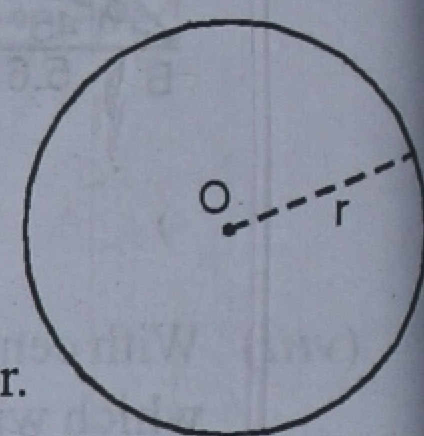
# Unit 5
# Mensuration

## Chapter 23
## Circumference and Area of a Circle

### POINTS TO REMEMBER

**1. Some Important Formulae :**

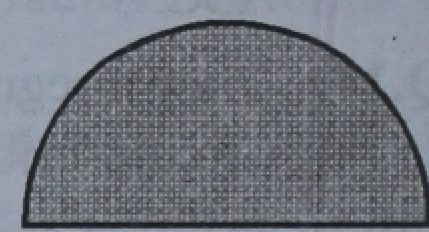



(*i*) For a circle of radius = $r$ units, we have

(*i*) Circumference of the circle = $(2\pi r)$ units

= $(\pi d)$ units, where $d$ is the diameter.

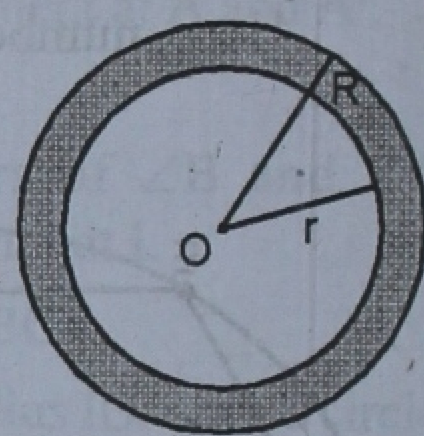
(*ii*) Area of the circle = $(\pi r^2)$ sq. units.



(*ii*) For a semi-circle of radius = $r$ units, we have

(*i*) Area of the semi-circle = $\left(\frac{1}{2}\pi r^2\right)$ sq. units

(*ii*) Perimeter of the semi-circle = $(\pi r + 2r)$ units.



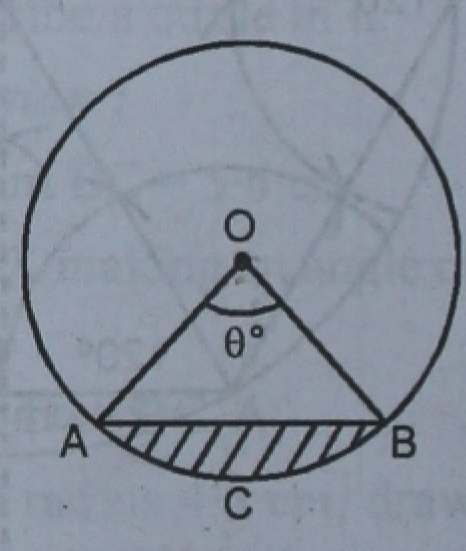

(*iii*) Area of a Circular Ring :

If R and $r$ be the outer and inner radii of a ring, then

**Area of the ring** = $\pi(R^2 - r^2)$ sq. units.

**2. Results on Sectors and Segments :**

Suppose an arc ACB makes an angle $\theta°$ at the centre O of a circle of radius = $r$ units. Then :




(*i*) Length of arc ACB = $\left(\frac{2\pi r\theta}{360}\right)$ units

(*ii*) Area of sector OACBO = $\left(\frac{\pi r^2\theta}{360}\right)$ sq. units

$= \frac{1}{2} \times r \times \left(\frac{2\pi r\theta}{360}\right)$ sq. units

$= \left(\frac{1}{2} \times \text{radius} \times \text{arc length}\right)$ sq. units (*iii*) Perimeter of sector OACBO = length of arc ACB + OA + OB

$$= \left(\frac{2\pi r\theta}{360} + 2r\right) \text{ units.}$$

(*iv*) Area of segment ACBA = (Area of sector OACBO) – (Area of ΔOAB)

$$= \left(\frac{\pi r^2 \theta}{360} - \frac{1}{2} r^2 \sin\theta\right) \text{ sq. units.}$$

(*v*) Perimeter of segment ACBA = (arc ACB + chord AB) units.

(*vi*) Area of Major segment BDAB = (Area of circle) – (Area of minor segment ACBA).

**3. Rotations Made By a Wheel :**

(*i*) Distance moved by a wheel in 1 revolution = Circumference of the wheel.

(*ii*) Number of rotations made by a wheel in unit time

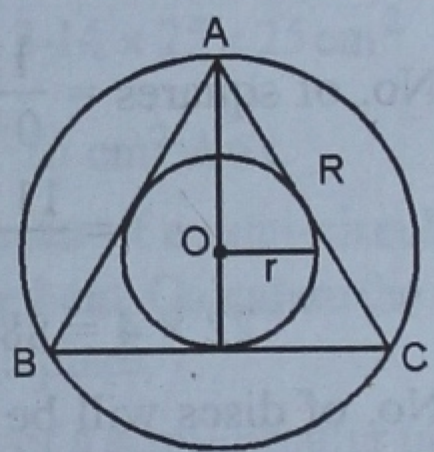
$$= \frac{\text{Distance moved by it in unit time}}{\text{Circumference of the wheel}}$$

**4.** (*i*) Angle described by minute hand in 60 minutes = 360°.

(*ii*) Angle described by minute hand in 5 minutes $= \left(\frac{360}{60} \times 5\right)^\circ = 30^\circ$.

(*iii*) Angle described by hour hand in 12 hours = 360°.

(*iv*) Angle described by hour hand in 1 hour = 30°.




**5.** In an equilateral triangle of side $a$ units, we have

(*i*) Height of the triangle, $h = \frac{\sqrt{3}}{2} a$ *units.*

(*ii*) Area of the triangle $= \left(\frac{\sqrt{3}}{4} a^2\right)$ *sq. units.*

(*iii*) Radius of incircle, $r = \frac{1}{3} h = \left(\frac{1}{3} \cdot \frac{\sqrt{3}}{2} a\right) = \left(\frac{a}{2\sqrt{3}}\right)$ *units.*

(*iv*) Radius of circumcircle, $R = \frac{2}{3} h = \left(\frac{2}{3} \cdot \frac{\sqrt{3}}{2} a\right) = \left(\frac{a}{\sqrt{3}}\right)$ units.

