | 62.8               | 20            | 3.14   |

Raju finds out that the circumference of any circle is slightly more than 3 times its diameter. The approximate value of **Circumference ÷ Diameter** for any circle is about 3.14. This value is represented by the Greek symbol,  $\pi$ .



We read ' $\pi$ ' as '**pi**'.

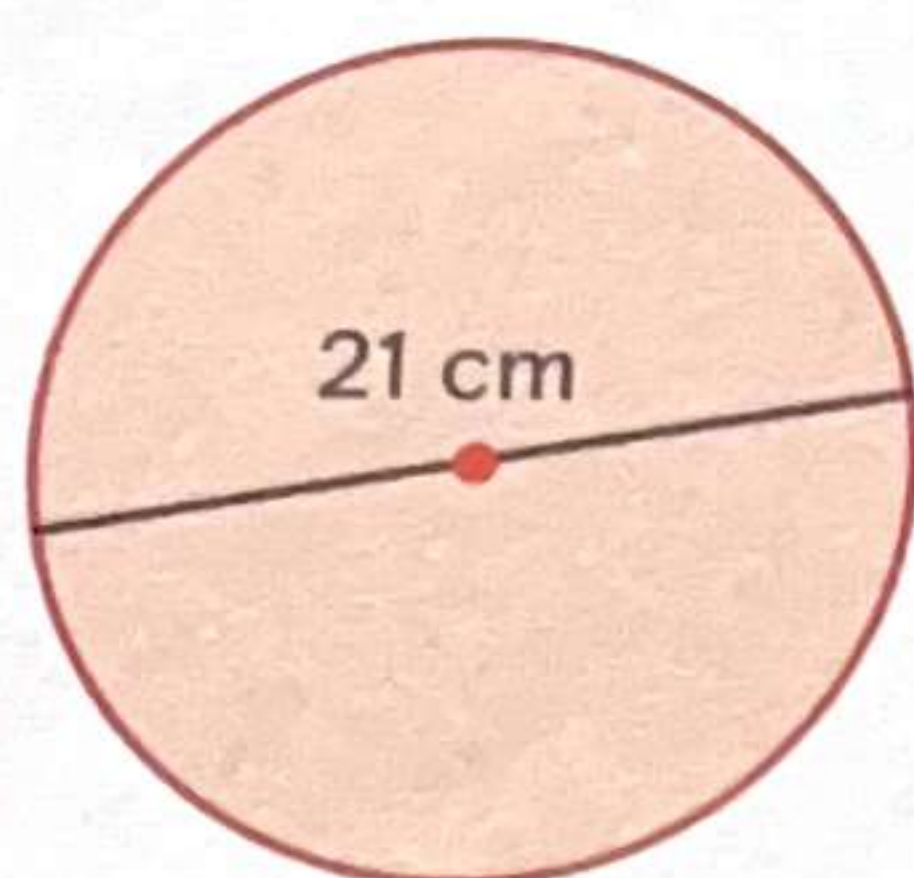
We usually take the value of  $\pi$  to be 3.14 or  $\frac{22}{7}$ .



$$\text{Circumference of a circle} = \pi \times \text{Diameter}$$



A circle has a diameter of 21 cm. Find its circumference. (Take  $\pi = \frac{22}{7}$ )

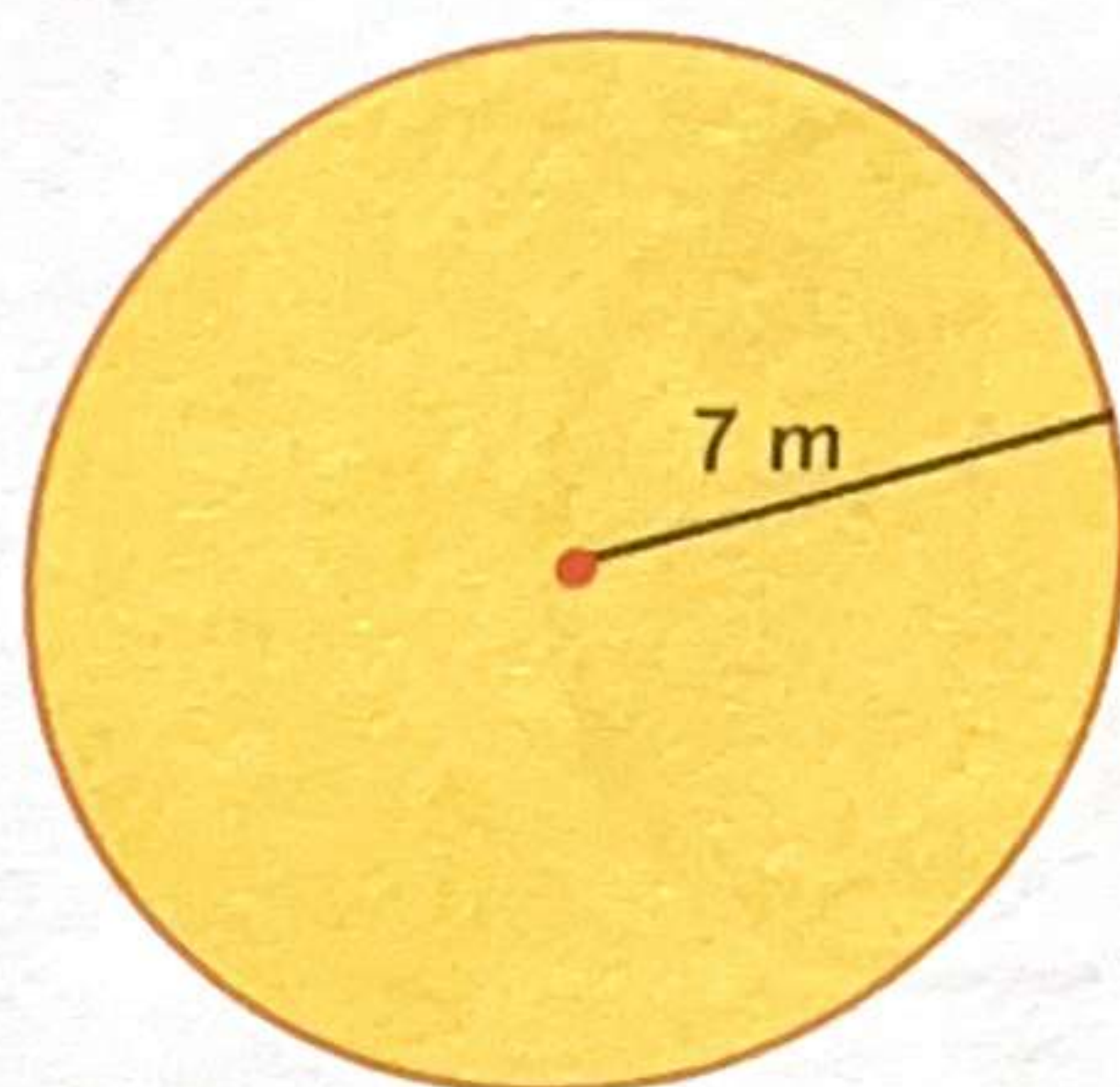


$$\text{Circumference} = \pi \times \text{Diameter}$$

$$= \frac{22}{7} \times 21$$

$$= 66 \text{ cm}$$

The radius of a circle is 7 m. Find its circumference. (Take  $\pi = \frac{22}{7}$ )



### Method 1

$$\text{Diameter} = 2 \times \text{Radius}$$

$$= 2 \times 7 \text{ m}$$

$$= 14 \text{ m}$$

$$\text{Circumference} = \pi \times \text{Diameter}$$

$$= \frac{22}{7} \times 14$$

$$= 44 \text{ m}$$

### Method 2

$$\text{Circumference} = 2 \times \pi \times \text{Radius}$$

$$= 2 \times \frac{22}{7} \times 7$$

$$= 44 \text{ m}$$

Since

$$\text{Diameter} = 2 \times \text{Radius}$$

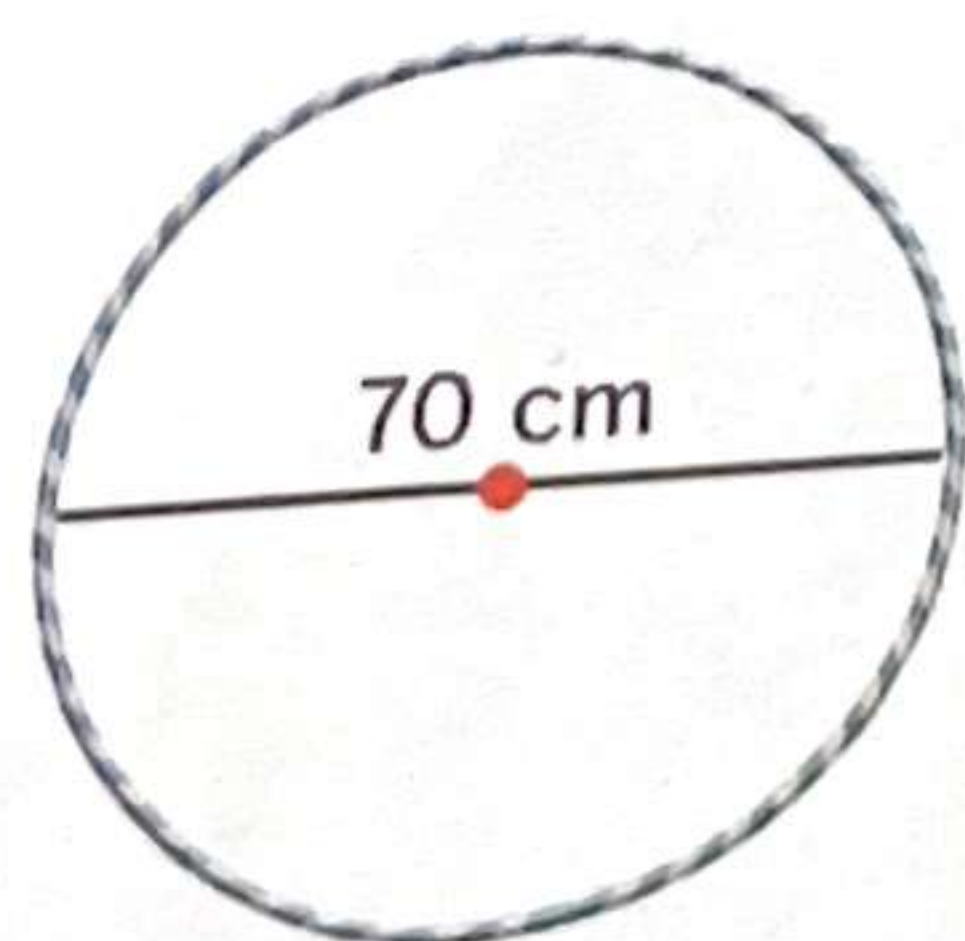
$$\text{Circumference} = \pi \times \text{Diameter}$$

$$= \pi \times 2 \times \text{Radius}$$

$$= 2 \times \pi \times \text{Radius}$$



The diameter of a hula hoop is 70 cm. Find the circumference of the hoop. (Take  $\pi = 3.14$ )



$$\text{Circumference} = \pi \times \text{Diameter}$$

$$= 3.14 \times 70 \text{ cm}$$

$$= 219.8 \text{ cm}$$

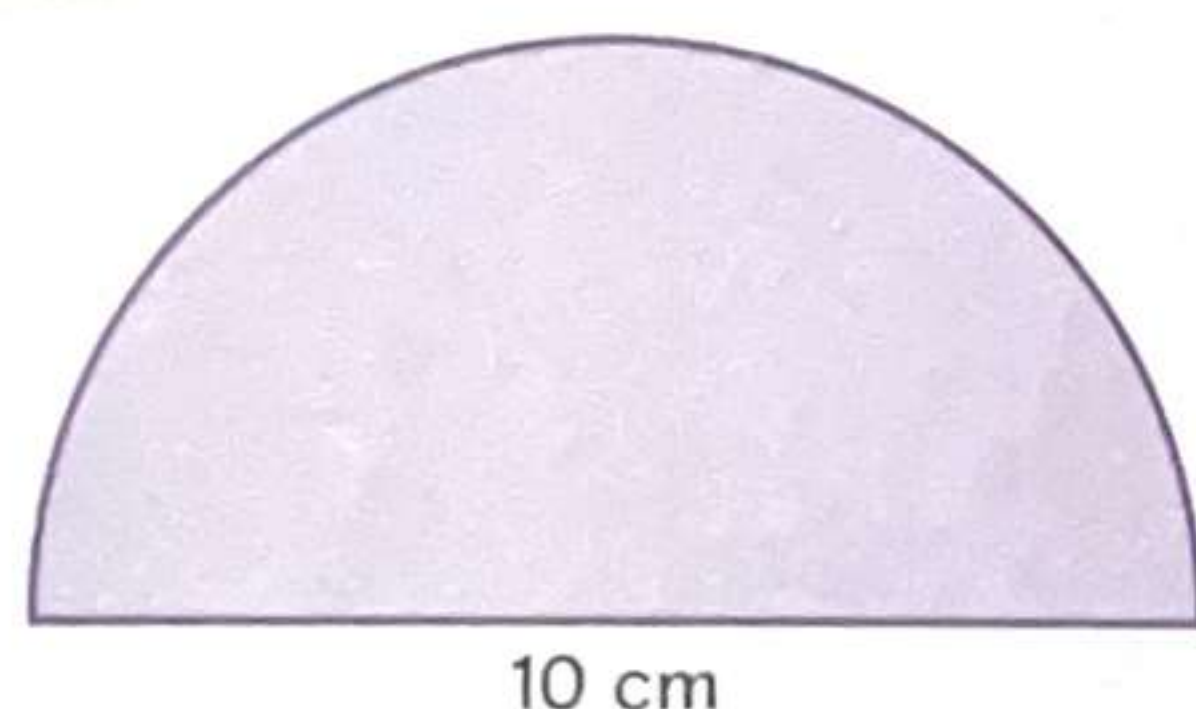
The circumference of the hula hoop is **219.8 cm**.



# Perimeter of a Semicircle and a Quarter Circle

The diameter of a circle is 10 cm.  
Find the perimeter of the following. (Take  $\pi = 3.14$ )

(a) semicircle

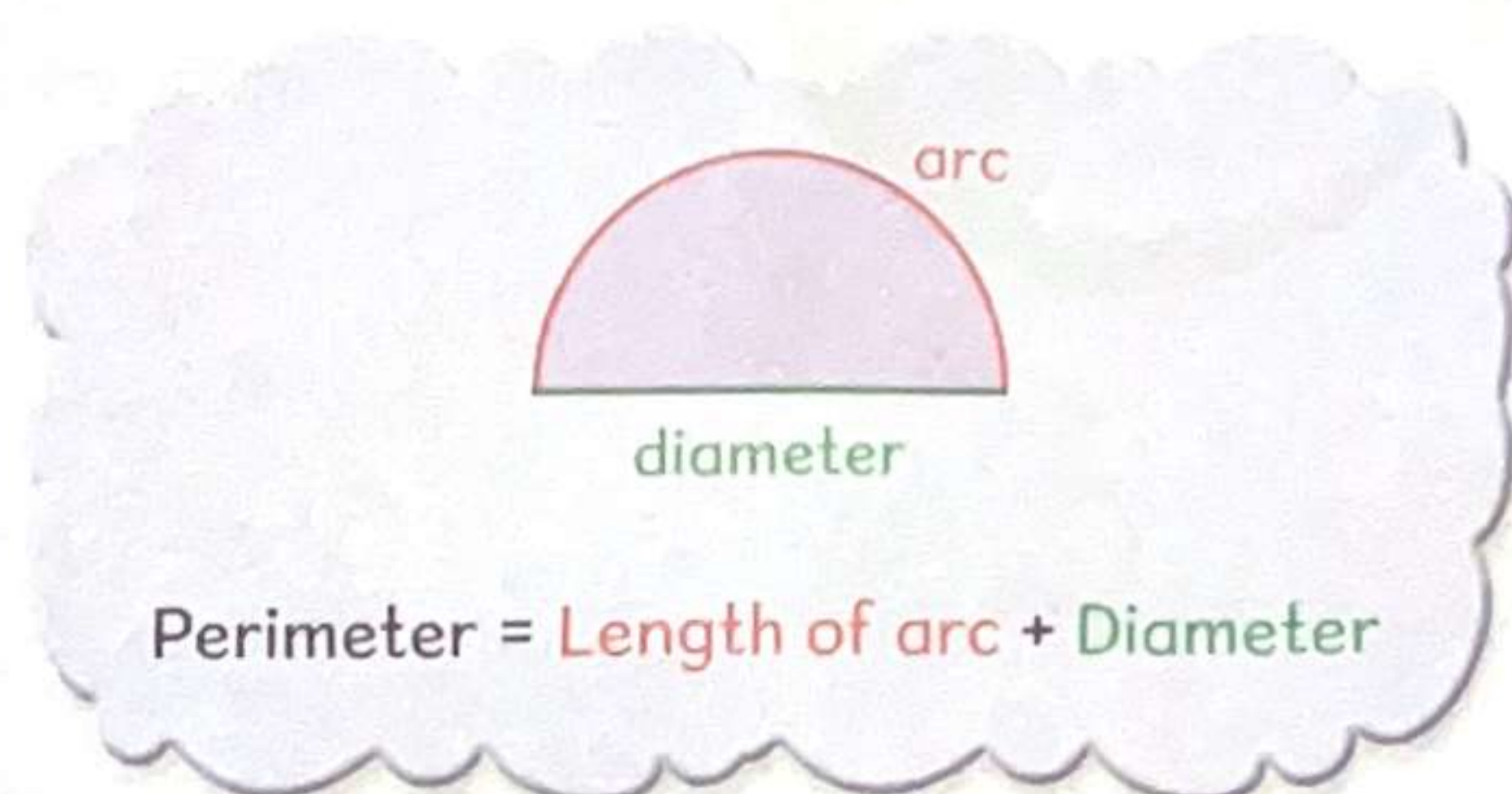


$$\begin{aligned}\text{Circumference} &= \pi \times \text{Diameter} \\ &= 3.14 \times 10 \text{ cm} \\ &= 31.4 \text{ cm}\end{aligned}$$

