CHAPTER 12

Areas Related to Circles

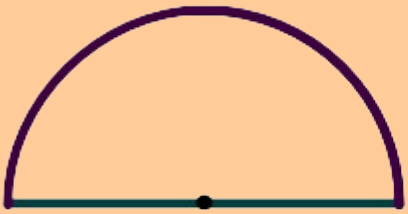
Areas of combinations of plane figures:

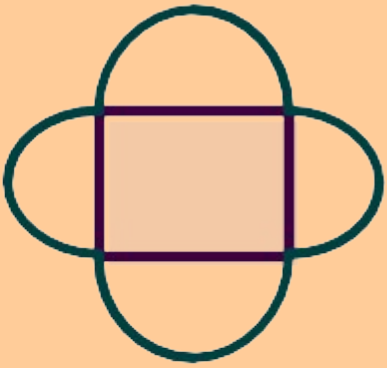
We have seen various types of plane figures, which are combination of two or more figures.

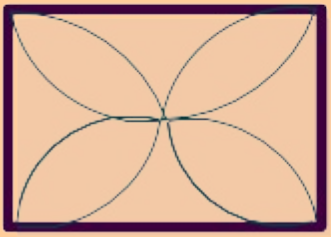
It may be combination of (quadrant and circle), (triangle and semicircle), (rectangle and semicircle) etc.

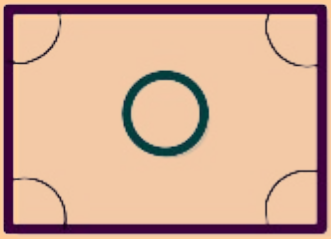
Examples of such type of figures are window design, drain covers, design on table covers etc.

In this session, we will study about how to calculate areas of these figures. Here, we have some combinations.









Example:

Find the area of the segments shaded in figure, if PQ = 24cm;

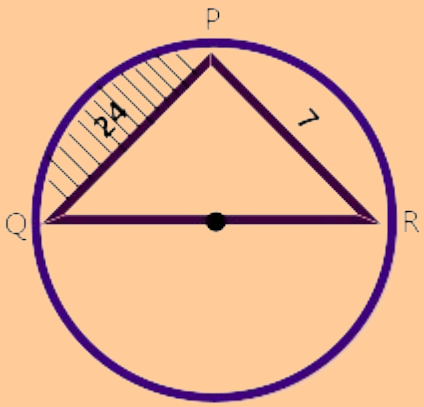
PR =7cm and QR is the diameter of the circle with centre 'O'

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

Sol.

Area of shaded segment =

Area of sector OQPR area of triangle PQR



Any angle made by the diameter QR in the semicircle is 90°.

$\angle QPR = 90°$

By using Pythagoras theorem,

In ΔQPR,

$QR^2 = PQ^2 + PR^2$

$= 24^2 + 7^2$

$= 576 + 49$

Given that,

PQ = 24 cm

PR = 7 cm

$QR^2 = 625$

$QR = \sqrt{625}$

QR = 25 cm

The radius of the circle = $\frac{1}{2}$ QR

$= \frac{1}{2} \times 25$

$= \frac{25}{2}$ cm

Now, Area of semicircle OQPR = $\frac{1}{2}\pi r^2$

$\frac{1}{2} \times \frac{22}{7} \times \frac{25}{2} \times \frac{25}{2}$

= 245.53 cm^2 ..... (1)

Area of right angled triangle QPR = $\frac{1}{2} \times PR \times PQ$

$= \frac{1}{2} \times 7 \times 24^{12}$

= 7 x 12

= 84 cm^2 ..... (2)

From equations (1) & (2),

The area of the shaded segments = 245.53 – 84

The area of the shaded segments = 161.53 cm^2

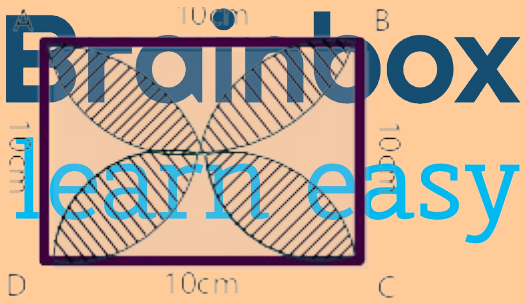
Example:

Find the area of the shaded region given in the figure where ABCD is a square of side 10 cm and semicircles are drawn with each side of the square as diameter $(\text{Use } \pi = 3.14)$.

Sol.

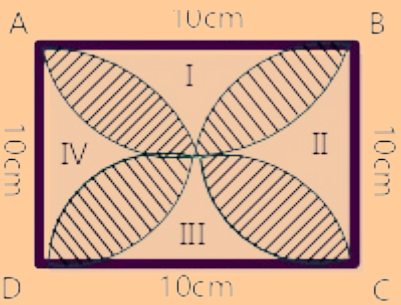
Let us mark the four unshaded regions as,

I, II, III and IV as shown in the figure.



Area of Part I + Area of Part II

= (Area of ABCD) – (Area of two semicircles each of radius 5cm)



$$= (10 \times 10) - \left(2 \times \frac{1}{2} \times \pi \times 5^2\right)$$

$$= 100 - (3.14 \times 25)$$

$$= 100 - 78.5$$

$$= 21.5 \text{ cm}^2$$

Similarly, Area of II + Area of IV = 21.5 cm^2

Area of the shaded design =

(Area of ABCD square) – (Area of I + II + III + IV)

= (10 x 10) – (21.5 + 21.5)

= 100 – 43

Area of the shaded design = 57 cm^2