Thus, $r = \frac{a}{2\sqrt{3}}$ and $R = \frac{a}{\sqrt{3}}$.

**Note :** Until and unless stated otherwise take $\pi = \frac{22}{7}$

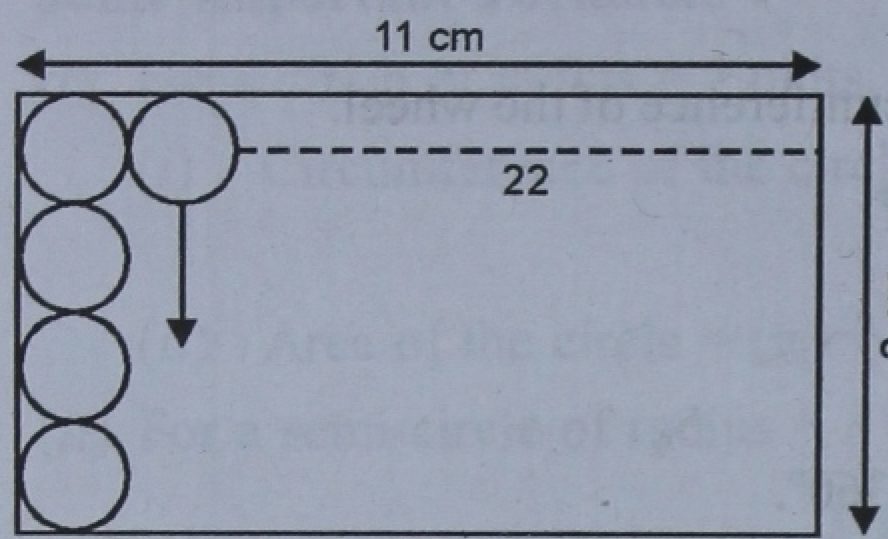
## EXERCISE 23

**Note :** Take $\pi = \frac{22}{7}$, unless mentioned otherwise.

**Q. 1.** A sheet is 11 cm long and 2 cm wide. Circular pieces 0·5 cm in diameter are cut from it to prepare discs. Calculate the number of discs that can be prepared. **(2004)**

**Sol.** Length of sheet = 11 cm

Width of sheet = 2 cm




First of all, we have to cut the sheet in squares of side 0·5 cm.

$\therefore$ No. of squares $= \frac{11}{0\cdot5} \times \frac{2}{0\cdot5}$

$= \frac{11 \times 10}{5} \times \frac{2 \times 10}{5}$

$\Rightarrow \quad 22 \times 4 = 88$

$\therefore$ No. of discs will be equal to number of squares cut out = 88 Ans.

**Q.2.** Find the circumference and area of a circle of radius 17·5 cm.

**Sol.** Radius ($r$) of the circle = 17·5 cm

$\therefore$ Circumference (C) $= 2\pi r$

$= 2 \times \frac{22}{7} \times 17\cdot5 = 110$ cm

And area (A) $= \pi r^2 = \frac{22}{7} \times (17\cdot5)^2$ cm$^2$

$= \frac{22}{7} \times \frac{175}{10} \times \frac{175}{10} = 962\cdot5$ cm$^2$ **Ans.**

**Q.3.** Find the circumference and area of a circle of diameter 91 cm.

**Sol.** Diameter of a circle = 91 cm.

$\therefore$ Radius ($r$) $= \frac{91}{2}$ cm.

$\therefore$ Circumference (C) $= 2\pi r$

$= 2 \times \frac{22}{7} \times \frac{91}{2}$ cm $\doteq 286$ cm

And Area (A) $= \pi r^2 = \frac{22}{7} \times \frac{91}{2} \times \frac{91}{2}$ cm$^2$

$= \frac{26026}{4}$ cm$^2$ $= 6506\cdot5$ cm$^2$ **Ans.**

**Q.4.** Find the circumference and area of a circle of radius 15 cm. (Take $\pi = 3\cdot14$)

**Sol.** Radius of a circle ($r$) = 15 cm

$\therefore$ Circumference (C) $= 2\pi r$

$= 2 \times 3\cdot14 \times 15 = 94\cdot2$ cm

And Area (A) $= \pi r^2 = 3\cdot14 \times (15)^2$ cm$^2$

$= 3\cdot14 \times 15 \times 15 = 706\cdot5$ cm$^2$ **Ans.**

**Q. 5.** The circumference of a circle is 123·2 cm. Taking $\pi = \frac{22}{7}$, calculate : **(1996)**

(*i*) The radius of the circle in cm ;

(*ii*) The area of the circle in cm$^2$, correct to the nearest cm$^2$ ;

(*iii*) The effect on the area of the circle if the radius is doubled.

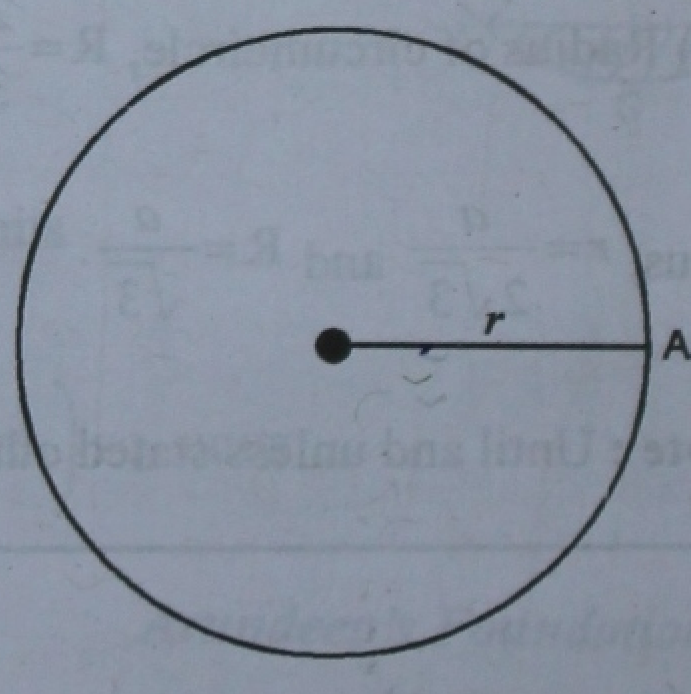
**Sol.** The circumference of a circle = 123·2 cm

(*i*) Let, radius of the circle be $r$, then

$2\pi r = 123\cdot2$

$\Rightarrow \frac{2 \times 22}{7} r = 123\cdot2$

$r = \frac{123\cdot2 \times 7}{2 \times 22} = 19\cdot6$ cm



(*ii*) Area of the circle

$= \pi r^2 = \frac{22}{7}(19{\cdot}6)^2 \text{ cm}^2$

$= \frac{22}{7} \times 19{\cdot}6 \times 19{\cdot}6$

$= 1207{\cdot}36 \text{ cm}^2$

$= 1207$ cm (Approx.)