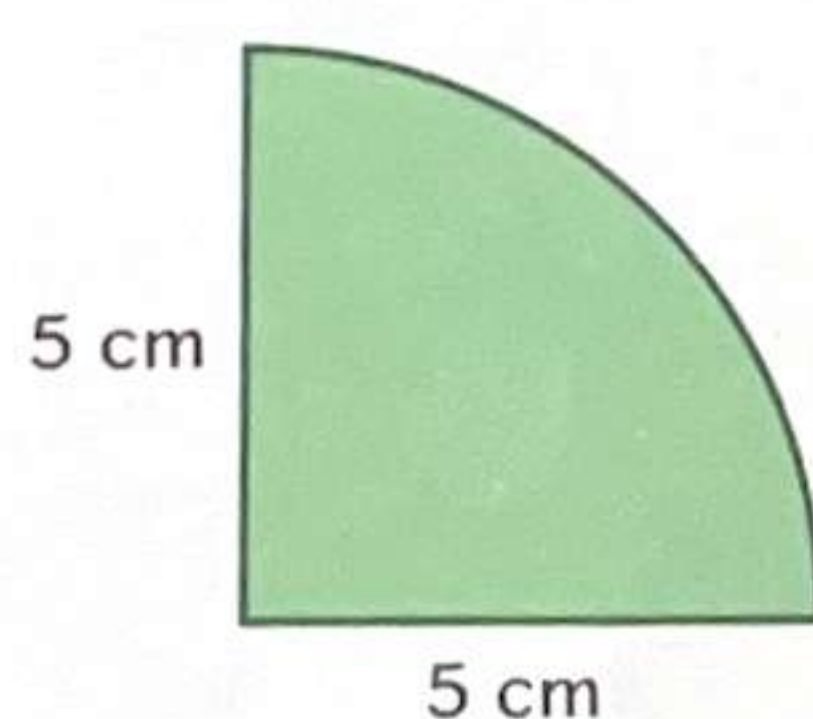
$$\begin{aligned}\text{Length of arc} &= 31.4 \text{ cm} \div 2 \\ &= 15.7 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Perimeter of semicircle} &= 15.7 \text{ cm} + 10 \text{ cm} \\ &= 25.7 \text{ cm}\end{aligned}$$

The perimeter of the semicircle is **25.7 cm**.



(b) quarter circle

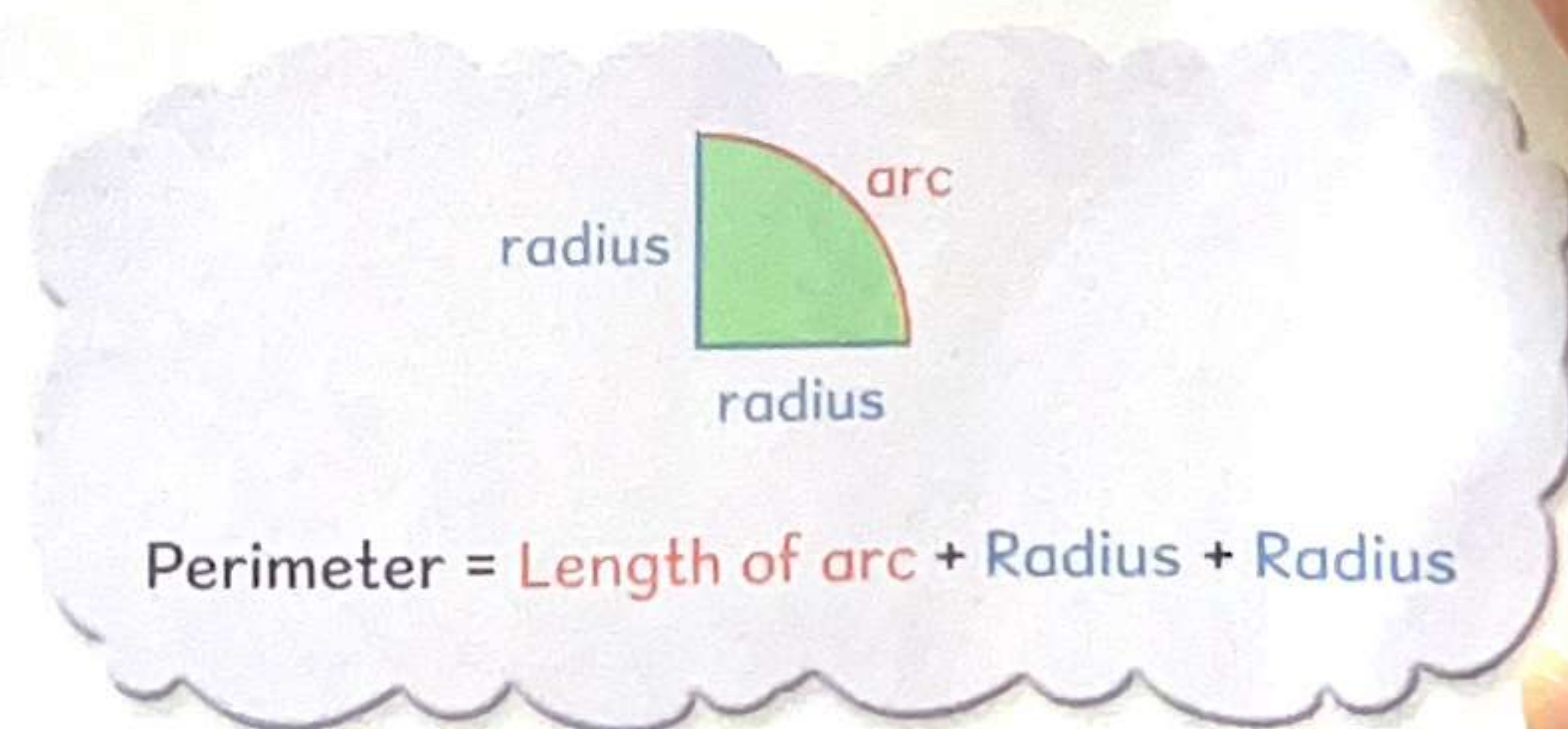


$$\begin{aligned}\text{Circumference} &= 2 \times \pi \times \text{Radius} \\ &= 2 \times 3.14 \times 5 \text{ cm} \\ &= 31.4 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Length of arc} &= 31.4 \text{ cm} \div 4 \\ &= 7.85 \text{ cm}\end{aligned}$$

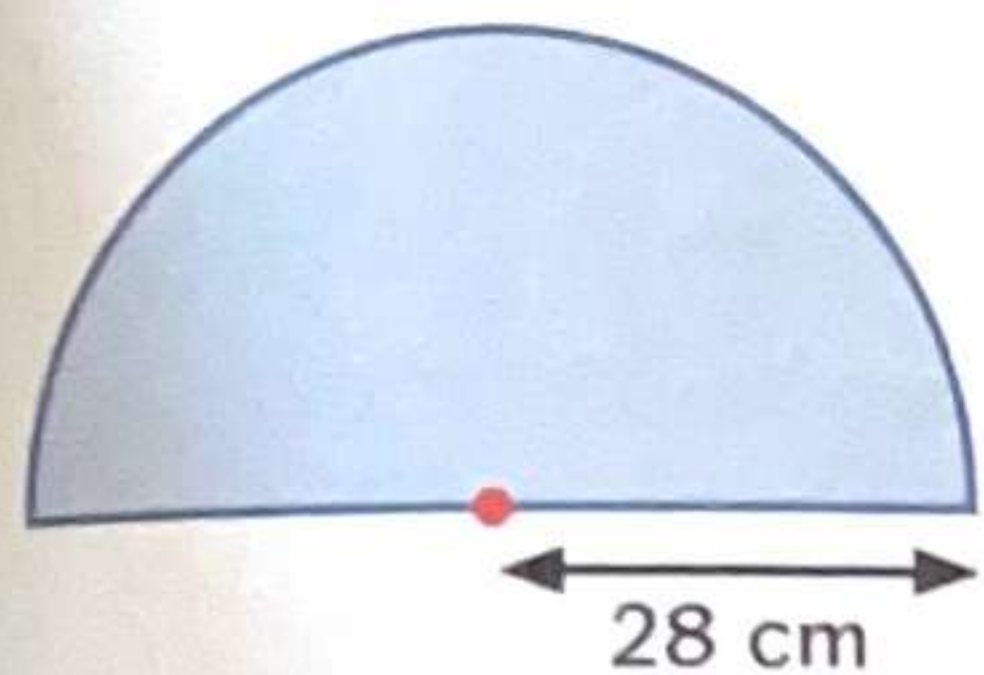
$$\begin{aligned}\text{Perimeter of quarter circle} &= 7.85 \text{ cm} + 5 \text{ cm} + 5 \text{ cm} \\ &= 17.85 \text{ cm}\end{aligned}$$

The perimeter of the quarter circle is **17.85 cm**.





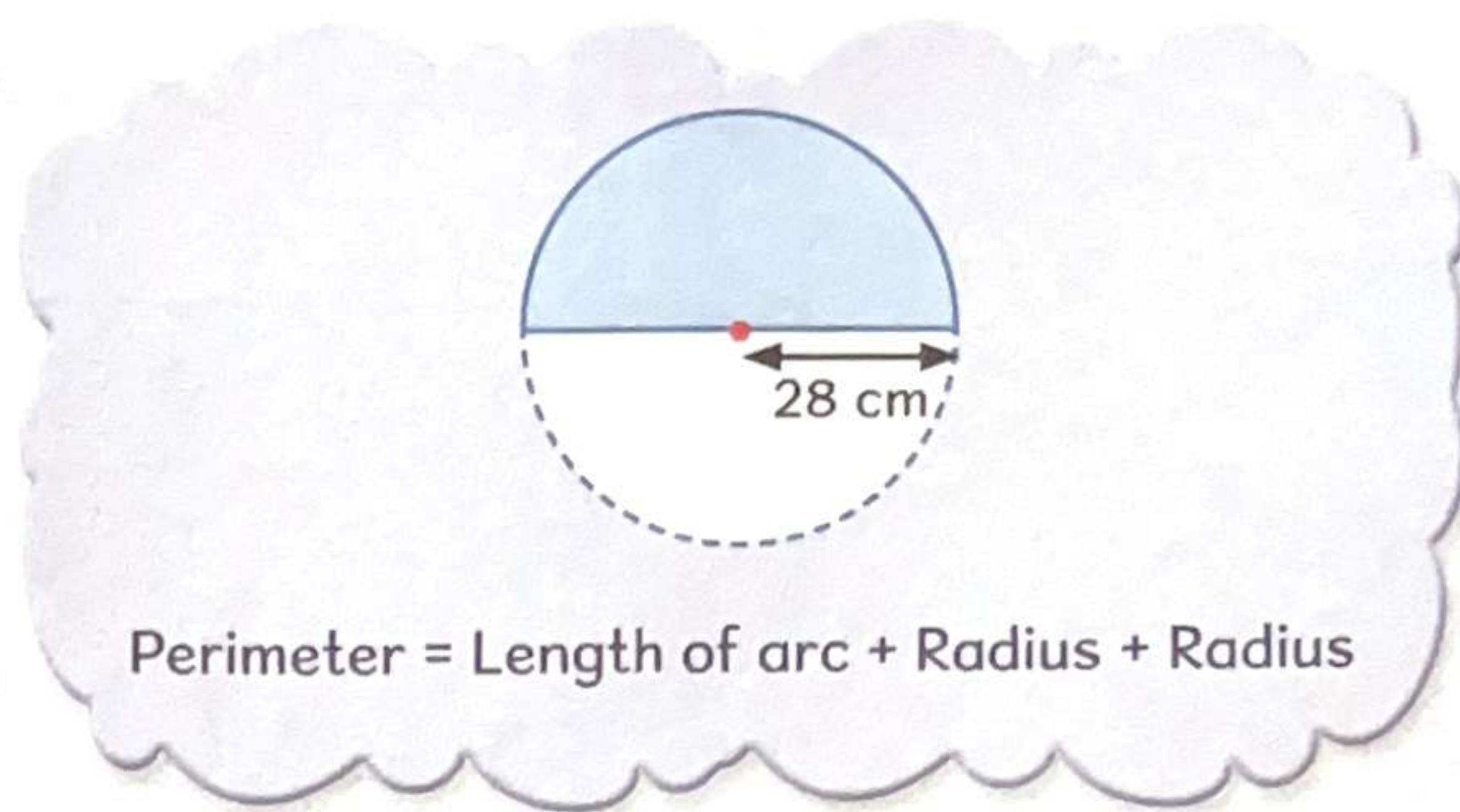
Find the perimeter of the semicircle. (Take  $\pi = \frac{22}{7}$ )



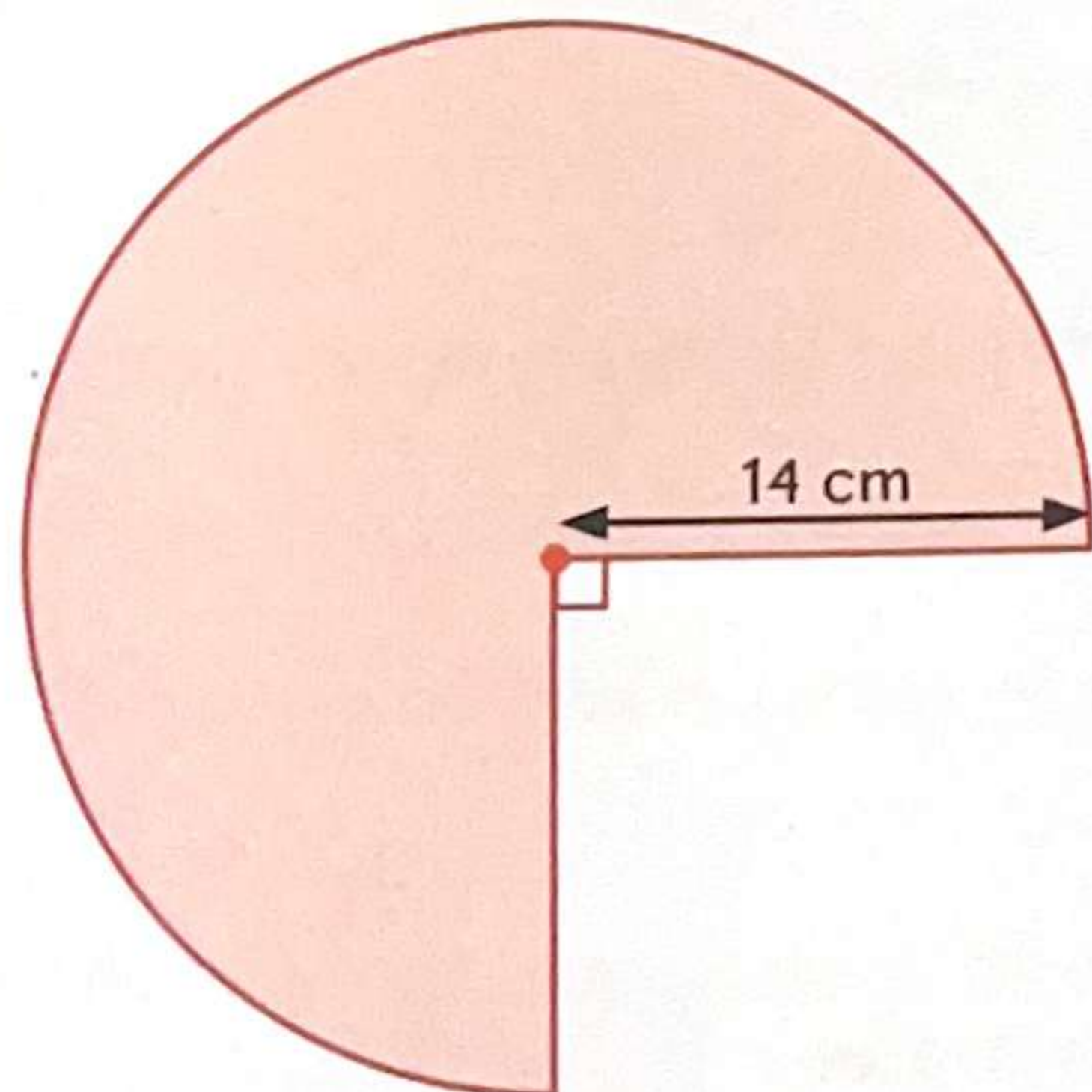
$$\begin{aligned}\text{Length of arc} &= \frac{1}{2} \times \text{Circumference} \\ &= \frac{1}{2} \times 2 \times \pi \times \text{Radius} \\ &= \frac{1}{2} \times 2 \times \frac{22}{7} \times 28 \\ &= 88 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Perimeter of semicircle} &= 88 \text{ cm} + 28 \text{ cm} + 28 \text{ cm} \\ &= 144 \text{ cm}\end{aligned}$$

The perimeter of the semicircle is **144 cm**.



