

Area of A ----- Area of small square – Area of small quadrant

$$\begin{aligned}
 &= (10 \text{ cm} \times 10 \text{ cm}) - (3.14 \times 10 \text{ cm} \times 10 \text{ cm} \times \frac{1}{4}) \\
 &= 100 \text{ square cm} - 78.5 \text{ square cm} \\
 &= 21.5 \text{ square cm}
 \end{aligned}$$

Area of 1 shaded portion ----

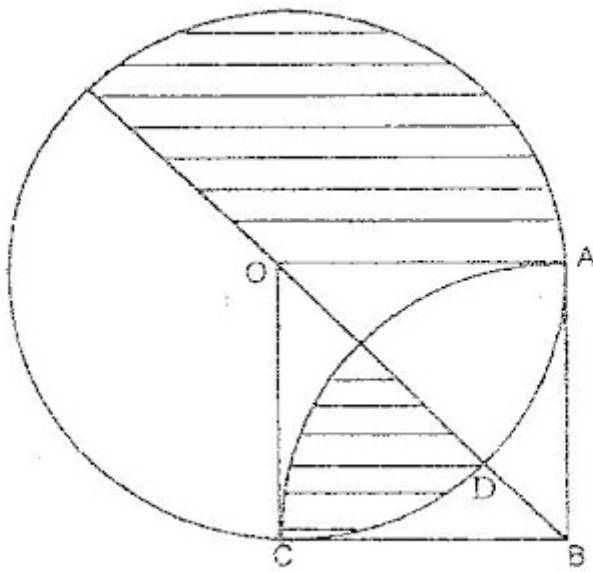
Area of large square – Area of large quadrant – Area of A

$$\begin{aligned}
 &= (20 \text{ cm} \times 20 \text{ cm}) - (3.14 \times 20 \text{ cm} \times 20 \text{ cm} \times \frac{1}{4}) - 21.5 \text{ square cm} \\
 &= (400 - 314 - 21.5) \text{ square cm} \\
 &= 64.5 \text{ square cm}
 \end{aligned}$$

Area of total shaded portion therefore is  $64.5 \text{ square cm} \times 2 = 129 \text{ square cm}$  (Answer)

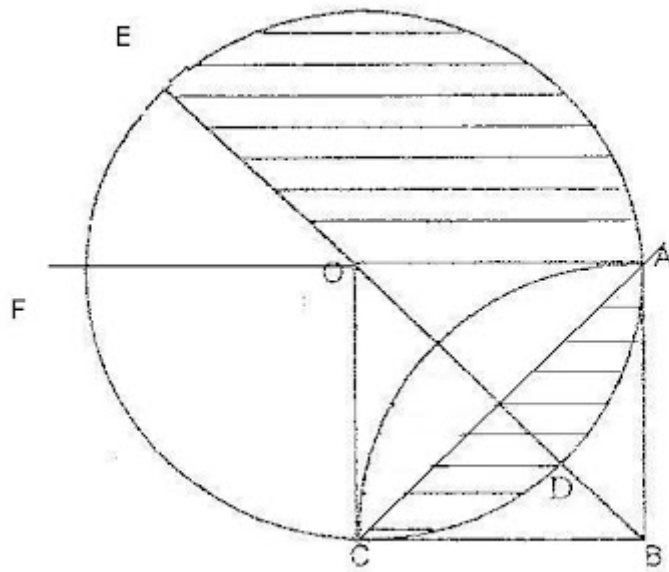
In the figure below, O is the centre of the circle. ABCD is a square and OD is 14 cm. Quadrant OAC is equal to Quadrant BAC. Find the area of the shaded parts.

$$\text{Take } \pi = \frac{22}{7}$$



**Solution**

Reconfiguring the figure ....