(*iii*) If the radius is doubled,

Then, effect of the area of the circle

$= \frac{\pi r^2}{\pi(2r)^2} = \frac{\pi r^2}{4\pi r^2} = \frac{1}{4}$

∴ Area of the resulting circle is four times the area of the original circle.

**Q. 6.** Find the length of a rope by which a cow must be tethered in order that it may be able to graze an area of 9856 $m^2$.

**Sol.** Let length of rope = $r$ m.

∴ radius = $r$ m

and Area of another place = 9856 $\text{m}^2$

According to the condition,

$\pi r^2 = 9856 \Rightarrow \frac{22}{7}r^2 = 9856$

$\Rightarrow r^2 = \frac{9856 \times 7}{22} = 448 \times 7 = 3136$

$(r)^2 = (56)^2$

∴ $r = 56$ m

Hence, length of rope = 56 m. **Ans.**

**Q. 7.** The area of a circle is $394{\cdot}24 \text{ cm}^2$. Calculate :

(*i*) the radius of the circle,

(*ii*) the circumference of the circle.

**Sol.** Area of the circle = $394{\cdot}24 \text{ cm}^2$

(*i*) Let radius of the circle = $r$

∴ $\pi r^2 = 394{\cdot}24$

$\Rightarrow \frac{22}{7}r^2 = 394{\cdot}24$

$\Rightarrow r^2 = \frac{394{\cdot}24 \times 7}{22}$

$\Rightarrow r^2 = 125{\cdot}44 = (11{\cdot}2)^2$

∴ $r = 11{\cdot}2$ cm

(*ii*) Circumference = $2\pi r$

$= 2 \times \frac{22}{7} \times 11{\cdot}2 \text{ cm}$

$= 70{\cdot}4$ cm **Ans.**

**Q. 8.** Find the perimeter and area of a semi-circular plate of radius 25 cm. (Take $\pi = 3{\cdot}14$).

**Sol.** Radius ($r$) of the semi-circular plate = 25 cm

∴ Circumference $= \frac{1}{2} \times 2\pi r + 2r$

$= \frac{2 \times 3{\cdot}14 \times 25}{2} + 2 \times 25$ cm

$= \frac{157{\cdot}0}{2} + 50 = 128{\cdot}5$ cm

And area of the circle $= \frac{1}{2}\pi r^2$

$= \frac{1}{2} \times 3{\cdot}14 \times 25 \times 25 \text{ cm}^2$

$= 981{\cdot}25 \text{ cm}^2$ **Ans.**

**Q. 9.** The perimeter of a semi-circular metalic plate is 86·4 cm. Calculate the radius and area of the plate.

**Sol.** Perimeter of a semi-circular plate = 86·4 cm.

Let the radius of the plate = $r$

∴ $\pi r + 2r = 86{\cdot}4$

$\frac{22}{7}r + 2r = 86{\cdot}4 \Rightarrow \frac{36}{7}r = 86{\cdot}4$

$\Rightarrow r = \frac{86{\cdot}4 \times 7}{36} = 16{\cdot}8$ cm

Area of the plate $= \frac{1}{2}\pi r^2$

$= \frac{1}{2} \times \frac{22}{7} \times (16{\cdot}8)^2 \text{ cm}^2$

$= \frac{11}{7} \times 16{\cdot}8 \times 16{\cdot}8$

$= 443{\cdot}52 \text{ cm}^2$ **Ans.**

**Q. 10.** The circumference of a circle exceeds its diameter by 180 cm. Calculate :

(*i*) the radius

(*ii*) the circumference and

(*iii*) the area of the circle.

**Sol.** Let the radius of the circle = $r$

then circumference = $2\pi r$

(*i*) $\therefore \quad 2\pi r - 2r = 180$

$$\Rightarrow \frac{2\times 22}{7}r - 2r = 180$$

$$\Rightarrow \frac{44-14}{7}r = 180 \Rightarrow \frac{30}{7}r = 180$$

$$\Rightarrow r = \frac{180\times 7}{30} = 42\text{cm.}$$

(*ii*) Circumference = $2\pi r$

$$= 2\times\frac{22}{7}\times 42 = 264\text{ cm}$$

(*iii*) Area of the circle $= \pi r^2$

$$= \frac{22}{7}\times(42)^2\text{ cm}^2$$

$$= \frac{22}{7}\times 42\times 42 = 5544\text{ cm}^2 \textbf{ Ans.}$$

**Q. 11.** A copper wire when bent in the form of a square encloses an area of 272·25 $cm^2$. If the same wire is bent into the form of a circle, what will be the area enclosed by the wire ?

**Ans.** Area of a square = 272·25 $cm^2$

Let '$a$' be the side of the square,

Then, $a^2 = 272{\cdot}25$

$$\Rightarrow \quad a = \sqrt{272{\cdot}25} = 16{\cdot}5\text{cm}$$

$\therefore$ Side of the square = 16·5 cm

Then, perimeter = $4a = 4\times 16{\cdot}5 = 66$ cm.

Now, the circumference of the circular wire = 66 cm

Let $r$ be the radius of the circular wire,

Then, $2\pi r = 66$

$$\Rightarrow \frac{2\times 22}{7}r = 66 \quad \Rightarrow r = \frac{66\times 7}{2\times 22} = \frac{21}{2}\text{ cm}$$

$$\therefore \text{Area} = \pi r^2 = \frac{22}{7}\times\left(\frac{21}{2}\right)^2\text{ cm}^2$$

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

$$= 346\cdot 5\text{cm}^2 \textbf{ Ans.}$$

**Q. 12.** A copper wire when bent in the form of an equilateral triangle has an area of $121\sqrt{3}$ $cm^2$. If the same wire is bent into the form of a circle, find the area enclosed by the wire.

**Sol.** Area of an equilateral triangle $= 121\sqrt{3}\text{ cm}^2$

Let side of the triangle = $a$

Then, $\frac{\sqrt{3}}{4}a^2 = 121\sqrt{3}$

$$\Rightarrow \quad a^2 = \frac{121\sqrt{3}\times 4}{\sqrt{3}}$$

$\Rightarrow a^2 = 484 = (22)^2$

$\therefore \quad a = 22$ cm.