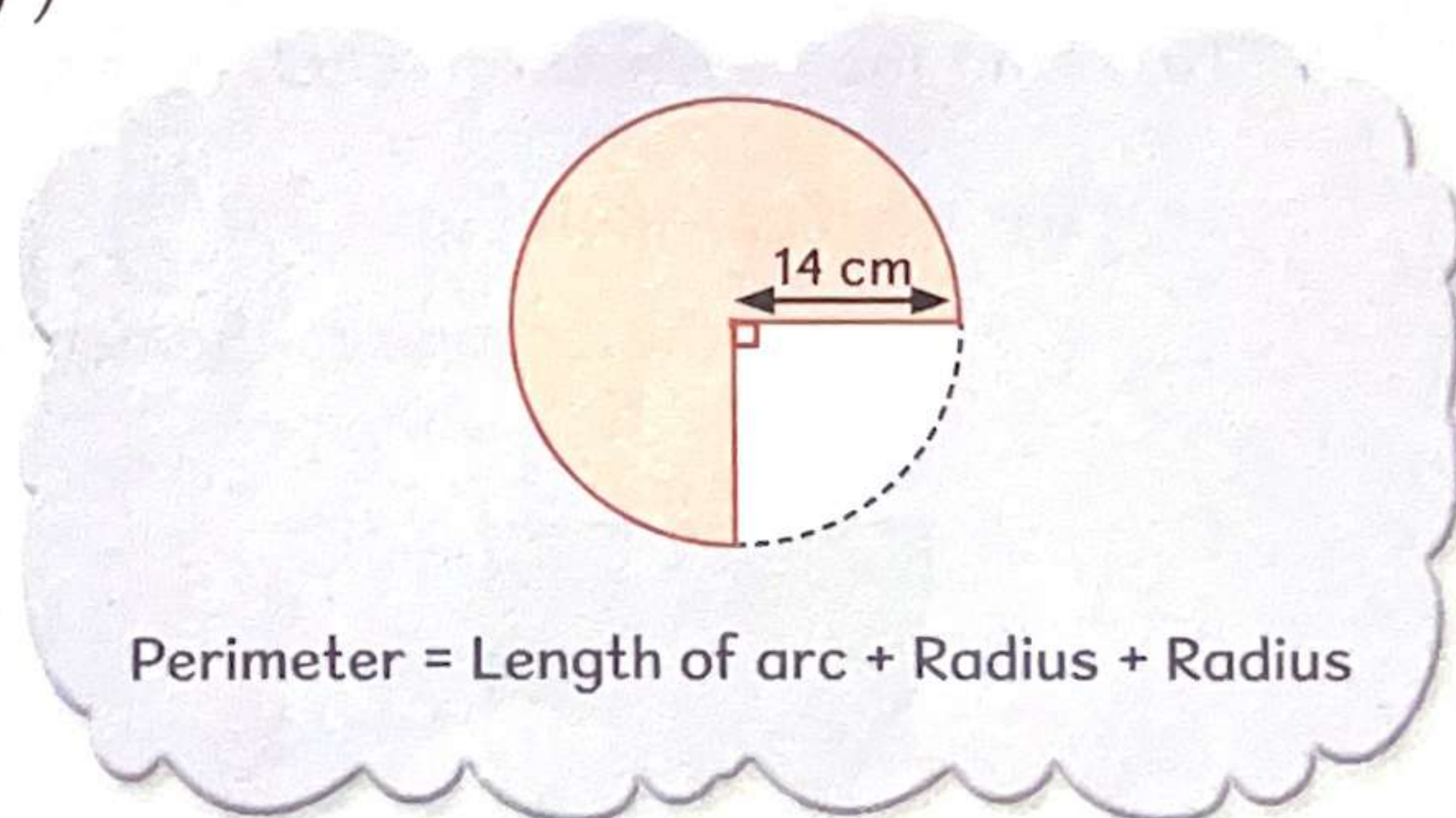
Find the perimeter of the figure. (Take  $\pi = \frac{22}{7}$ )



$$\begin{aligned}\text{Length of arc} &= \frac{3}{4} \times \text{Circumference} \\ &= \frac{3}{4} \times 2 \times \pi \times \text{Radius} \\ &= \frac{3}{4} \times 2 \times \frac{22}{7} \times 14 \\ &= 66 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Perimeter of figure} &= 66 \text{ cm} + 14 \text{ cm} + 14 \text{ cm} \\ &= 94 \text{ cm}\end{aligned}$$

The perimeter of the figure is **94 cm**.



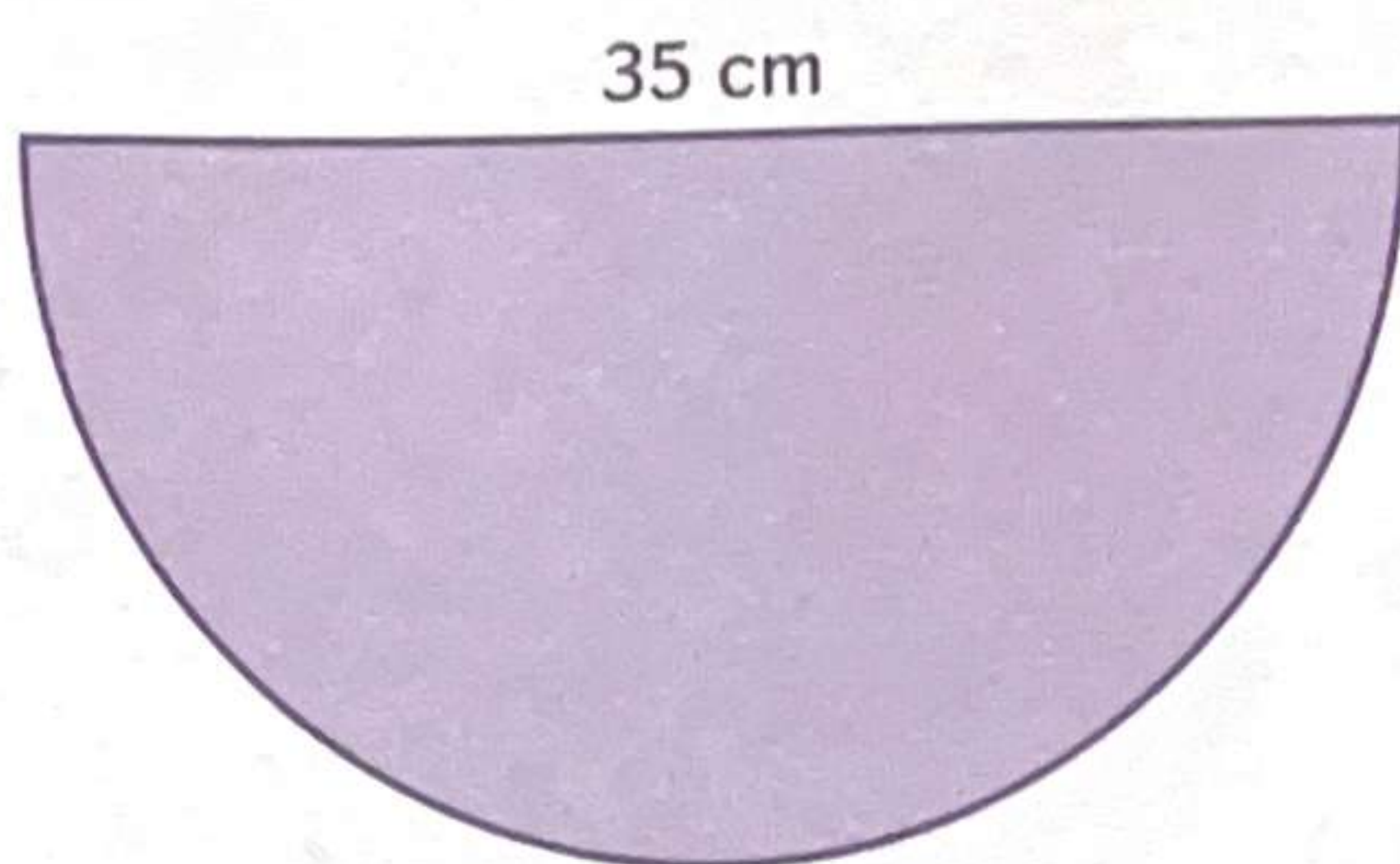
Is there another way to find the perimeter of the figure?





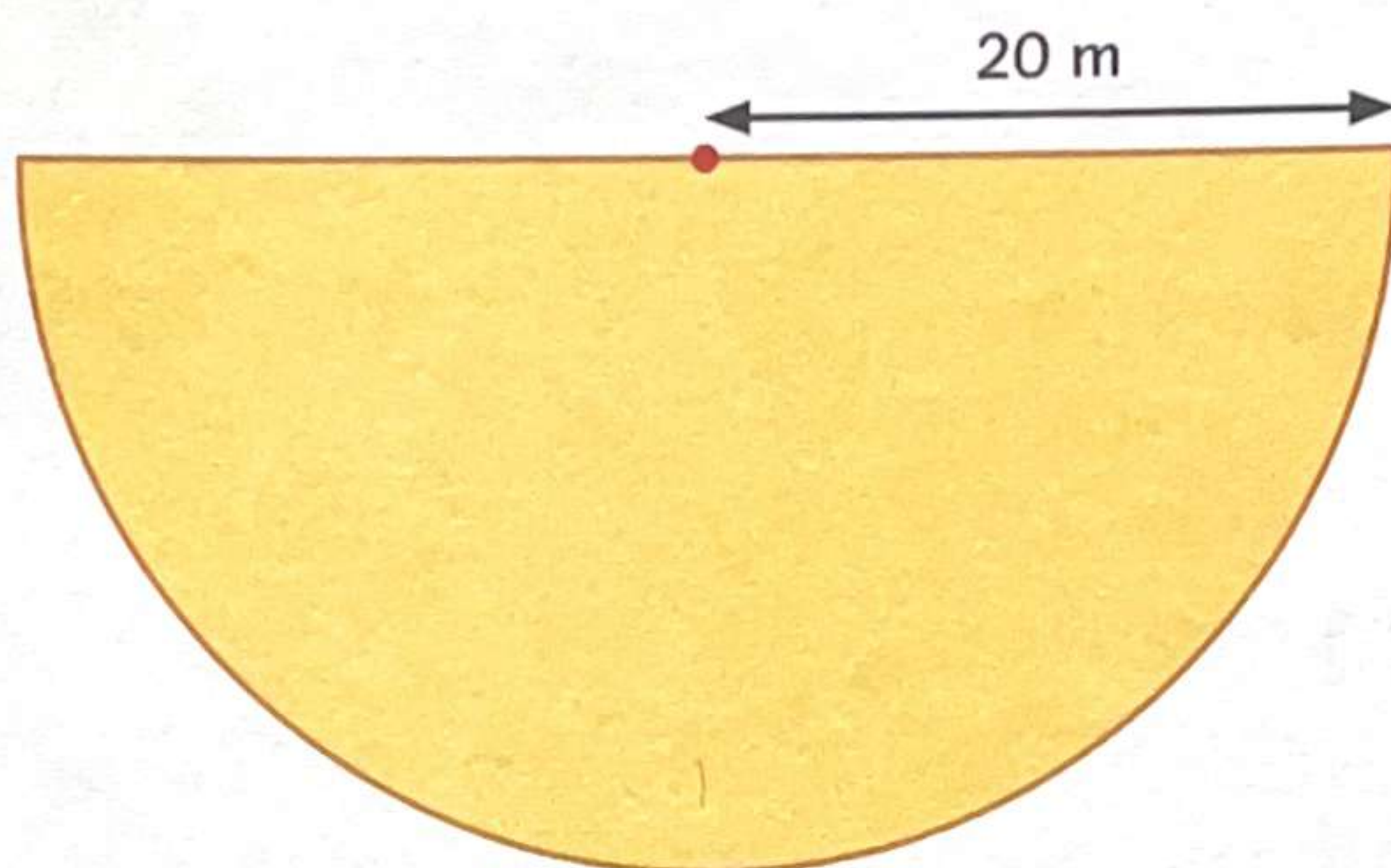
(a) Find the perimeter of each semicircle.

(i) Diameter = 35 cm (Take  $\pi = \frac{22}{7}$ )



Perimeter =  cm

(ii) Radius = 20 m (Take  $\pi = 3.14$ )

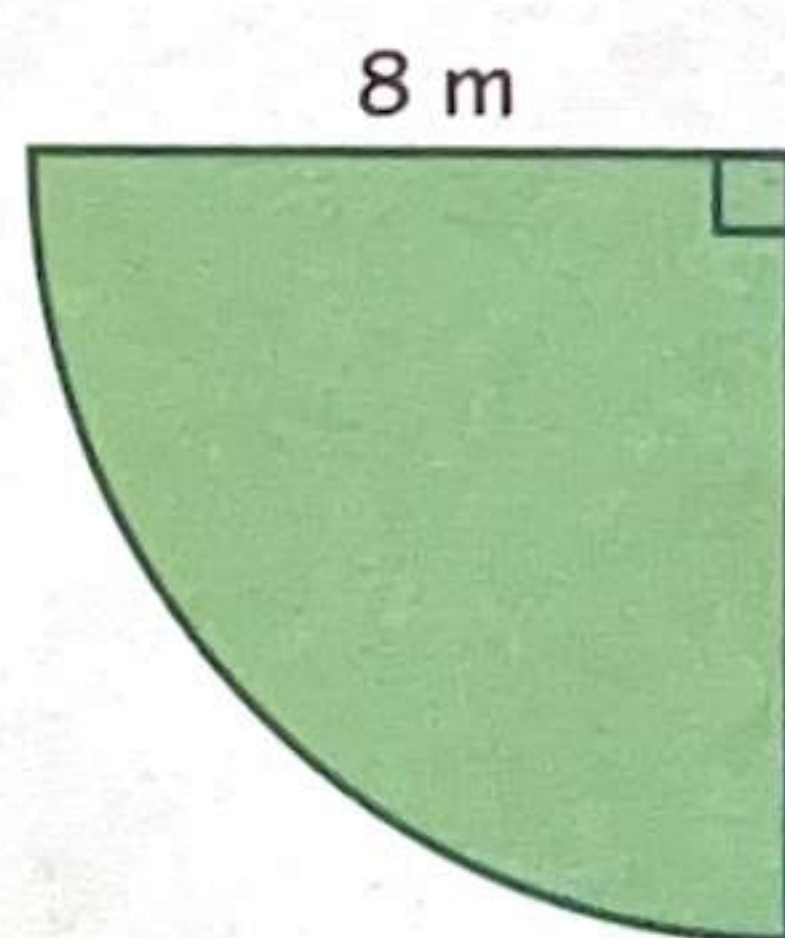


Perimeter =  m

 (b) Find the perimeter of each figure.

