AREAS OF COMBINATION OF PLANE FIGURES:

In previous classes, we have studied about area of different plane figures like triangle, square, circle etc.

- Area of Circle $= \pi r^2$
- Area of Semi Circle $= \frac{1}{2}\pi r^2$
- Area of triangle $= \frac{1}{2} \times b \times h$
- Area of Equilateral triangle $= \frac{\sqrt{3}}{4}a^2$
- Area of square $= (\text{side})^2$

Now in this section, we shall discuss about combination of plane figures. $e.g.$ Square in the circle, circle in the square etc. Let us discuss a few solved examples:-

1. **Find the area of the shaded region in the figure, where ABCD is a square of side 14 cm.** **[Example 5]**

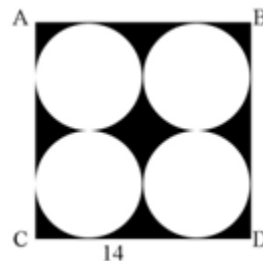**Sol:-** Given Side of the square $= 14\ cm$

∴ **According to diagram**, we have

Diameter of two circles = 14cm

$\Rightarrow$ Diameter of each circle $= 7cm$ $\Rightarrow r = \frac{7}{2}cm$

Now Area of shaded part $=$ **(Area of square ABCD)**

$$-4 \times \textbf{(Area of each circle)}$$

$$= (\text{side})^2 - 4 \times \pi r^2$$

$$= 14 \times 14 - 4 \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = 196 - 154 = \textbf{42 } cm^2$$
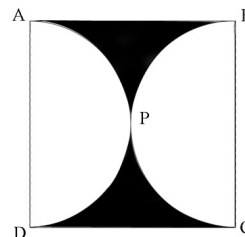
2. **Find the area of the shaded part in the figure, if ABCD is a square of side 14 cm and APD and BPC are semi-circles.** **[Ex 12.3, Q3]**

Sol:- According to diagram, side of the square $=$ diameter of the semi $-$ circle $= 14\ cm$

$\Rightarrow$ radius of semi $-$ circle$(r) = 7cm$

Now Area of shaded part

$$= \textbf{(Area of square ABCD)} - \textbf{2} \times \textbf{(Area of semi circle)}$$

$$= (\text{side})^2 - 2 \times \frac{1}{2}\pi r^2$$

$$= 14 \times 14 - \frac{22}{7} \times 7 \times 7 = 196 - 154 = \mathbf{42\ cm^2}$$

3. **From each of the corner of a square of side 4cm a quadrant of circle of radius 1cm is cut and also a circle of diameter 2 cm is cut as shown in the figure. Find the area of the remaining portion of the square.** **[Ex 12.3, Q5]**

Sol:- Side of the square $= 4\ cm$,

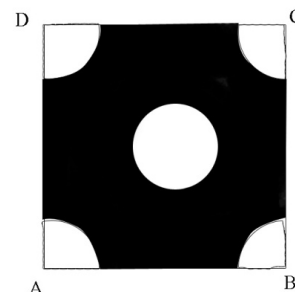radius of quadrant $(r) = 1cm$ and radius of inner circle$(r) = 1cm$

Now Area of shaded part = (**Area of square ABCD**)

$-4 \times$ (**Area of quadrants**) $-$ (**Area of inner circle**)

$$= (\text{side})^2 - 4 \times \frac{1}{4}\pi r^2 - \pi r^2$$

$$= 4 \times 4 - \pi r^2 - \pi r^2 = 16 - 2\pi r^2$$

$$= 16 - 2 \times \frac{22}{7} \times 1 \times 1 = \mathbf{16} - \frac{44}{7} = \frac{112-44}{7} = \frac{\mathbf{68}}{\mathbf{7}}\ \mathbf{cm^2}$$

4. **In figure ABCD is a square of side 14 cm. With centres A, B, C and D, four circles are drawn such that each circle touch externally two of the remaining three circles. Find the area of the shaded region.** **[Ex 12.3, Q7]**

Sol:- Side of the square $= 14\ cm$,

∴ **According to diagram**, we have

Radius of two circles = 14cm

⇒ Radius of each circle $= 7cm$

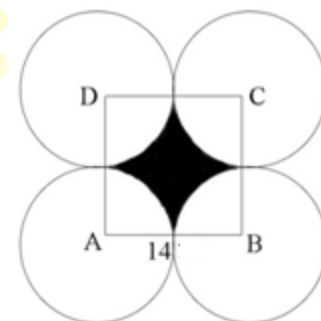**Now Area of shaded part** = (**Area of square ABCD**)

$-4 \times$ (**Area of each quadrant**)

$$= (\text{side})^2 - 4 \times \frac{1}{4}\pi r^2$$

$$= 14 \times 14 - \pi r^2 = 196 - \frac{22}{7} \times 7 \times 7$$
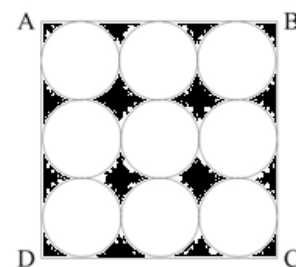
$$= 196 - 154 = \mathbf{42\ cm^2}$$

5. **On a square handkerchief, nine circular designs each of radius 7 cm are made. Find the area of the remaining portion of the handkerchief.** **[Ex 12.3, Q11]**

Sol:- Radius of one circular design $= 7\ cm$,

∴ **According to diagram**, we have

Side of square = 3(Diameter of each circular design) =

$3 \times 14 = 42\ cm$

Now **Area of remaining part of handkerchief = (Area of square ABCD) −**
9 × (Area of each circular design)

$$= (\text{side})^2 - 9 \times \pi r^2$$

$$= 42 \times 42 - 9 \times \frac{22}{7} \times 7 \times 7 = 1764 - 1386 = \textbf{378 } \textbf{\textit{cm}}^2$$