Now, the perimeter of the wire = $3a$

$= 3\times 22 = 66$ cm

Then, circumference of the circular wire = 66 cm

Let $r$ be the radius, then

$$2\pi r = 66 \quad \Rightarrow \frac{2\times 22}{7}\times r = 66$$

$$\Rightarrow r = \frac{66\times 7}{2\times 22} = \frac{21}{2}\text{ cm.}$$

$\therefore$ Area enclose by it = $\pi r^2$

$$= \frac{22}{7}\times\left(\frac{21}{2}\right)^2\text{ cm}^2$$

$$= \frac{22}{7}\times\frac{21}{2}\times\frac{21}{2} = 346{\cdot}5\text{cm}^2 \textbf{ Ans.}$$

**Q. 13.** The circumference of a circular field 528 m. Calculate :

(*i*) its radius ; (*ii*) its area ;

(*iii*) the cost of levelling the field at Rs. 1·5 per $m^2$.

**Sol.** Circumference of the circular field = 528 m.

(*i*) Let $r$ be the radius of the field, then

$$2\pi r = 528 \Rightarrow 2\times\frac{22}{7}\times r = 528$$

$$\Rightarrow \quad r = \frac{528\times 7}{2\times 22} = 84\,\text{m}$$

(*ii*) The area of the field $= \pi r^2 = \frac{22}{7}\times(84)^2\,\text{m}^2$

$$= \frac{22}{7}\times 84\times 84 = 22176\,\text{m}^2$$

(*iii*) Rate of levelling the field = Rs. 1·50 per $\text{m}^2$

∴ Total cost = Rs. 1·50 × 22176

= Rs. 33264 **Ans.**

**Q. 14.** The cost of levelling a circular field at Rs. 2 per sq. metre is Rs. 33957. Calculate :

(*i*) the area of the field ;

(*ii*) the radius of the field ;

(*iii*) the circumference of the field ;

(*iv*) the cost of fencing it at Rs. 2·75 per metre.

**Sol.** (*i*) Cost of levelling the field = Rs. 33957

Rate of levelling = Rs. 2 per sq. metre

$$\therefore \text{ Area of the field } = \frac{33957}{2} = 16978\cdot 5\,\text{m}^2$$

(*ii*) Let $r$ be the radius of the field, then

$$\pi r^2 = 16978\cdot 5$$

$$\Rightarrow \frac{22}{7}\times r^2 = 16978\cdot 5$$

$$\Rightarrow \quad r^2 = \frac{16978\cdot 5\times 7}{22} = 5402\cdot 25$$

$$\Rightarrow \quad r = \sqrt{5402\cdot 25} = 73\cdot 5\,\text{m}.$$

∴ Radius = 73·5 m.

(*iii*) The circumference $= 2\pi r$

$$= 2\times\frac{22}{7}\times 73\cdot 5\,m$$

$$= 462\,\text{m}$$

(*iv*) Cost of fencing at the rate of Rs. 2·75 per metre

= 462 × Rs. 2·75 = Rs. 1270·50 **Ans.**

**Q. 15.** The cost of fencing a circular field at Rs. 9·50 per metre is Rs. 2926. Find the cost of ploughing the field at Rs. 1·50 per sq. metre.

**Sol.** Rate of fencing the circular field

= Rs. 9·50 per metre

Total cost = Rs. 2926

$$\therefore \text{ Circumference } = \frac{2926}{9\cdot 50} = 308\,\text{m}$$

Let $r$ be the radius of the circular field

then $2\pi r = 308 \quad \Rightarrow 2\times\frac{22}{7}r = 308$

$$\Rightarrow \quad r = \frac{308\times 7}{2\times 22} \Rightarrow \quad r = 49$$

Now, area of the field $= \pi r^2$

$$= \frac{22}{7}(49)^2\,m^2$$

$$= \frac{22}{7}\times 49\times 49 = 7546\,\text{m}^2$$

Rate of ploughing the field = Rs. 1·50 per $\text{m}^2$

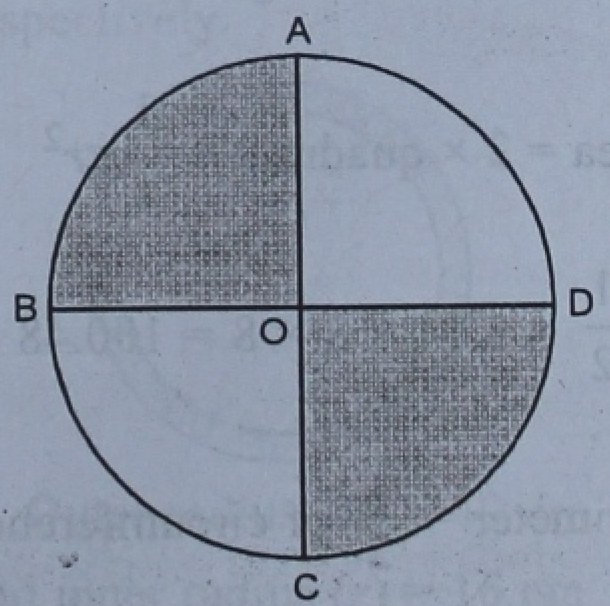
∴ Total cost = Rs. 1·50 × 7546

= Rs. 11319 **Ans.**

**Q. 16.** AC and BD are two perpendicular diameters of a circle ABCD. Given that the area of the shaded portion is 308 $\text{cm}^2$ ; calculate : **(2004)**

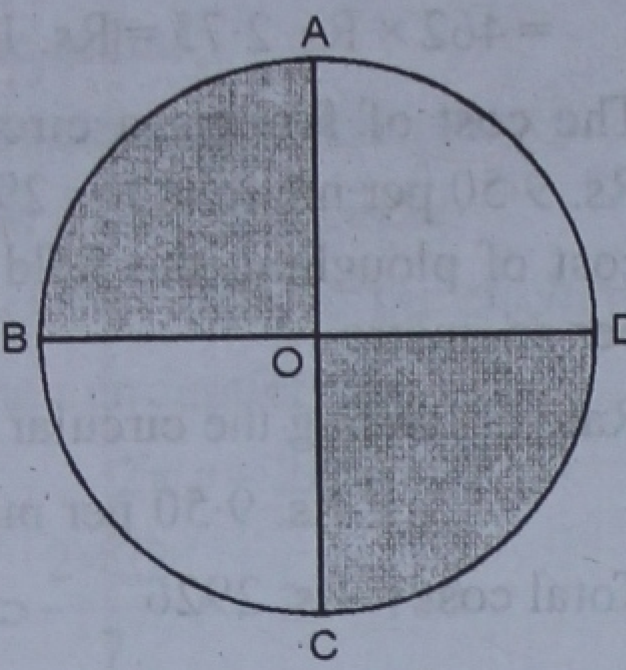
(*i*) The length of AC ; and

(*ii*) The circumference of the circle.