(i) Radius = 8 m (Take  $\pi = \frac{22}{7}$ )

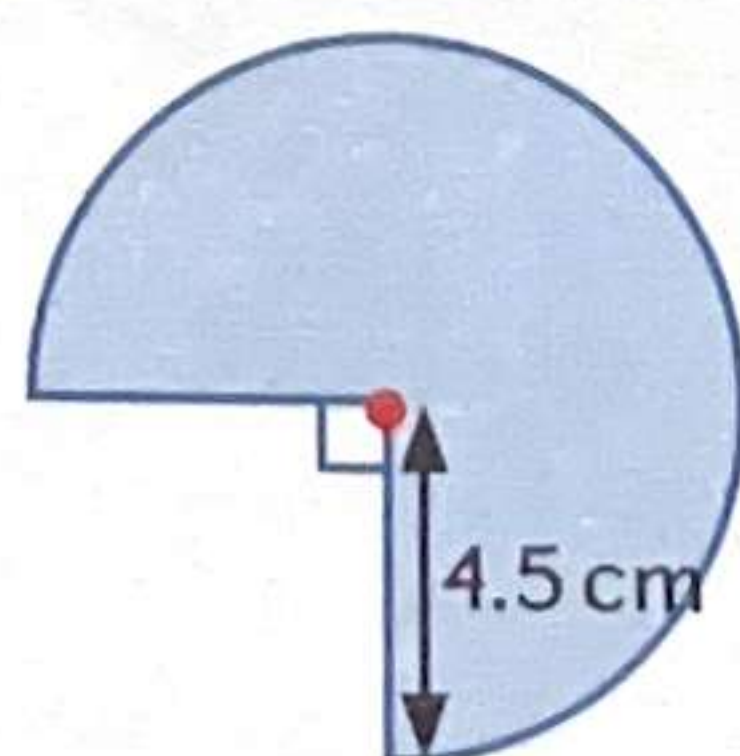
Round the answer to the nearest whole number.



Perimeter =  m

(ii) Radius = 4.5 cm (Take  $\pi = 3.14$ )

Round the answer to 2 decimal places.

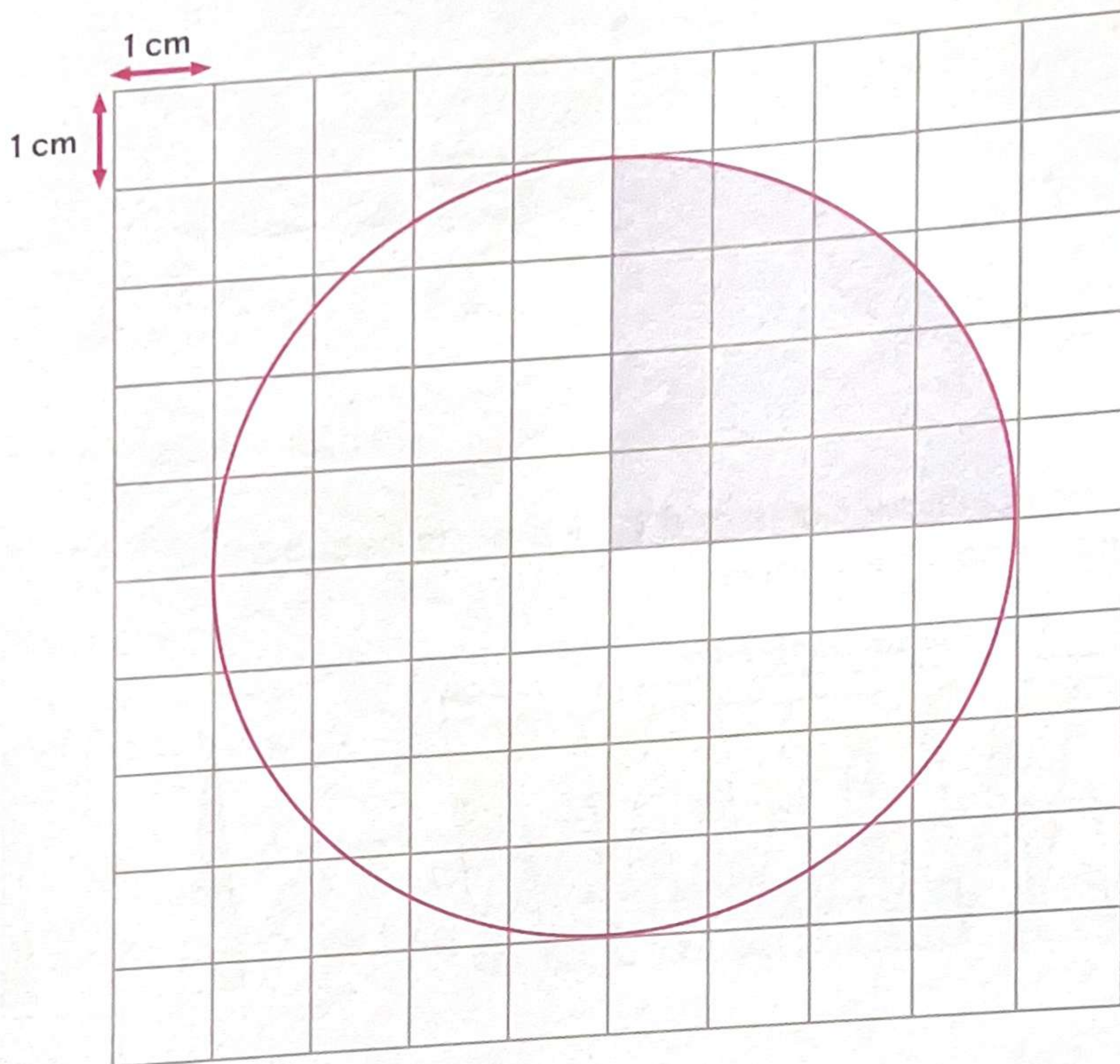


Perimeter =  cm



# Area of a Circle

A circle is drawn on a 1-cm square grid.  
Estimate the area of this circle.



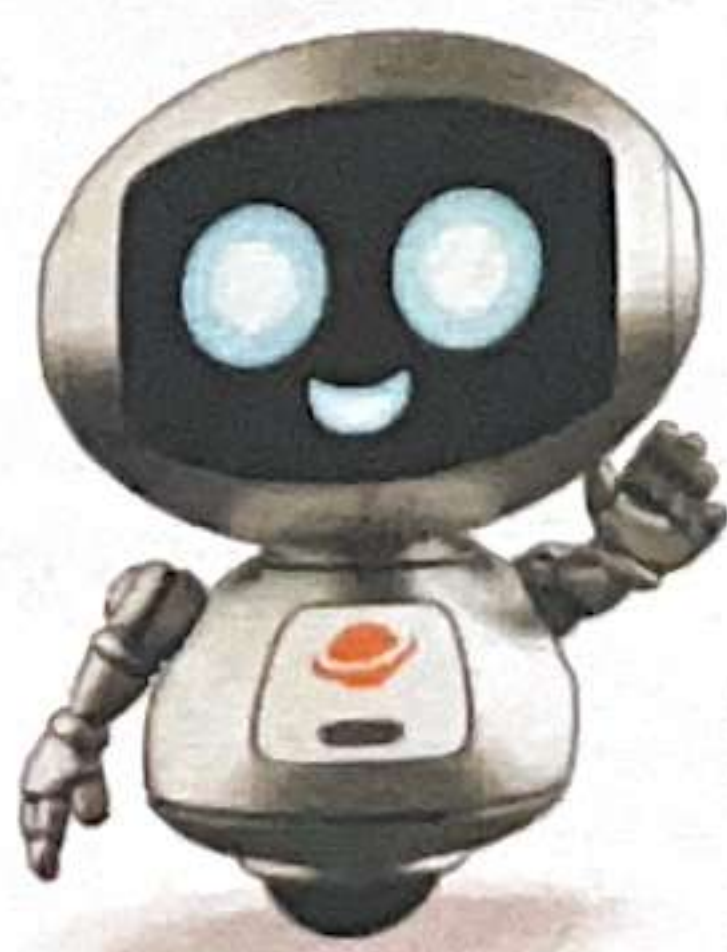
Count the number of squares that make up  $\frac{1}{4}$  of the circle.

There are about 12 whole squares.

The area of one quarter of the circle is about  $12 \text{ cm}^2$ .

$$4 \times 12 = 48$$

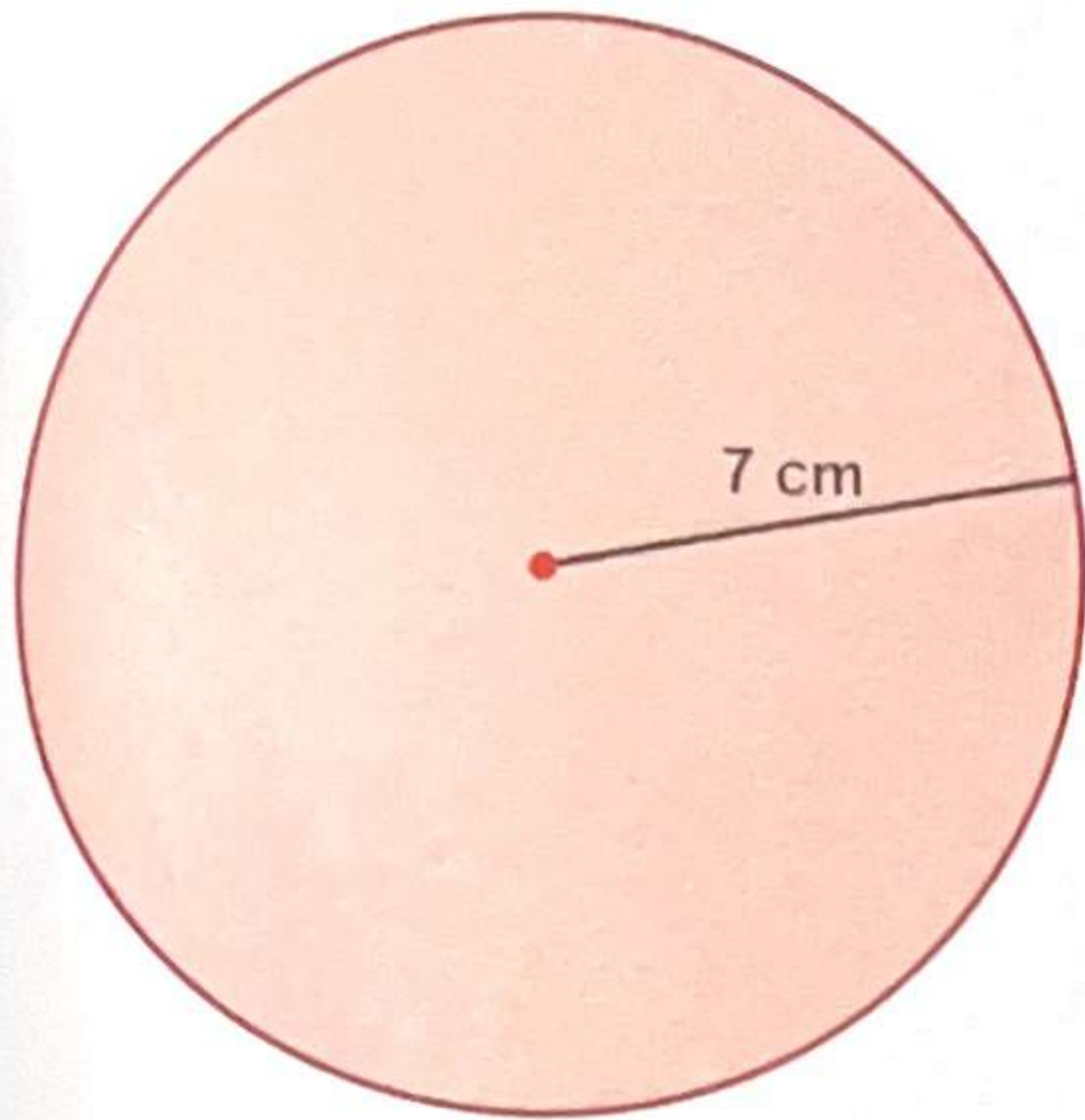
The area of the circle is about  **$48 \text{ cm}^2$** .



Is there another way to find the area of a circle without counting the squares?



A circle has a radius of 7 cm. Find its area. (Take  $\pi = \frac{22}{7}$ )



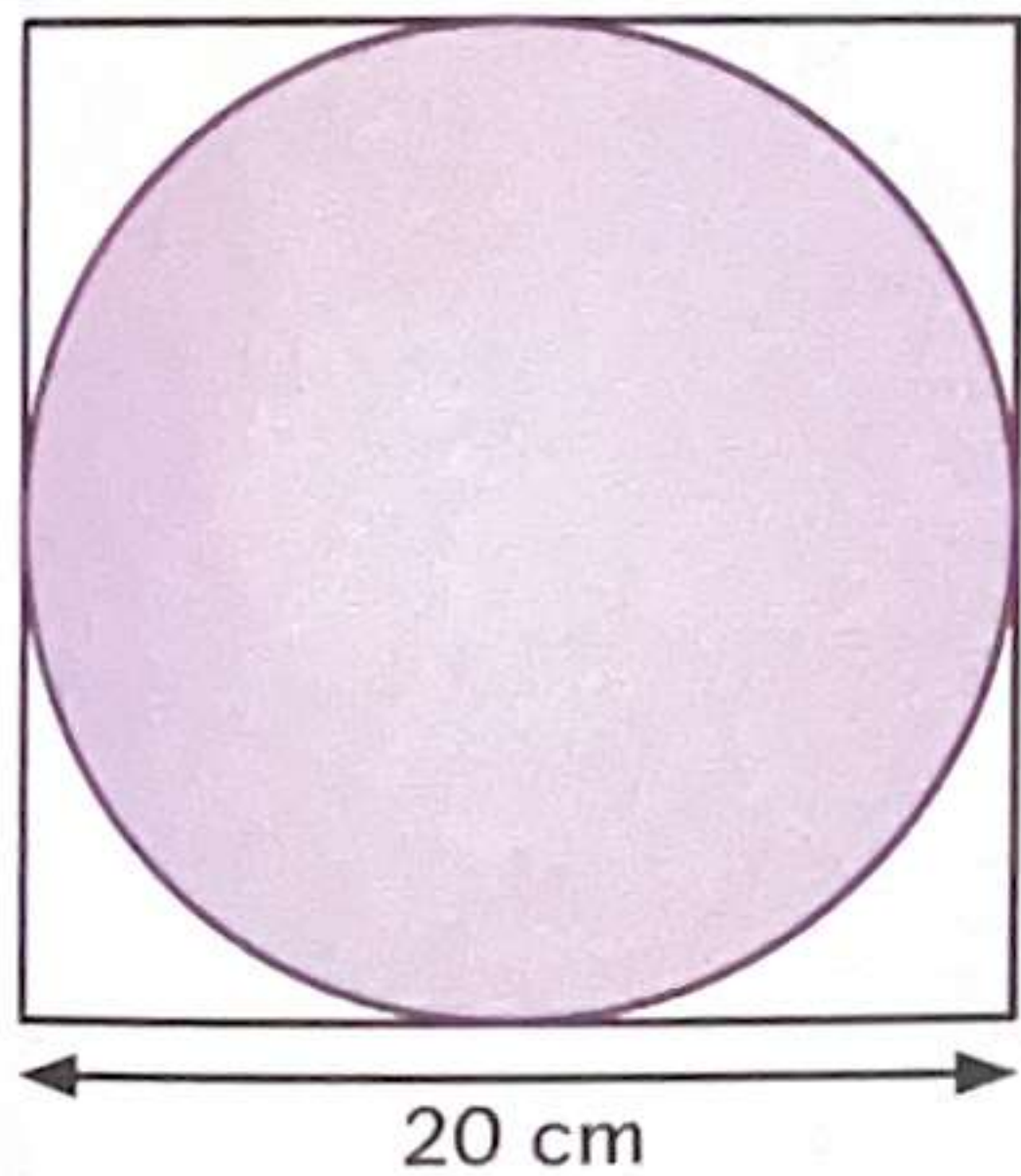
Area of circle =  $\pi \times \text{Radius} \times \text{Radius}$

$$= \frac{22}{7} \times 7 \times 7$$

$$= 154 \text{ cm}^2$$

The area of the circle is **154 cm<sup>2</sup>**.