**Angle EOC** ----- Angle FOC + Angle FOE

= 90 degrees + 45 degrees

= 135 degrees

Area of EOC is therefore ----

135 degrees divided by 360 degrees --- **3/8 of whole circle**

**Shaded area of circle is**

Area of whole circle – Area of EOC – Area of Triangle AOC

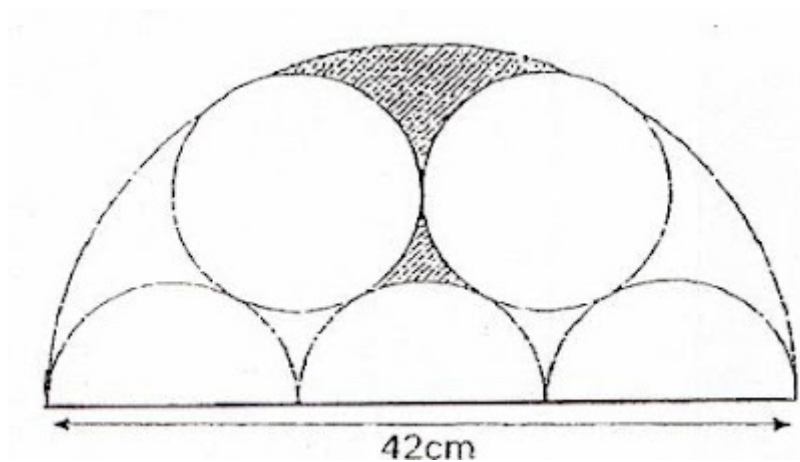
$$\pi r^2 - \frac{3}{8} \pi r^2 - \frac{1}{2} (\text{base})(\text{height})$$

$$(22/7)(14)(14) \text{ square cm} - (3/8)(22/7)(14)(14) \text{ square cm} - (1/2)(14)(14) \text{ square cm}$$

$$= (616 - 231 - 98) \text{ square cm}$$

$$= \mathbf{287 \text{ square cm}}$$

The figure below, not shown to scale, is made up of semi-circles and circles. Given that the diameter of the large semicircle is 42 cm, find the area of the shaded region and express your answer as a fraction in the lowest term.



$$\text{Take } \pi = \frac{22}{7}$$

**Solution**

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

Area of large semi-circle

$$1/2 \times (22/7) \times 21\text{cm} \times 21\text{cm} = 693 \text{ square cm}$$

Area of 1 circle (within large semi-circle)

$$(22/7) \times 7\text{cm} \times 7\text{cm} = 154 \text{ square cm}$$

Note -

Radius of circle is 7cm because diameter of large semi-circle is 42cm. This diameter is equivalent to the total diameters of the 3 smaller semi-circles at the base of the figure above. Diameter of 1 small semi-circle is therefore 42cm divided by 3 = 14cm. Radius of smaller semi-circle (and circle) is hence, 7 cm.

There are 2 circles and 3 smaller semi-circles in the large semi-circle. This is equivalent to an area of 3.5 circles within the large semi-circle. Therefore,

Area of 3.5 circles (within large semi-circle) is

$$154 \text{ square cm} \times 3.5 = 539 \text{ square cm.}$$

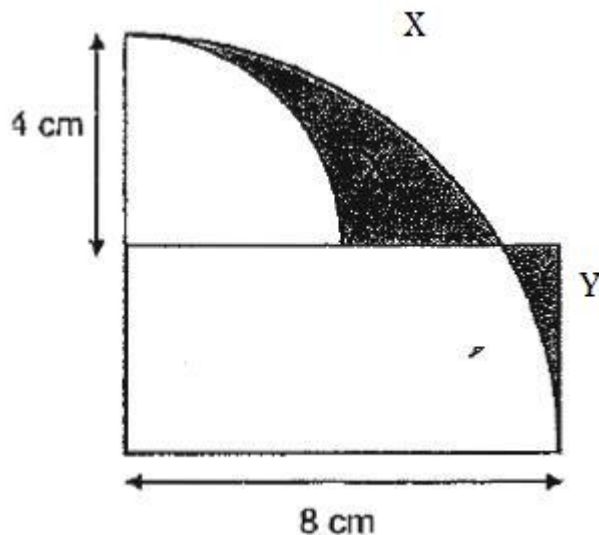
Area of the portion that is inside large semi-circle, but outside the two circles and three small semi-circles is

$$693 \text{ square cm} - 539 \text{ square cm} = 153 \text{ square cm}$$

Area of shaded portion is  $\frac{1}{3}$  the area above, therefore,

$$154 \text{ square cm divided by } 3 \\ = 51 \text{ and } \frac{1}{3} \text{ square cm (Answer)}$$

The figure below shows 2 quarter circles and a rectangle. The radius of the big quarter circle is 8 cm. The radius of the small quarter circle is 4 cm. Find the difference in area between the two shaded parts of X and Y. Use the calculator value of pi and give your answer correct to 1 decimal place.