**Sol.** Area of AOB + Area of COD = 308 $cm^2$

Let $r$ be the radius of the circle




$$308 = \frac{1}{4}\pi r^2 + \frac{1}{4}\pi r^2 \Rightarrow 308 = \frac{1}{2}\pi r^2$$

$$\Rightarrow 308 = \frac{1}{2} \times \frac{22}{7} r^2$$

$$\Rightarrow r^2 = \frac{308 \times 2 \times 7}{22} = 196 = (14)^2$$

$\therefore$ $r = 14$ cm.

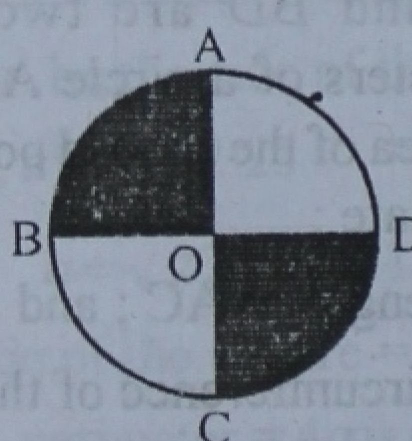
$\therefore$ Radius = 14 cm and diameter

AC = 2 × 14 = 28 cm

Now, circumference of the circle = $2\pi r$

$$= 2 \times \frac{22}{7} \times 14 = 88 \text{ cm}$$ **Ans.**

**17.** AC and BD are two perpendicular diameters of a circle with centre O. If AC = 16 cm, calculate the area and perimeter of the shaded part. (Take $\pi = 3.14$). **(2009)**




**Sol.** Area = 2 × quadrant = $\frac{1}{2}\pi r^2$

$$= \frac{1}{2} \times 3.14 \times 8 \times 8 = 100.48 \text{ cm}^2$$

Perimeter = $\frac{1}{2}$ of circumference + $4r$

$$= \pi r + 4r = r(\pi + 4) = 8(3.14 + 4)$$

$$= 8 \times 7.14 = 57.12 \text{ cm}$$

**Q. 18.** The sum of the radii of two circles is 140 cm and the difference of their circumferences is 88 cm. Find the radii of the two circles.

**Sol.** Let R and $r$ be the radii of the two circles

Then, $R + r = 140$

and $2\pi R - 2\pi r = 88$

$$\Rightarrow 2\pi(R - r) = 88 \Rightarrow 2 \times \frac{22}{7}(R - r) = 88$$

$$\Rightarrow R - r = \frac{88 \times 7}{2 \times 22} = 14$$

$\therefore$ $R + r = 140$ ...(*i*)

and $R - r = 14$ ...(*ii*)

Adding, we get, 2R = 154 $\Rightarrow$ R = 77

and subtracting, we get, $2r = 126$

$$\Rightarrow r = \frac{126}{2} = 63$$

Hence, radii of the two circles are 77 m and 63 m **Ans.**

**Q. 19.** The sum of the radii of two circles is 84 cm and the difference of their areas is 5544 $cm^2$. Calculate the radii of the two circles.

**Sol.** Let R and $r$ be the radii of the two circles, then $R + r = 84$ ...(*i*)

and $\pi R^2 - \pi r^2 = 5544$

$$\Rightarrow \pi(R^2 - r^2) = 5544$$

$$\Rightarrow \frac{22}{7}(R^2 - r^2) = 5544$$

$$\Rightarrow R^2 - r^2 = \frac{5544 \times 7}{22}$$

$\Rightarrow (R + r)(R - r) = 1764$ ...(*ii*)

$\Rightarrow 84(R - r) = 1764$ {from (*i*)}

$$\Rightarrow R - r = \frac{1764}{84} = 21$$

Now, $R + r = 84$, $R - r = 21$

Adding, we get, 2R = 105

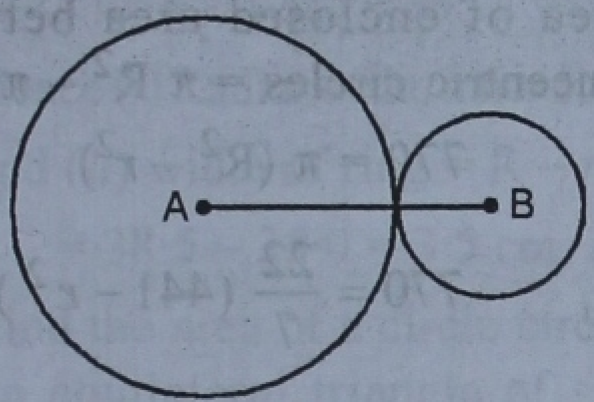
$\Rightarrow \qquad R = \dfrac{105}{2} = 52{\cdot}5$ cm

And subtracting, $2r = 63$

$\Rightarrow \qquad r = \dfrac{63}{2} = 31{\cdot}5$ cm

$\therefore$ Radii of the two circles are 52·5 cm and 31·5 cm **Ans.**

**Q. 20.** Two circles touch externally. The sum of their areas is $117\,\pi$ cm$^2$ and the distance between their centres is 15 cm. Find the radii of the two circles.




**Sol.** Let R and $r$ be the radii of two circles,

Then $\qquad R + r = 15$ cm $\qquad ...(i)$

and $\pi R^2 + \pi r^2 = 117\,\pi$

$\Rightarrow \quad \pi(R^2 + r^2) = 117\pi \quad \Rightarrow \quad R^2 + r^2 = 117$

$(R + r)^2 = (15)^2$

$\Rightarrow R^2 + r^2 + 2Rr = 225 \quad \Rightarrow \quad 117 + 2Rr = 225$

$\Rightarrow 2Rr = 225 - 117 = 108$

$\therefore 2Rr = 108$

Now, $(R - r)^2 = R^2 + r^2 - 2Rr$

$= 117 - 108 = 9 = (3)^2$

$\therefore \qquad R - r = 3 \qquad ...(ii)$

Adding $(i)$ and $(ii)$,

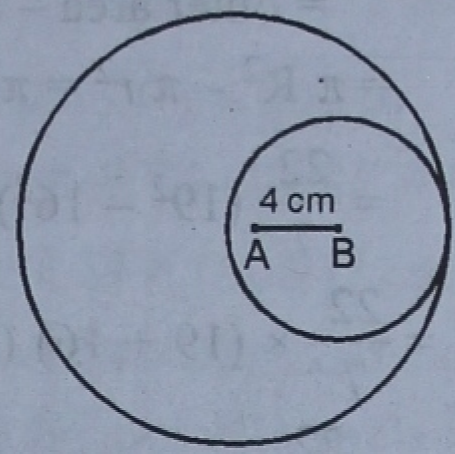
$2R = 18 \Rightarrow \quad R = \dfrac{18}{2} = 9$

Subtracting $(ii)$ from $(i)$

$2r = 12 \Rightarrow \quad r = 6$

$\therefore$ Radii of the two circles are 9 cm and 6 cm.