The diameter of a circle is 20 cm. Find its area. (Take  $\pi = 3.14$ )



Diameter = 20 cm

$$\begin{aligned} \text{Radius} &= 20 \text{ cm} \div 2 \\ &= 10 \text{ cm} \end{aligned}$$

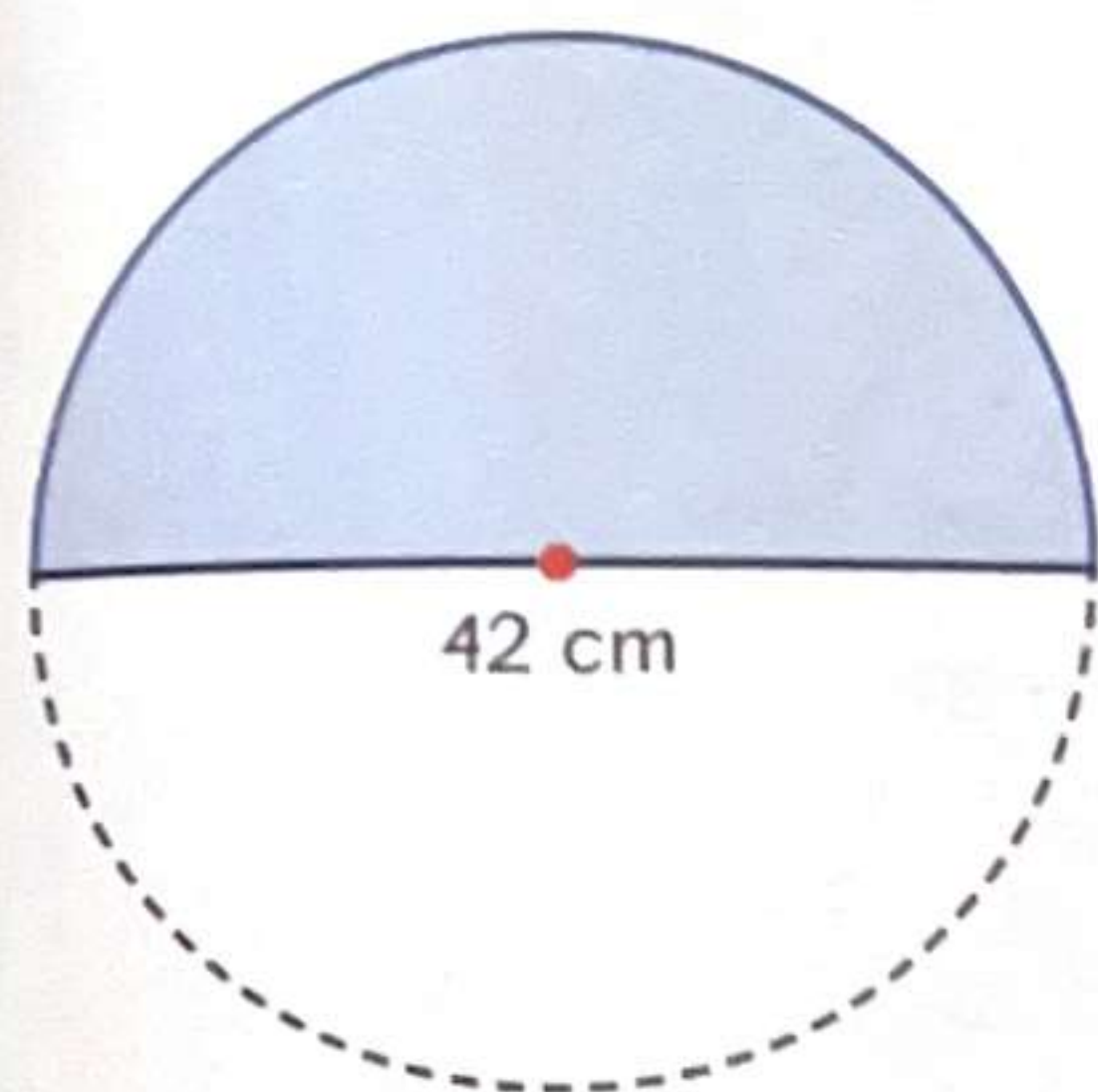
$$\begin{aligned} \text{Area of circle} &= \pi \times \text{Radius} \times \text{Radius} \\ &= 3.14 \times 10 \times 10 \\ &= 314 \text{ cm}^2 \end{aligned}$$

The area of the circle is **314 cm<sup>2</sup>**.



# Area of a Semicircle and a Quarter Circle

Find the area of the semicircle. (Take  $\pi = \frac{22}{7}$ )



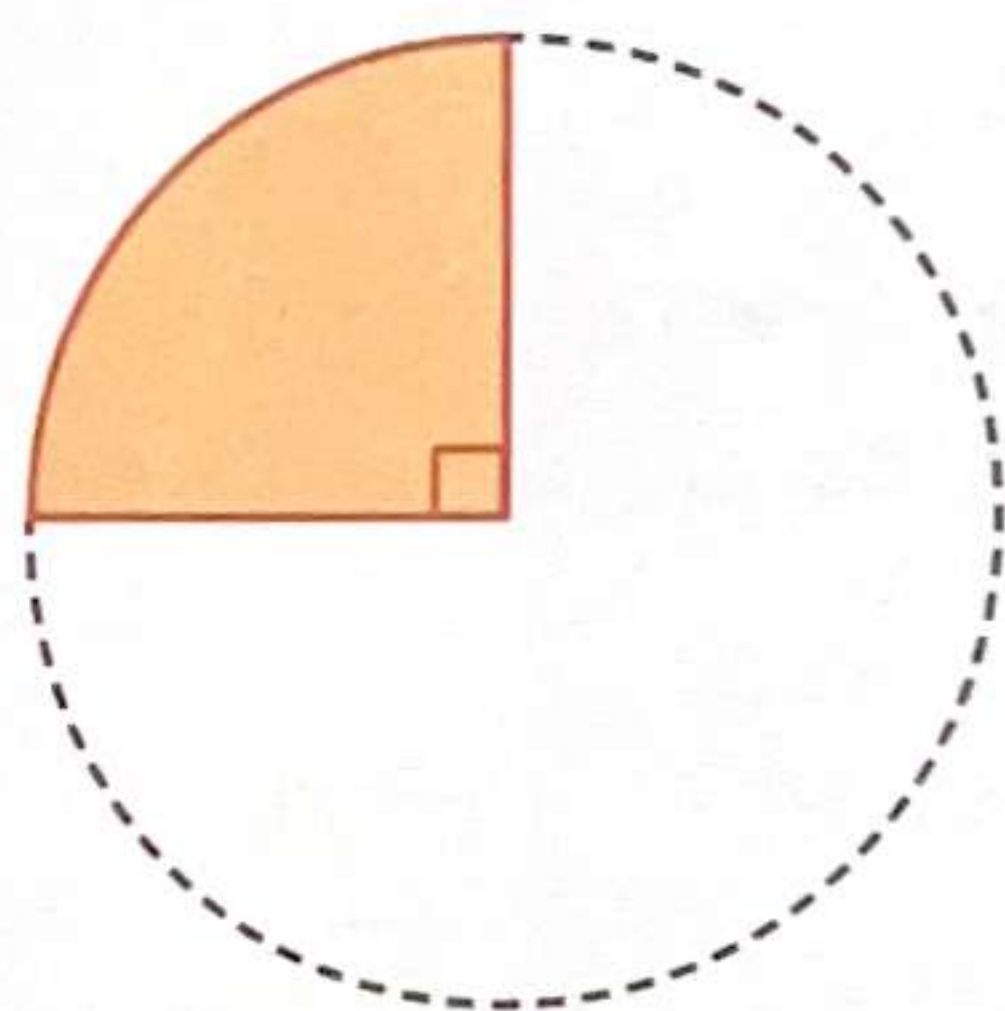
$$\begin{aligned}\text{Radius} &= \text{Diameter} \div 2 \\ &= 42 \text{ cm} \div 2 \\ &= 21 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Area of circle} &= \pi \times \text{Radius} \times \text{Radius} \\ &= \frac{22}{7} \times 21 \times 21 \\ &= 1386 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Area of semicircle} &= 1386 \text{ cm}^2 \div 2 \\ &= 693 \text{ cm}^2\end{aligned}$$

The area of the semicircle is **693 cm<sup>2</sup>**.

Find the area of the quarter circle. (Take  $\pi = 3.14$ )



$$\begin{aligned}\text{Area of circle} &= \pi \times \text{Radius} \times \text{Radius} \\ &= 3.14 \times 4 \times 4 \\ &= 50.24 \text{ cm}^2\end{aligned}$$

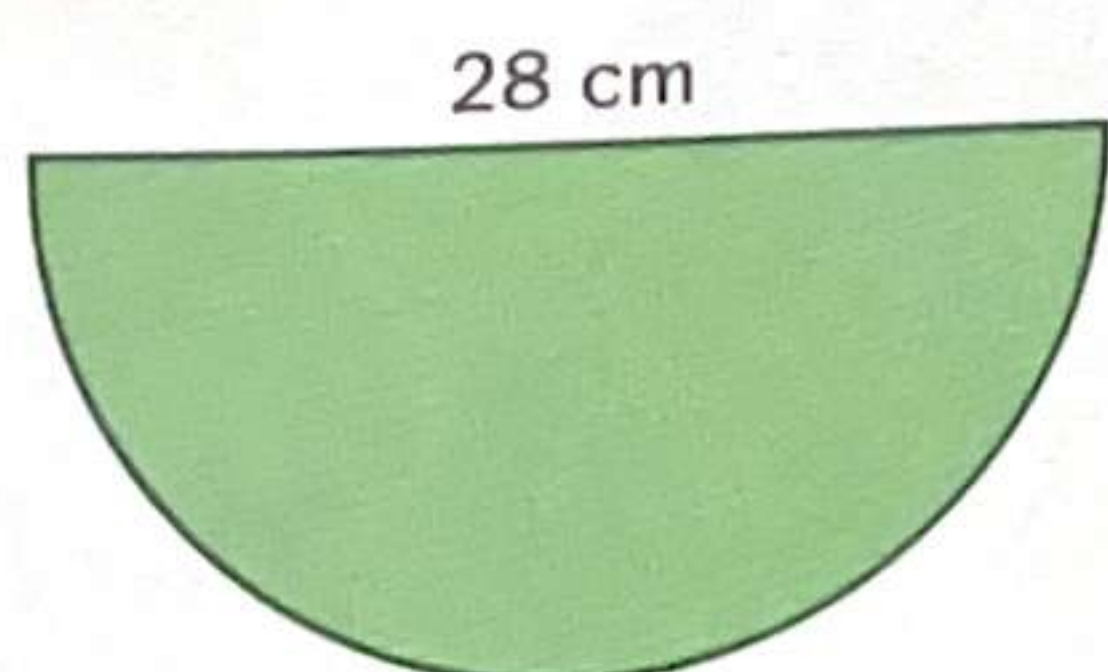
$$\begin{aligned}\text{Area of quarter circle} &= 50.24 \text{ cm}^2 \div 4 \\ &= 12.56 \text{ cm}^2\end{aligned}$$

The area of the quarter circle is **12.56 cm<sup>2</sup>**.

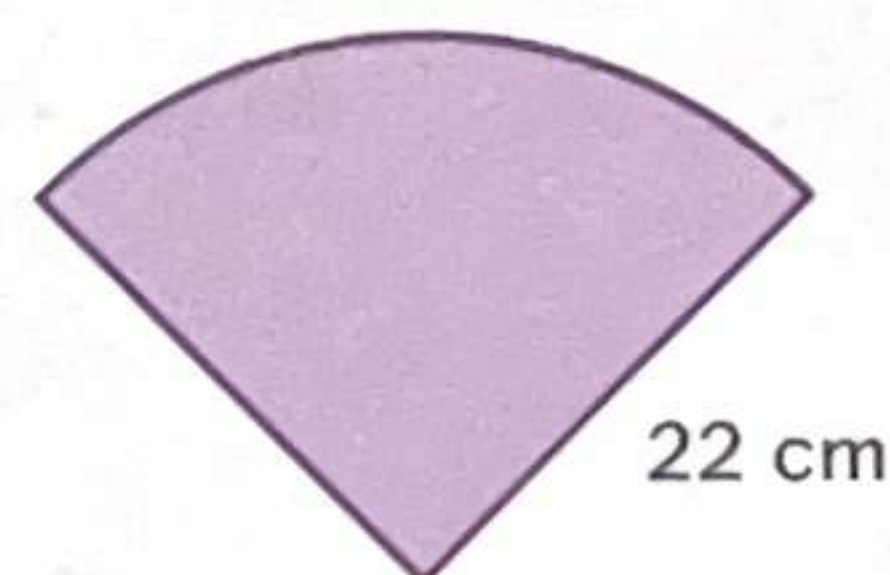
Let's Try!  
5

Find the area of the semicircle and the quarter circle.

(a) Diameter = 28 cm (Take  $\pi = \frac{22}{7}$ )      (b) Radius = 22 cm (Take  $\pi = 3.14$ )



Area =  cm<sup>2</sup>



Area =  cm<sup>2</sup>





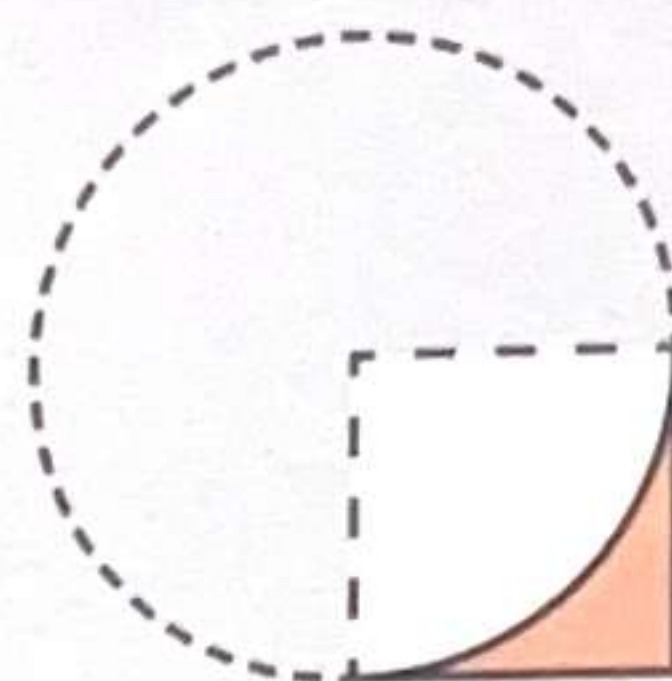
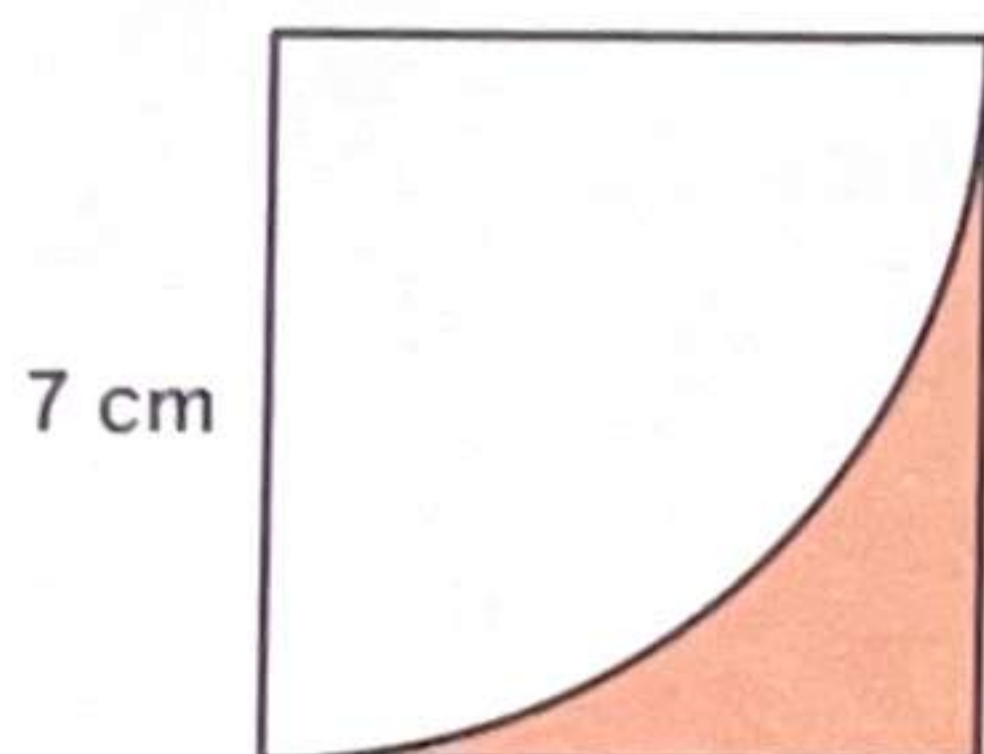
# Area and Perimeter of Composite Figures

The figure shows a quarter circle in a square.