### Solution

$$\text{Area of rectangle} = 8 \text{ cm} \times 4 \text{ cm} = 32 \text{ square cm}$$

$$\begin{aligned} \text{Area of large quadrant} &= \\ \left(\frac{1}{4}\right) \times \pi \times 8 \text{ cm} \times 8 \text{ cm} \\ &= 16(\pi) \text{ square cm} \end{aligned}$$

$$\begin{aligned} \text{Area of small quadrant} &= \\ \left(\frac{1}{4}\right) \times (\pi) \times 4 \text{ cm} \times 4 \text{ cm} \\ &= 4(\pi) \text{ square cm} \end{aligned}$$

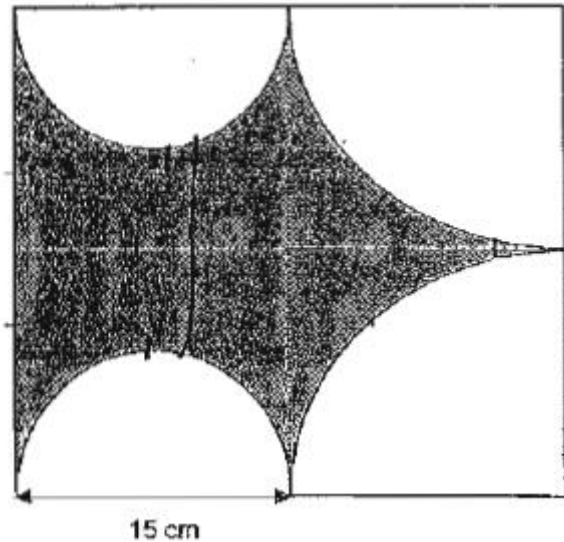
$$\begin{aligned} \text{Area of Large quadrant} - \text{Area of small quadrant} &= \\ 16(\pi) \text{ square cm} - 4(\pi) \text{ square cm} \\ &= 12(\pi) \text{ square cm} \end{aligned}$$

$$\begin{aligned} \text{Difference between the two shaded parts X and Y} &= \\ (12 \times \pi) \text{ square cm} - 32 \text{ square cm} \\ \text{approximately} &= 5.7 \text{ square cm} \end{aligned}$$

**Answer: 5.7 square cm**

The shaded figure below is formed by semicircles, quarter circles and straight lines of 15 cm each. For each of the following, use the calculator value of  $\pi$  to find

- the perimeter of the shaded figure, correct to 2 decimal places.
- the area of the shaded figure, correct to 2 decimal places.



### Solution

(a)

Circumference of 2 semicircles (1 circle)

$$\begin{aligned} &\rightarrow 2\pi r \\ &= 2\pi \times 7.5\text{cm} \\ &= 47.12\text{ cm} \end{aligned}$$

Circumference of 2 quarter circles (1 semi circle)

$$\begin{aligned} &\rightarrow \left(\frac{1}{2}\right)2\pi r \\ &= \left(\frac{1}{2}\right)(2)(\pi) \times 15\text{cm} \\ &= 47.12\text{ cm} \end{aligned}$$

Length of vertical line on the left side of figure

$$\rightarrow 2 \times 15\text{cm} = 30\text{cm}$$

Perimeter of shaded figure

$$\begin{aligned} &\rightarrow 47.12\text{cm} + 47.12\text{cm} + 30\text{cm} \\ &= 124.25\text{cm} \end{aligned}$$

**Answer: 124.25 cm**

(b)

Area of 2 quarter circles (1 semi circle)

$$\begin{aligned} &\rightarrow \left(\frac{1}{2}\right)\pi r^2 \\ &= \left(\frac{1}{2}\right)\pi \times 15\text{cm} \times 15\text{cm} \\ &= 353.43\text{cm}^2 \end{aligned}$$