**Q. 21.** Two circles touch internally. The sum of their areas is $170\,\pi$ cm$^2$ and the distance between their centres is 4 cm. Find the radii of the circles.




**Sol.** Let R and $r$ be the radii of the two circles, then $R - r = 4$ cm $\qquad ...(i)$

and, sum of their areas $= 170\pi$

$\Rightarrow \qquad \pi R^2 + \pi r^2 = 170\,\pi$

$\Rightarrow \qquad R^2 + r^2 = 170$

Now, $\qquad R - r = 4$

$\therefore \qquad (R - r)^2 = R^2 + r^2 - 2Rr$

$\Rightarrow (4)^2 = 170 - 2Rr$

$\Rightarrow \quad 16 = 170 - 2Rr$

$\Rightarrow 2Rr = 170 - 16 = 154$

Now, $(R + r)^2 = R^2 + r^2 + 2Rr$

$= 170 + 154 = 324 = (18)^2$

$R + r = 18 \qquad ...(ii)$

Adding $(i)$ and $(ii)$, we get

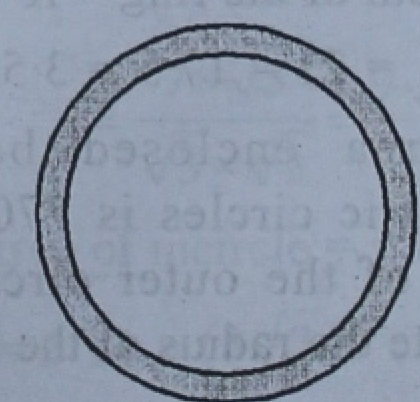
$2R = 22 \qquad \Rightarrow R = \dfrac{22}{2} = 11$

Subtracting $(i)$ from $(ii)$,

$2r = 14 \qquad \Rightarrow r = 7$

Hence, Radii of the circles are 11 cm and 7cm **Ans.**

**Q. 22.** Find the area of a ring whose outer and inner radii are 19 cm and 16 cm respectively.



**Sol.** $\qquad$ Outer radius (R) = 19 cm

and inner radius ($r$) = 16 cm

∴ Area of the ring

$= \text{outer area} - \text{inner area}$

$= \pi R^2 - \pi r^2 = \pi (R^2 - r^2)$

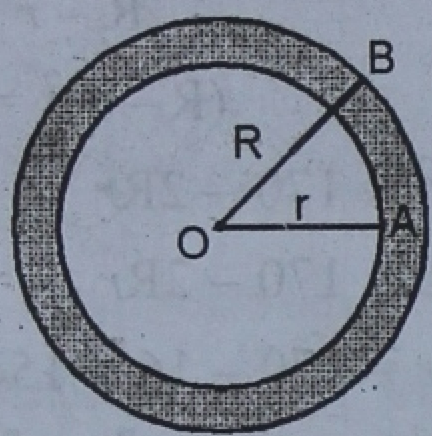
$= \frac{22}{7}(19^2 - 16^2)\text{ cm}^2$

$= \frac{22}{7} \times (19 + 16)(19 - 16)\text{ cm}^2$

$= \frac{22}{7} \times 35 \times 3 = 330\text{ cm}^2$ **Ans.**

**Q. 23.** The areas of two concentric circles are $962{\cdot}5\text{ cm}^2$ and $1386\text{ cm}^2$ respectively. Find the width of the ring.

**Sol.** Let R and $r$ be the radii of the outer circle and inner circle respectively.




Then, $\pi r^2 = 962{\cdot}5$

$\Rightarrow \frac{22}{7} r^2 = 962{\cdot}5$

$\Rightarrow r^2 = \frac{962{\cdot}5 \times 7}{22}$

$= 306{\cdot}25 = (17{\cdot}5)^2$

∴ $r = 17{\cdot}5$ cm.

And $\pi R^2 = 1386$

$\Rightarrow \frac{22}{7} R^2 = 1386$

$\Rightarrow R^2 = \frac{1386 \times 7}{22} = 441 = (21)^2$

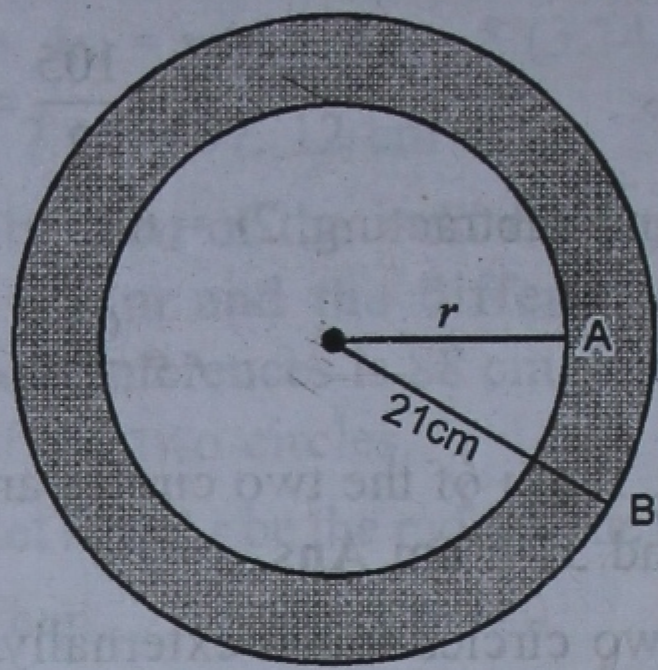
∴ $R = 21$ cm

∴ Width of the ring $= R - r$

$= 21 - 17{\cdot}5 = 3{\cdot}5$ cm **Ans.**

**Q. 24.** The area enclosed between two concentric circles is $770\text{ cm}^2$. If the radius of the outer circle is 21 cm, calculate the radius of the inner circle. **(2001)**