(a) Find the perimeter of the shaded part.

(b) Find the area of the shaded part.

(Take  $\pi = \frac{22}{7}$ )



Perimeter of shaded part  
= Length of arc + Radius + Radius  
=  $\frac{1}{4}$  of circumference of circle + Radius + Radius



$$\begin{aligned} \text{(a)} \quad \text{Length of arc} &= \frac{1}{4} \times \text{Circumference} \\ &= \frac{1}{4} \times 2 \times \frac{22}{7} \times 7 \\ &= 11 \text{ cm} \end{aligned}$$

$$\begin{aligned} \text{Perimeter of shaded part} &= 11 \text{ cm} + 7 \text{ cm} + 7 \text{ cm} \\ &= 25 \text{ cm} \end{aligned}$$

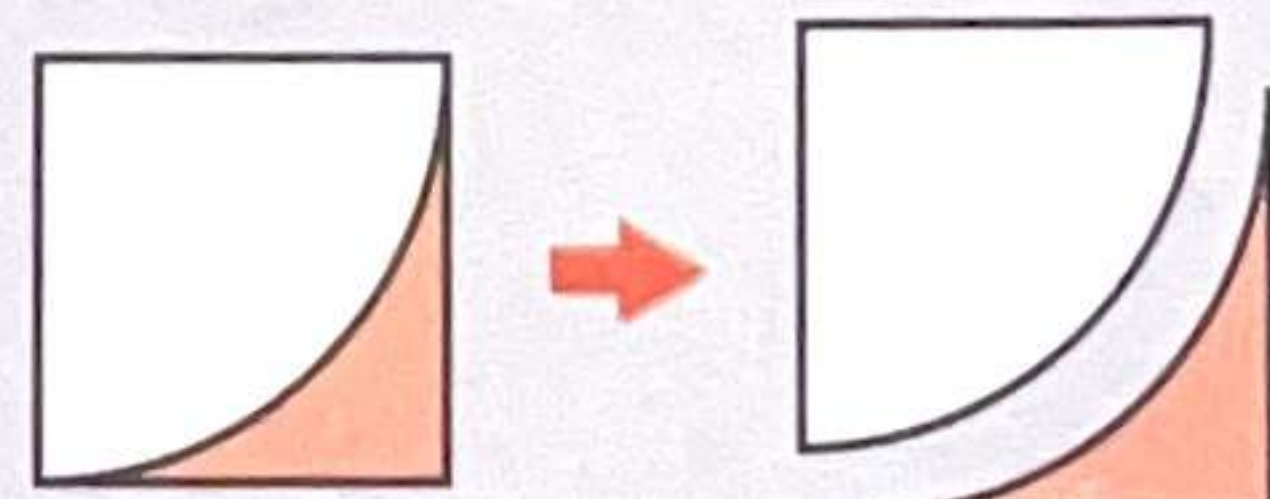
The perimeter of the shaded part is 25 cm.

$$\begin{aligned} \text{(b)} \quad \text{Area of square} &= 7 \times 7 \\ &= 49 \text{ cm}^2 \\ \text{Area of quarter circle} &= \frac{1}{4} \times \pi \times \text{Radius} \times \text{Radius} \\ &= \frac{1}{4} \times \frac{22}{7} \times 7 \times 7 \\ &= 38.5 \text{ cm}^2 \end{aligned}$$

$$\begin{aligned} \text{Area of shaded part} &= \text{Area of square} - \text{Area of quarter circle} \\ &= 49 \text{ cm}^2 - 38.5 \text{ cm}^2 \\ &= 10.5 \text{ cm}^2 \end{aligned}$$

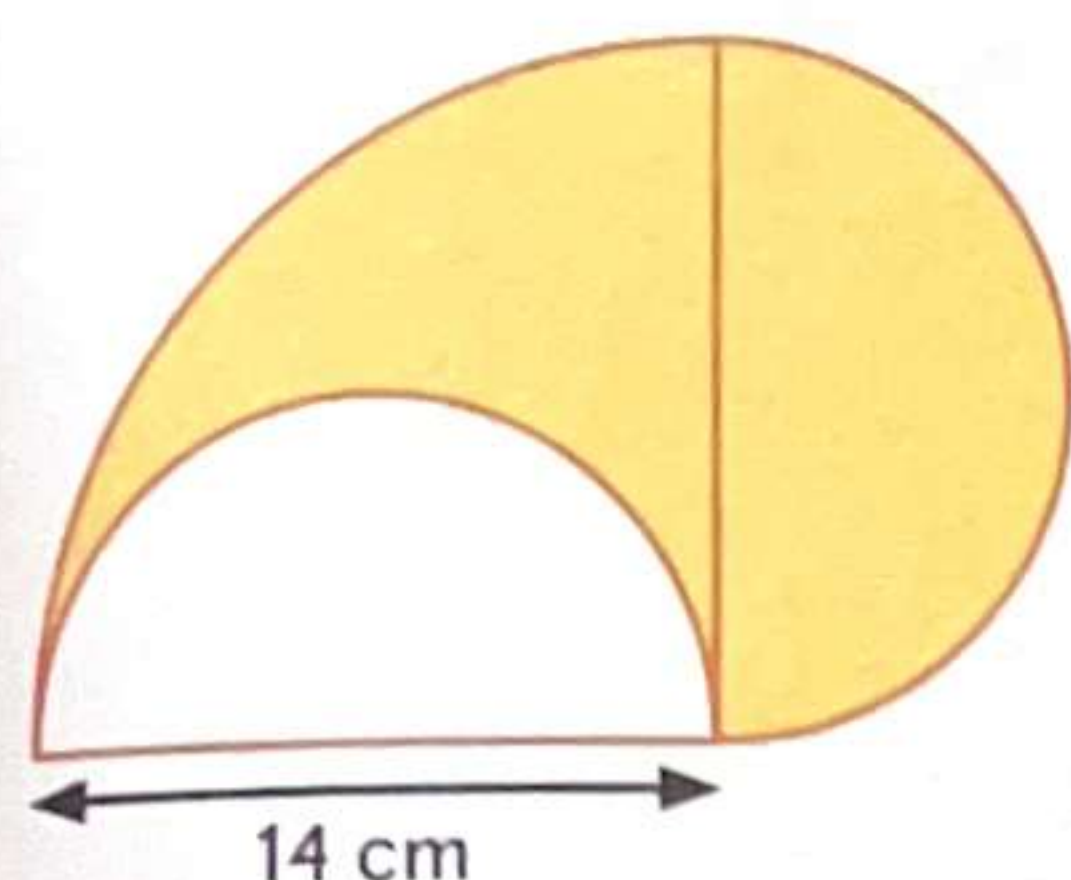
The area of the shaded part is 10.5 cm<sup>2</sup>.

Cut out the quarter circle from the square.





The figure is made up of 2 identical semicircles and a quarter circle.  
Find the area of the shaded part. (Take  $\pi = \frac{22}{7}$ )



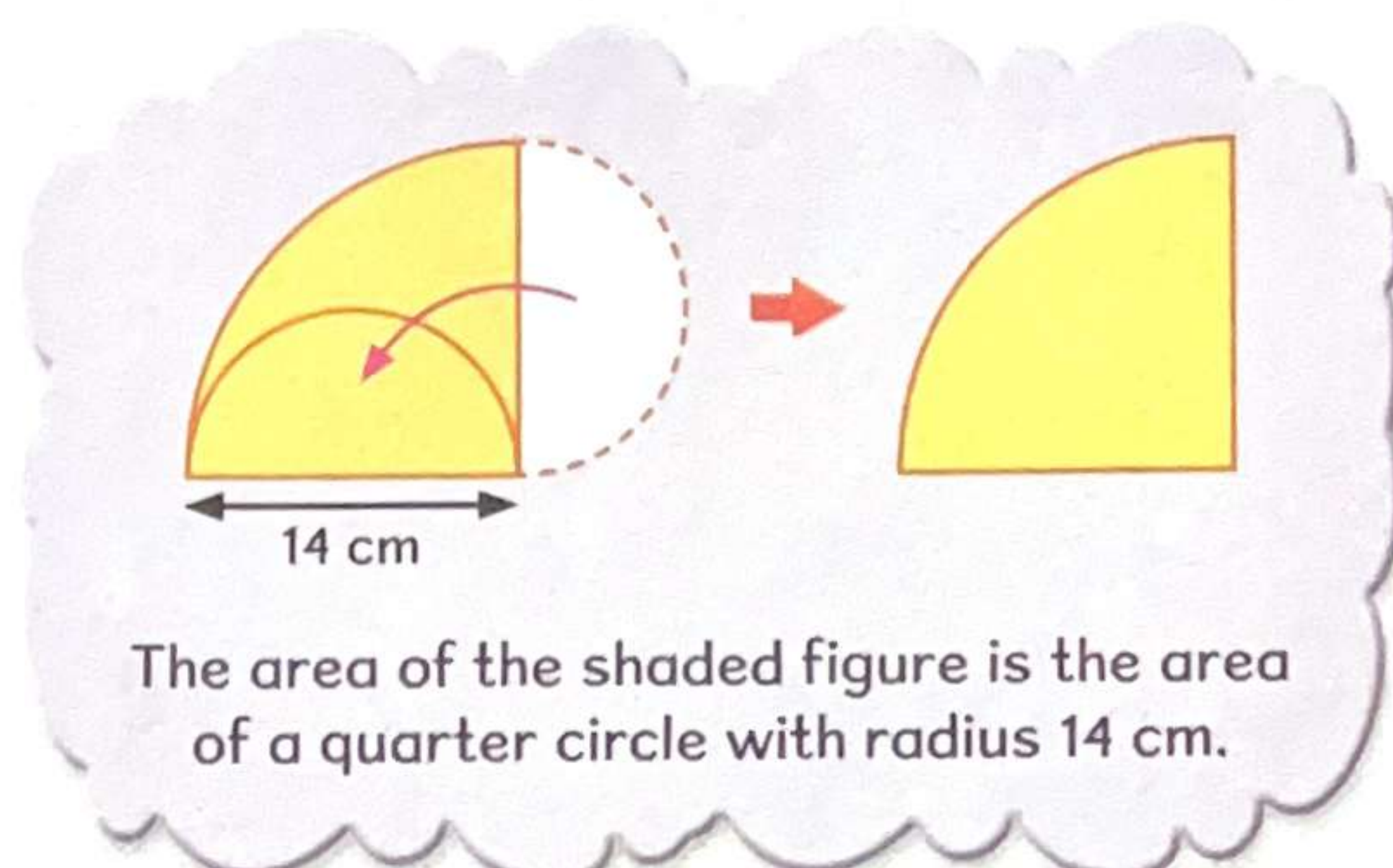
Area of quarter circle = Area of the shaded part

$$= \frac{1}{4} \times \pi \times \text{Radius} \times \text{Radius}$$

$$= \frac{1}{4} \times \frac{22}{7} \times 14 \times 14$$

$$= 154 \text{ cm}^2$$

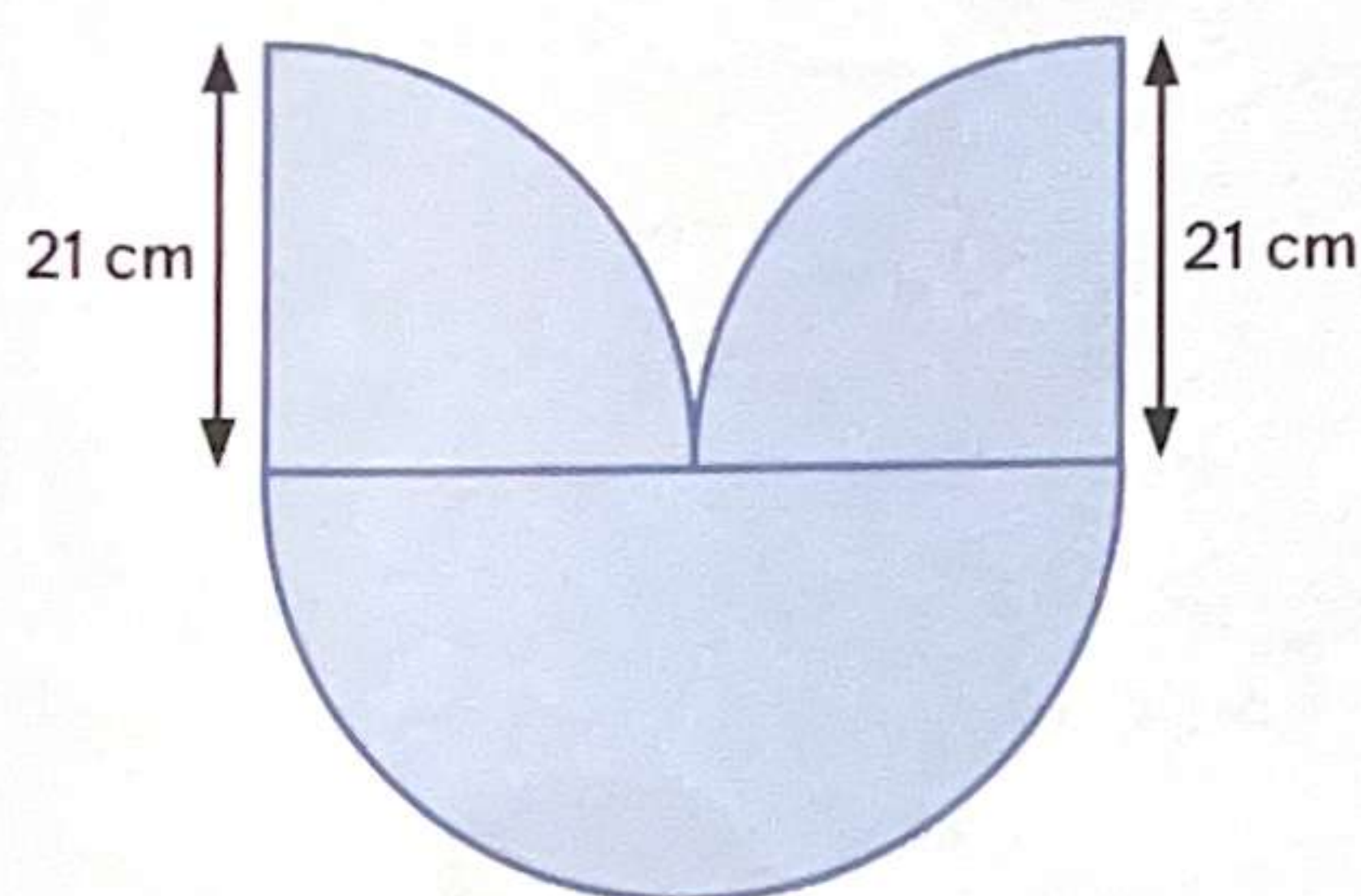
The area of the shaded part is **154 cm<sup>2</sup>**.



The area of the shaded figure is the area of a quarter circle with radius 14 cm.