**Sol.** Radius of the outer circle (R) = 21 cm




Let $r$ be the inner radius and area of enclosed is between two concentric circles $= 770\text{ cm}^2$

Area of enclosed area between two concentric circles $= \pi R^2 - \pi r^2$

$\Rightarrow 770 = \pi (R^2 - r^2)$

$\Rightarrow 770 = \frac{22}{7}(441 - r^2)$

$441 - r^2 = 770 \times \frac{7}{22} = 245$

$r^2 = 441 - 245 = 196 = (14)^2$

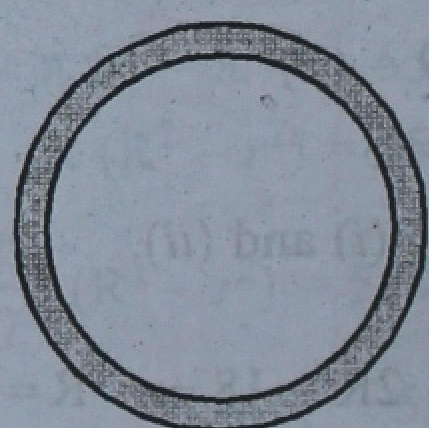
$r = 14$ cm

Radius of the inner circle = 14 cm.

**Q. 25.** In the given figure, the area enclosed between two concentric circles is $808{\cdot}5\text{ cm}^2$. The circumference of the outer circle is 242 cm. Calculate :

(*i*) the radius of the inner circle,

(*ii*) the width of the ring.



**Sol.** Area enclosed by two concentric circles $= 808{\cdot}5\text{ cm}^2$

Circumference of outer circle = 242 cm.

Let R and $r$ be the radii of two circles.

Then, $2\pi R = 242 \quad \Rightarrow 2 \times \frac{22}{7} R = 242$

$\Rightarrow \quad R = \frac{242\times7}{2\times22} = \frac{77}{2} = 38{\cdot}5\text{cm}.$

and $\quad \pi(R^2 - r^2) = 808{\cdot}5$

$\Rightarrow \frac{22}{7}(R^2 - r^2) = 808{\cdot}5$

$\Rightarrow \quad R^2 - r^2 = \frac{808{\cdot}5\times7}{22}$

$\Rightarrow \quad (38{\cdot}5)^2 - r^2 = 257{\cdot}25$

$\Rightarrow \quad 1482{\cdot}25 - r^2 = 257{\cdot}25$

$\Rightarrow \quad r^2 = 1482{\cdot}25 - 257{\cdot}25 = 1225{\cdot}00$

$\therefore \quad r = \sqrt{1225} = 35$

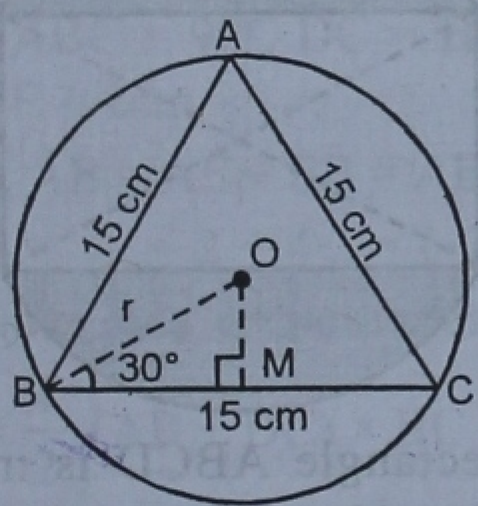
Hence (*i*) Radius of the inner circle = 35cm.

and (*ii*) width of ring = R – *r*

$= 38{\cdot}5 - 35{\cdot}0 = 3{\cdot}5$ cm. **Ans.**

**Q. 26.** Find the area of a circle circumscribing an equilateral triangle of side 15 cm. [Take $\pi = 3{\cdot}14$].

**Sol.** $\Delta ABC$ is an equilateral and a circle with centre O is drawn to pass through the vertices of the triangle. Each side of the triangle = 15 cm. Join OB and draw OM ⊥ BC.




In right $\Delta OBM$, $\angle OBM = \frac{60^\circ}{2} = 30^\circ$

$\because$ OM ⊥ BC

$\therefore \quad BM = \frac{1}{2}BC = \frac{15}{2}$ cm

Now, $\cos\theta = \frac{BM}{OB}$

$\therefore OB = \frac{BM}{\cos\theta} = \frac{BM}{\cos 30^\circ} = \frac{7{\cdot}5}{\frac{\sqrt3}{2}} = \frac{7{\cdot}5\times2}{\sqrt3}$

$\therefore \; OB = \frac{15\times\sqrt3}{\sqrt3\times\sqrt3} = \frac{15\sqrt3}{3} = 5\sqrt3$

$\Rightarrow$ Radius $(r) = 5\sqrt3$ cm

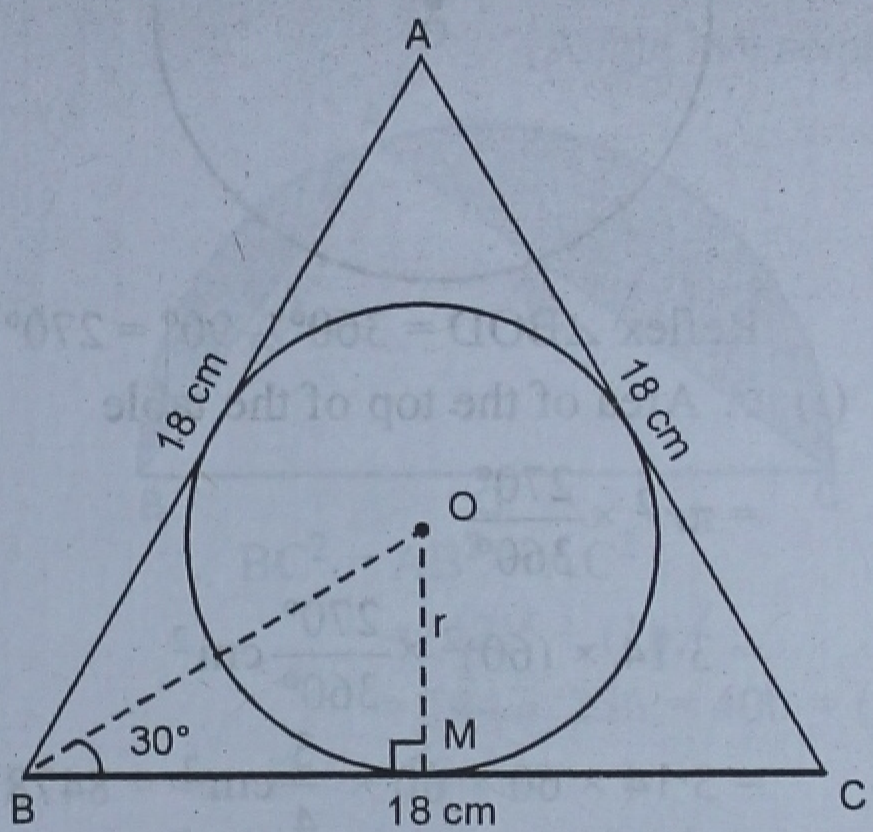
$\therefore$ Area of the circle $= \pi r^2$