The figure is made up of two quarter circles and a semicircle.  
Find the perimeter of the figure. (Take  $\pi = \frac{22}{7}$ )



$$\text{Circumference} = 2 \times \pi \times \text{Radius}$$

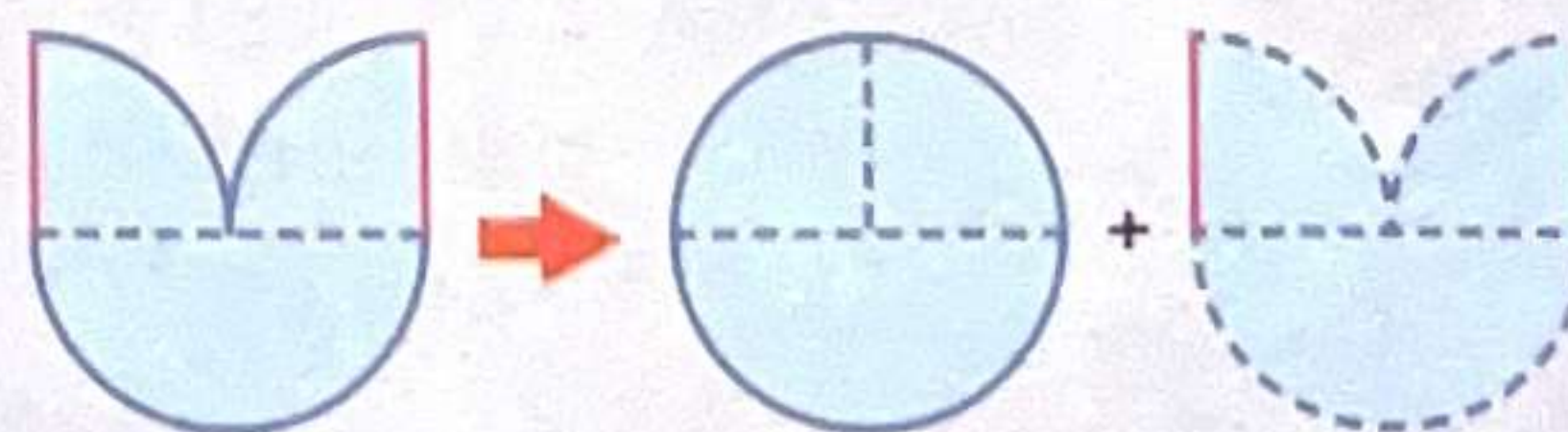
$$= 2 \times \frac{22}{7} \times 21 \text{ cm}$$

$$= 132 \text{ cm}$$

$$\begin{aligned} \text{Perimeter of figure} &= 132 \text{ cm} + 21 \text{ cm} + 21 \text{ cm} \\ &= 174 \text{ cm} \end{aligned}$$

The perimeter of the figure is **174 cm**.

I can rearrange the two quarter circles to complete a circle.



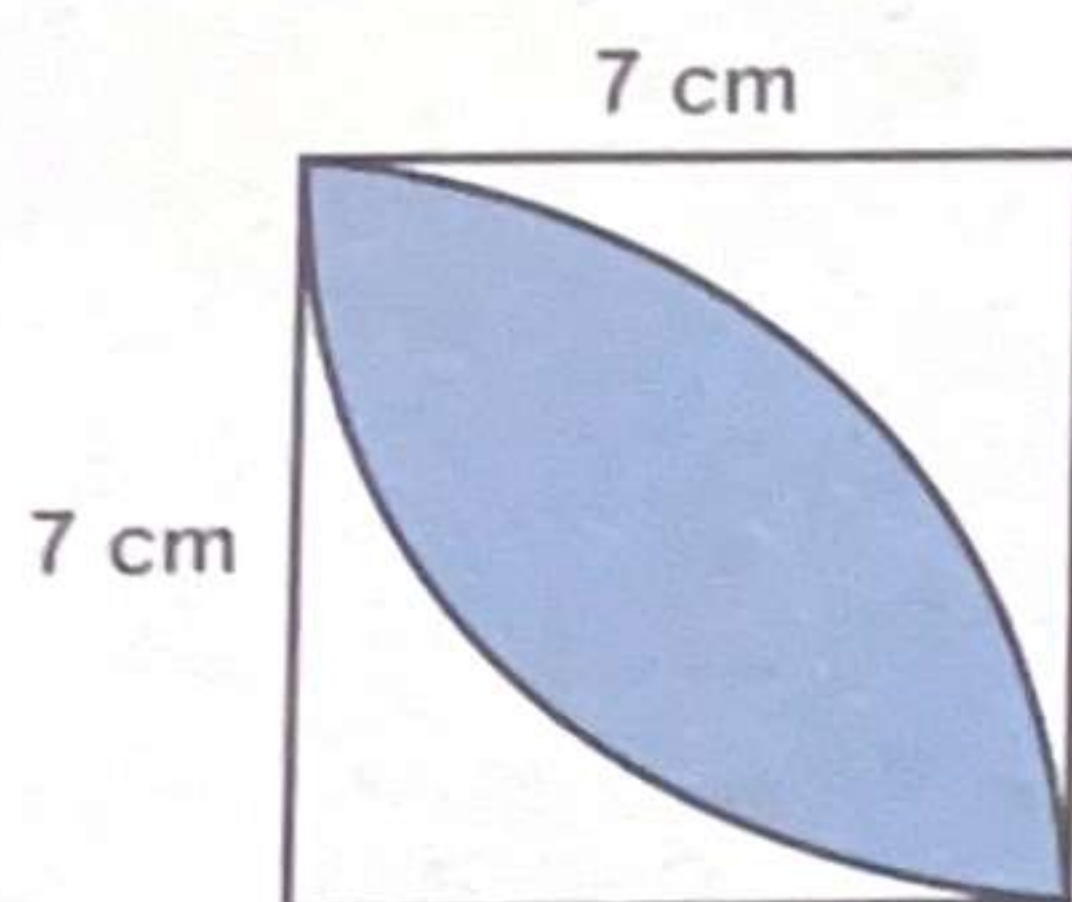


The figure is made up of two overlapping quarter circles.

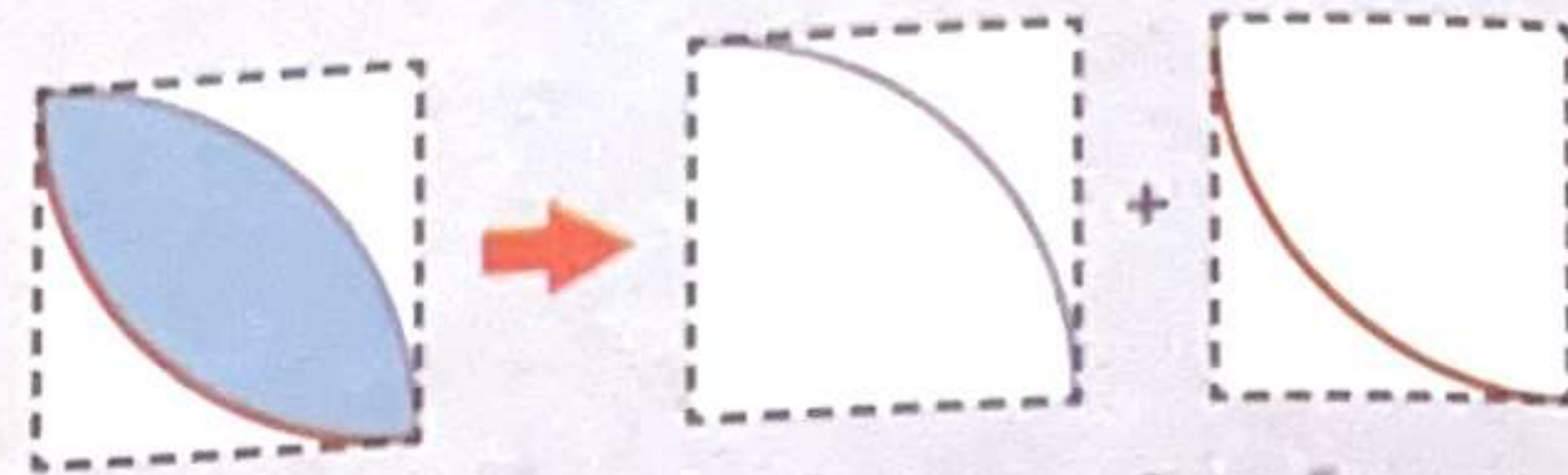
(a) Find the perimeter of the shaded part of the figure.

(b) Find the area of the shaded part.

(Take  $\pi = \frac{22}{7}$ )



The perimeter of the shaded part is made up of the two identical arcs of the quarter circles.



(a)

$$\begin{aligned}\text{Length of arc} &= \frac{1}{4} \times \text{Circumference} \\ &= \frac{1}{4} \times 2 \times \pi \times \text{Radius} \\ &= \frac{1}{4} \times 2 \times \frac{22}{7} \times 7 \\ &= 11 \text{ cm}\end{aligned}$$

$$\begin{aligned}\text{Perimeter of shaded part} &= 2 \times 11 \text{ cm} \\ &= 22 \text{ cm}\end{aligned}$$

The perimeter of the shaded part of the figure is **22 cm**.

(b)

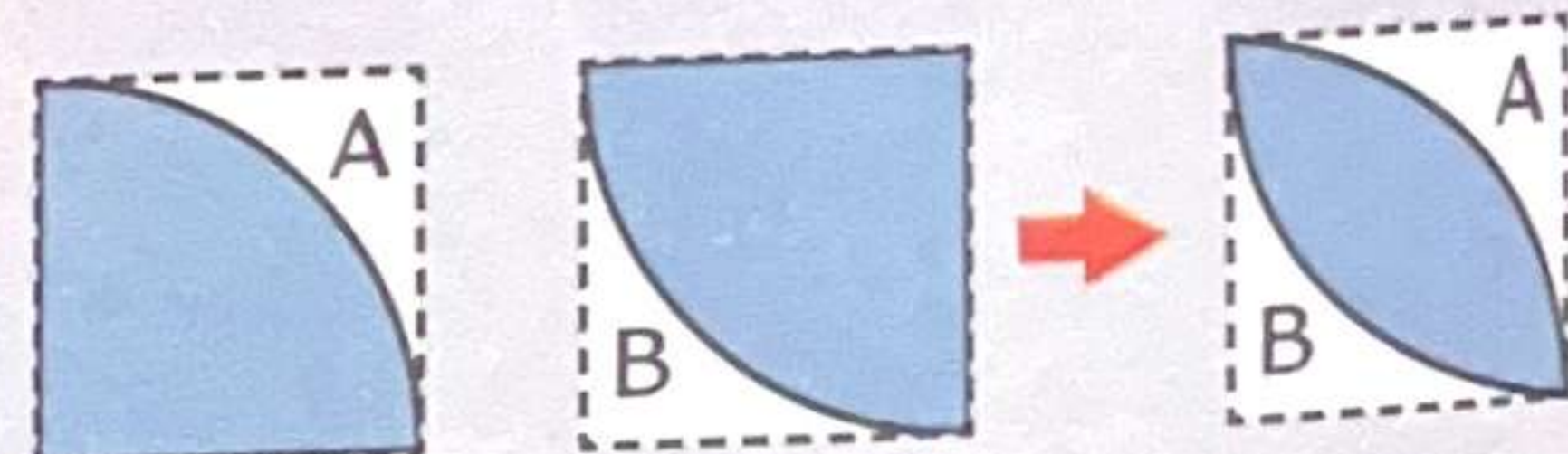
$$\begin{aligned}\text{Area of square} &= 7 \times 7 \\ &= 49 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Area of quarter circle} &= \frac{1}{4} \times \pi \times \text{Radius} \times \text{Radius} \\ &= \frac{1}{4} \times \frac{22}{7} \times 7 \times 7 \\ &= 38.5 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Area of A} &= \text{Area of B} \\ &= 49 \text{ cm}^2 - 38.5 \text{ cm}^2 \\ &= 10.5 \text{ cm}^2\end{aligned}$$

$$\begin{aligned}\text{Area of shaded part} &= 49 \text{ cm}^2 - 10.5 \text{ cm}^2 - 10.5 \text{ cm}^2 \\ &= 28 \text{ cm}^2\end{aligned}$$

The area of the shaded part is **28 cm<sup>2</sup>**.



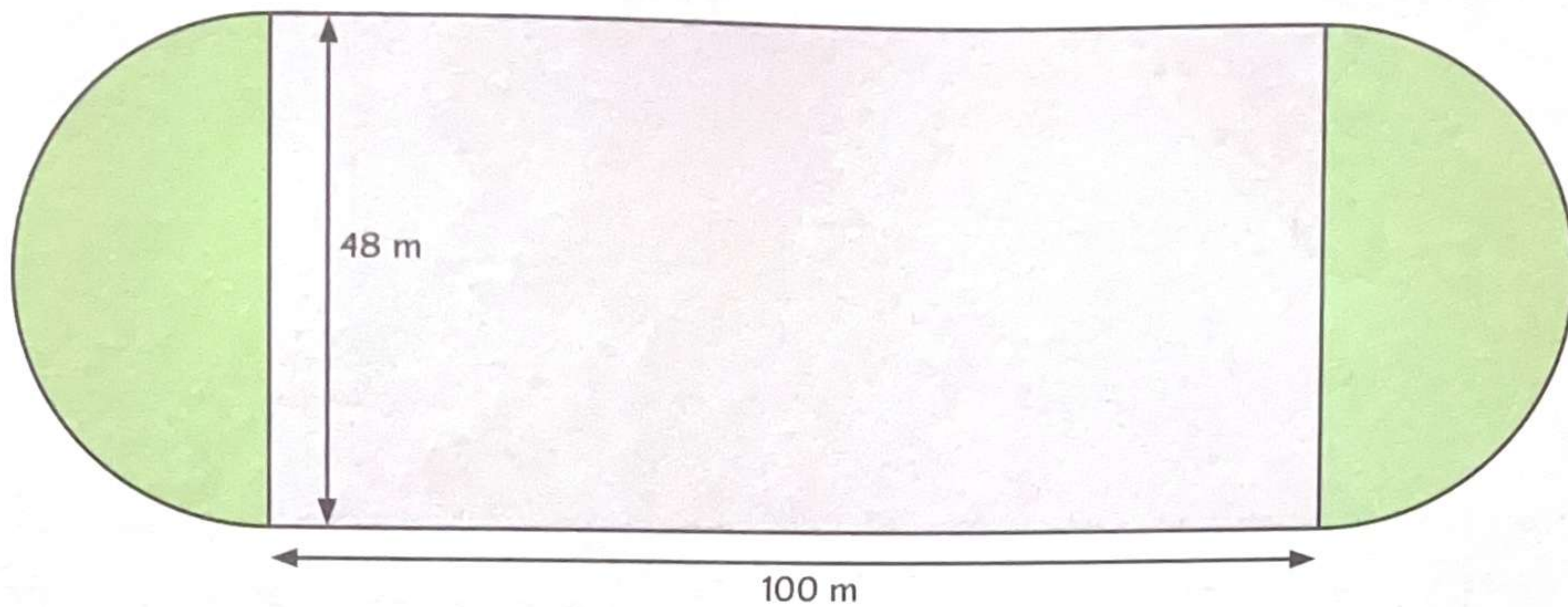
A and B have the same area.

Is there another way to solve this problem?





The figure is made up of a rectangle and two semicircles.  
Find the area of the figure.  
(Take  $\pi = 3.14$ )



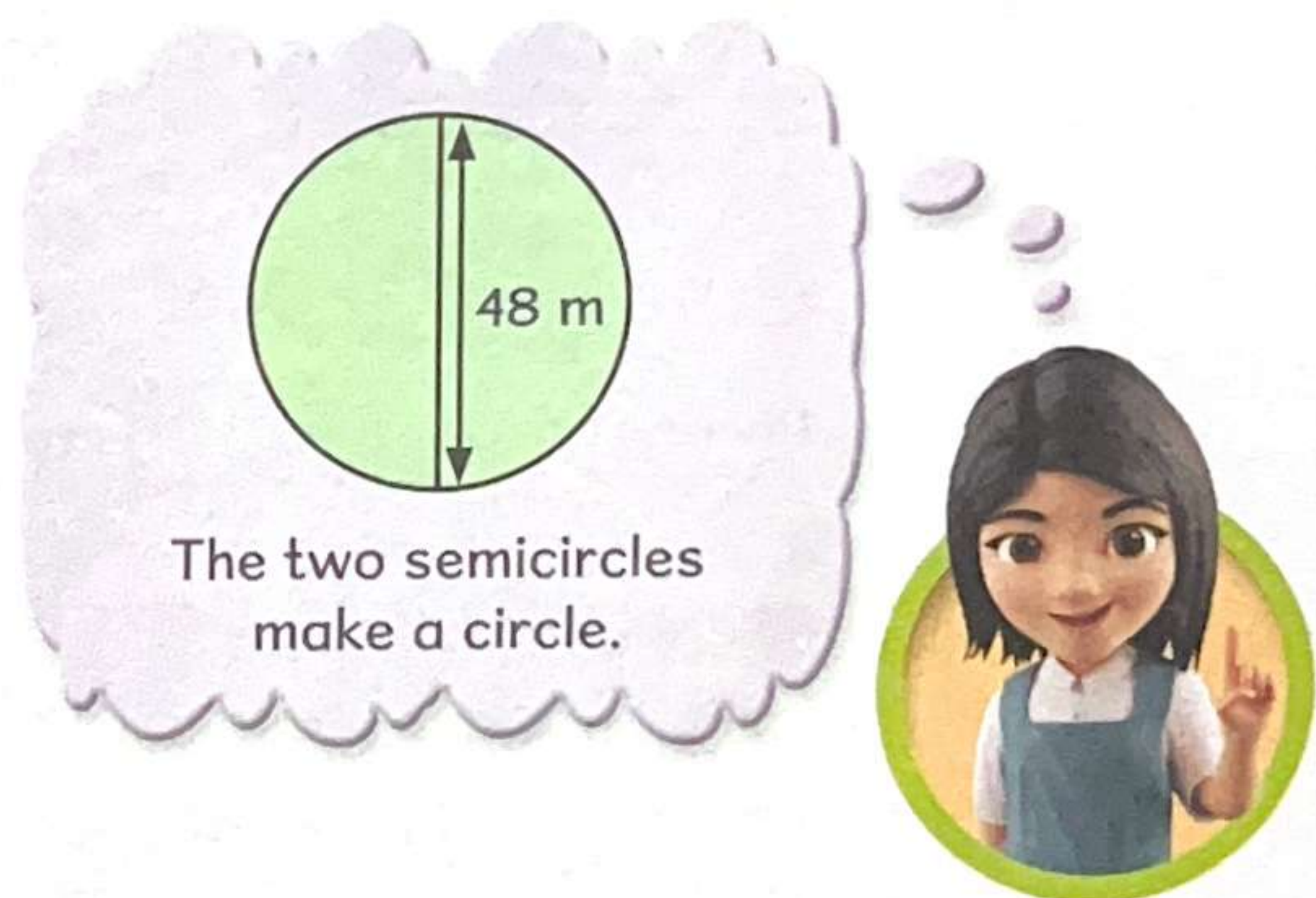
$$\begin{aligned}\text{Radius of circle} &= 48 \text{ m} \div 2 \\ &= 24 \text{ m}\end{aligned}$$

$$\begin{aligned}\text{Area of circle} &= \pi \times \text{Radius} \times \text{Radius} \\ &= 3.14 \times 24 \times 24 \\ &= 1808.64 \text{ m}^2\end{aligned}$$

$$\begin{aligned}\text{Area of rectangle} &= 100 \times 48 \\ &= 4800 \text{ m}^2\end{aligned}$$

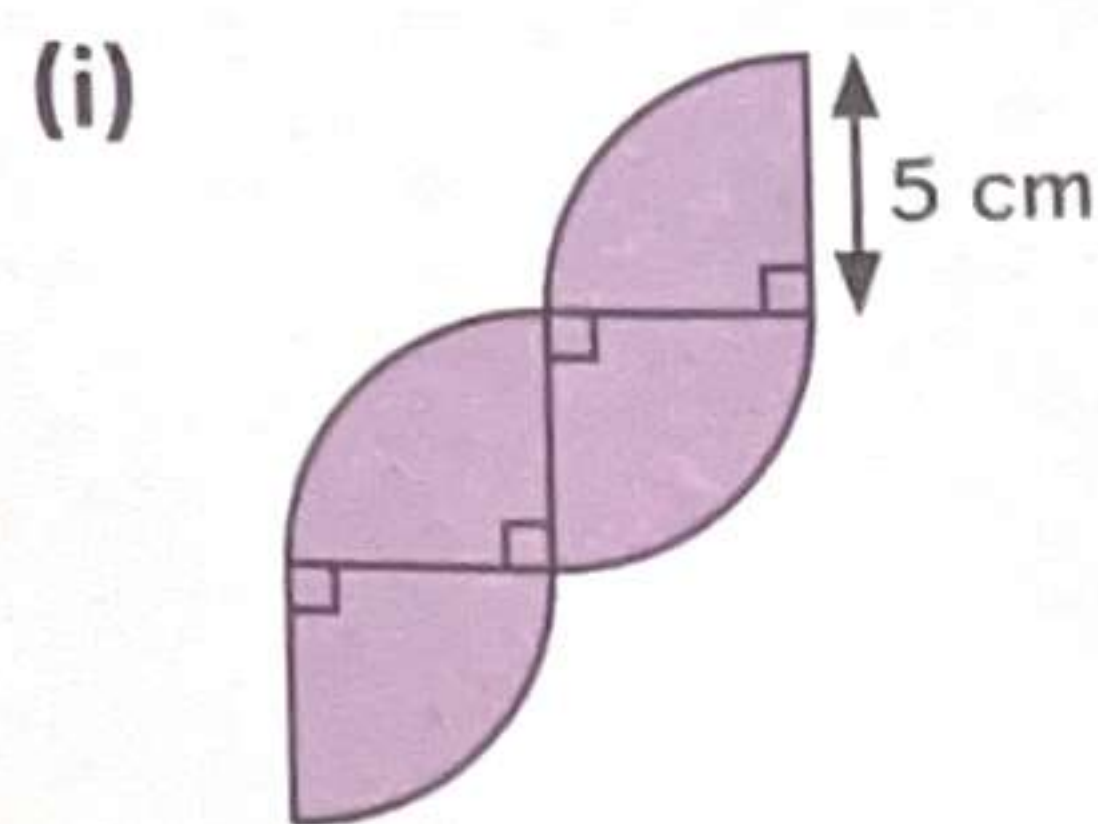
$$\begin{aligned}\text{Area of figure} &= 4800 \text{ m}^2 + 1808.64 \text{ m}^2 \\ &= 6608.64 \text{ m}^2\end{aligned}$$

The area of the figure is **6608.64 m<sup>2</sup>**.

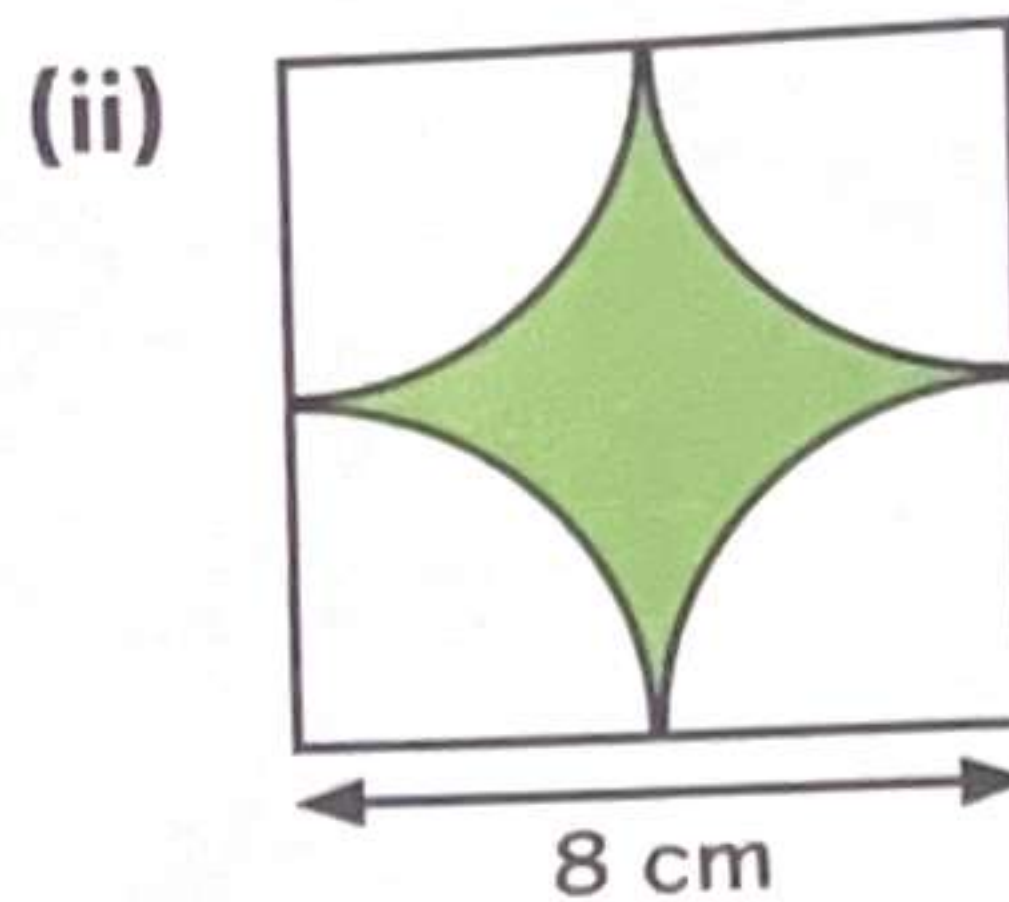




- (a) The figures below are made up of quarter circles. Find the area of the shaded part in each figure. (Take  $\pi = 3.14$ )



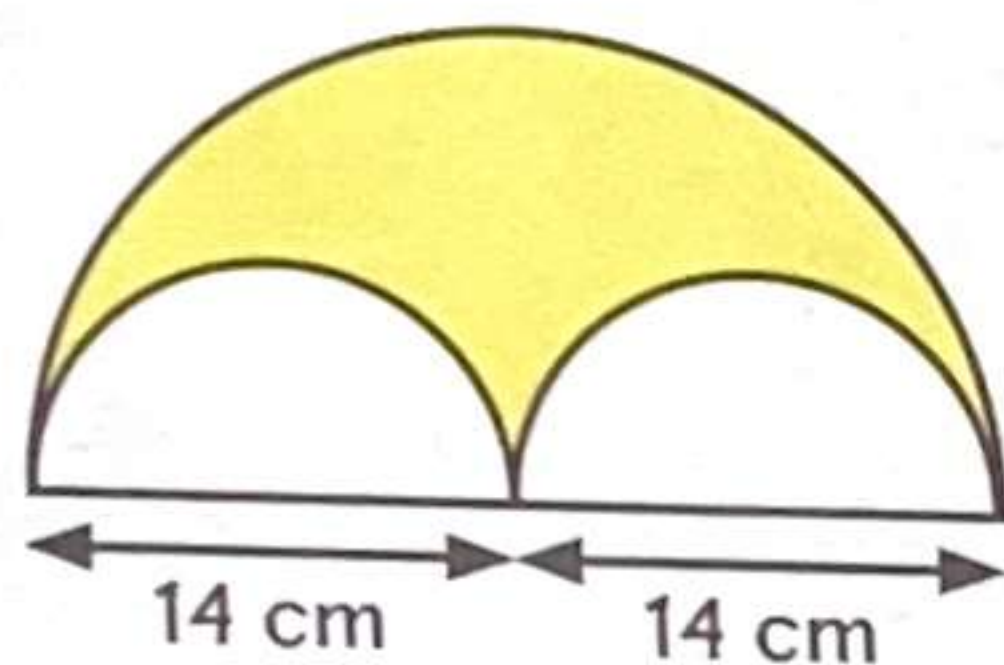
Area =   $\text{cm}^2$



Area =   $\text{cm}^2$

- (b) Find the area and perimeter of the shaded part in each figure. (Take  $\pi = \frac{22}{7}$ )

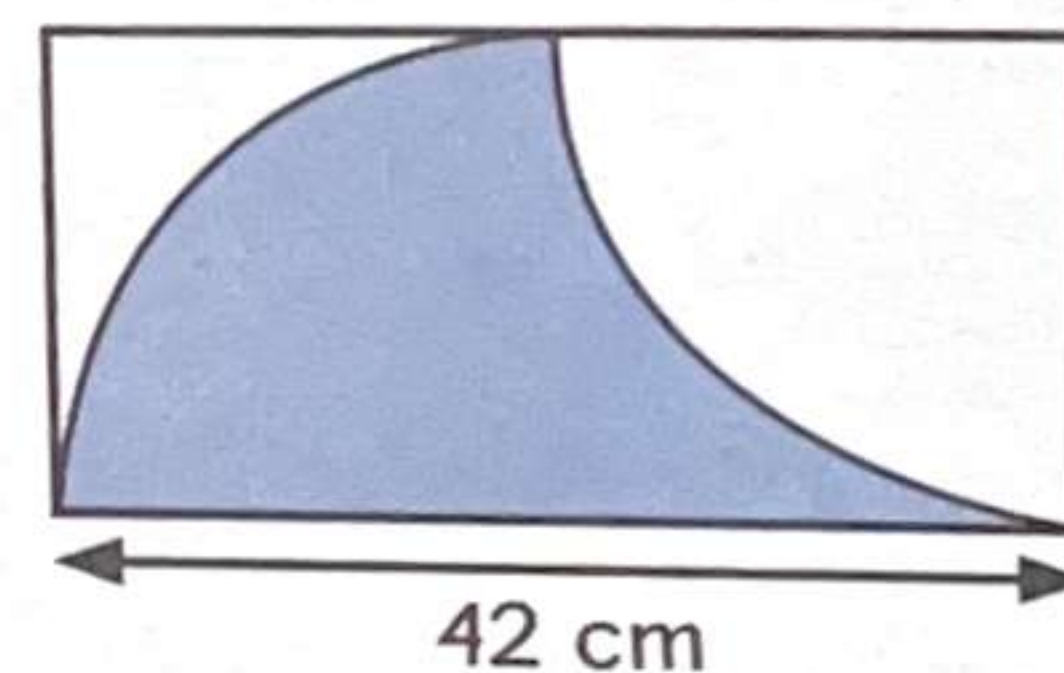
- (i) The figure is made up of semicircles. Find the area and perimeter of the shaded part.



Area =   $\text{cm}^2$

Perimeter =  cm

- (ii) The figure is made up of quarter circles. Find the area and perimeter of the shaded part.



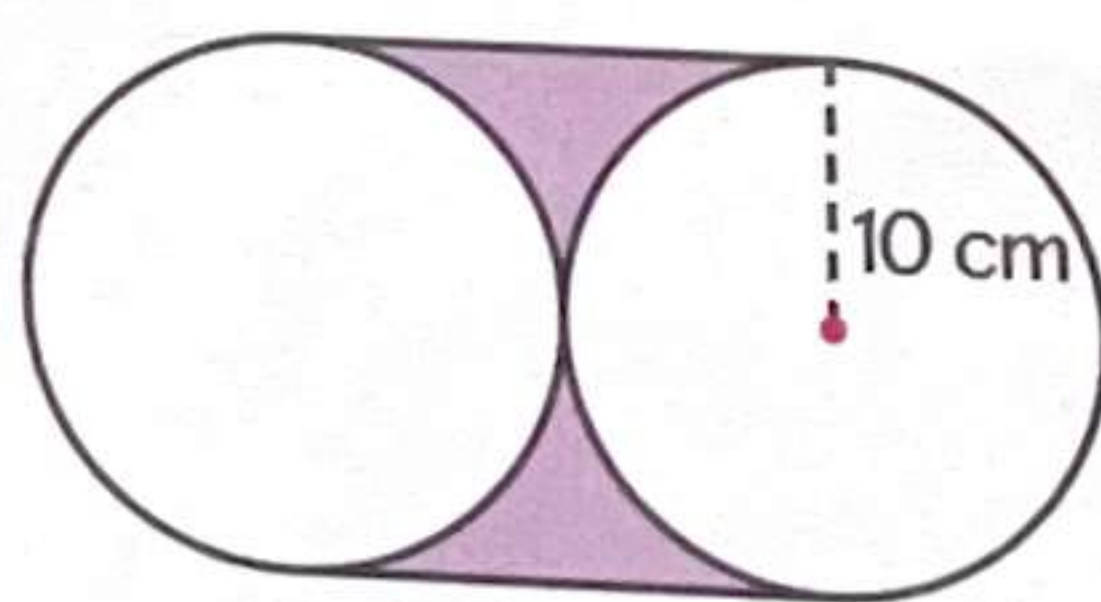
Area =   $\text{cm}^2$

Perimeter =  cm

- (c) The figure shows 2 identical circles with two lines touching the circles. The radius of each circle is 10 cm.

- (i) Find the perimeter of the shaded part.

- (ii) Find the area of the shaded part. (Take  $\pi = 3.14$ )



- (d) The figure shows a curved path that is 7 m wide throughout. The diameters of the smaller semicircles are 28 m each. Find the area of the path. (Take  $\pi = \frac{22}{7}$ )