$= 3{\cdot}14 \times (5\sqrt3)^2 \text{ cm}^2$

$= 3{\cdot}14 \times 75 = 235{\cdot}5 \text{ cm}^2$ **Ans.**

**Q. 27.** Find the area of a circle inscribed in an equilateral triangle of side 18 cm. [Take $\pi = 3{\cdot}14$].

**Sol.** A circle is inscribed in an equilateral triangle ABC whose each side is 18 cm.




Join OB and draw OM ⊥ BC

$\therefore \angle OBM = \frac{60^\circ}{2} = 30^\circ$

$\because$ OM ⊥ BC

$\therefore BM = \frac{1}{2}, BC = \frac{18}{2} = 9\text{cm}$

In right $\Delta OBM$, $\tan 30^\circ = \frac{OM}{BM}$

$\Rightarrow OM = BM \tan 30^\circ$

$OM\,(r) = \frac{1}{\sqrt3}\times9$

$= \frac{9\times\sqrt3}{\sqrt3\times\sqrt3} = \frac{9\sqrt3}{3} = 3\sqrt3\text{cm}$

$\therefore$ Area of incircle $= \pi r^2$

$= 3{\cdot}14 \times (3\sqrt3)^2 \text{ cm}^2$

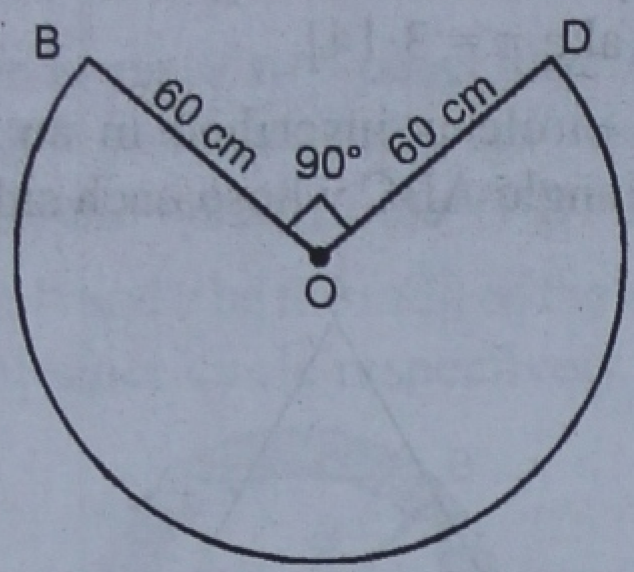
$= 3{\cdot}14 \times 27 = 84{\cdot}78 \text{ cm}^2$ **Ans.**

**Q. 28.** The shape of the top of a table in a restaurant is that of a segment of a circle with centre O and ∠BOD = 90°. BO = OD = 60 cm. Find

(*i*) the area of the top of the table

(*ii*) the perimeter of the table. [Take π = 3·14]

**Sol.** Radius ($r$) of the circular segment = 60 cm.




Reflex ∠BOD = 360° – 90° = 270°

(*i*) ∴ Area of the top of the table

$$= \pi r^2 \times \frac{270^\circ}{360^\circ}$$

$$= 3\cdot14 \times (60)^2 \times \frac{270^\circ}{360^\circ} \text{cm}^2$$

$$= 3\cdot14 \times 60 \times 60 \times \frac{3}{4} \text{cm}^2 = 8478 \text{ cm}^2$$

(*ii*) Perimeter $= 2\pi r \times \frac{270^\circ}{360^\circ} + 2r$

$$= \left[2(3\cdot14)\times60\times\frac{3}{4}+2\times60\right]\text{cm}$$

$$= (3\cdot14 \times 90 + 120) \text{ cm}$$

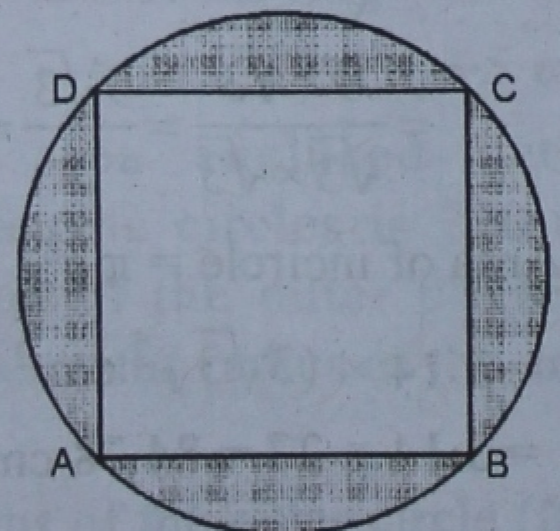
$$= 282\cdot6 + 120 = 402\cdot6 \text{ cm}$$ **Ans.**

**Q. 29.** In the given figure, ABCD is a square of side 5 cm inscribed in a circle. Find

(*i*) the radius of the circle,

(*ii*) the area of the shaded region.

[Take π = 3·14]




**Sol.** Each side of square ABCD = 5 cm

Radius of the circumcircle ($r$)

$$= \frac{1}{2}\times\text{diagonal} = \frac{1}{2}\times\sqrt{2}\times\text{side}$$

$$= \frac{\sqrt{2}}{2}\times5\text{cm.} = \frac{5\sqrt{2}}{2}\text{cm.}$$

Now, area of circle = $\pi r^2$

$$= 3\cdot14 \times \left(\frac{5\sqrt{2}}{2}\right)^2 \text{cm}^2$$

$$= 3\cdot14\times\frac{25\times2}{4} = 3\cdot14\times\frac{25}{2}\text{cm}^2 = 39\cdot25 \text{ cm}^2$$

Area of square = $(\text{side})^2 = (5)^2 = 25$ cm$^2$

∴ Area of shaded region = 39·25 – 25·00

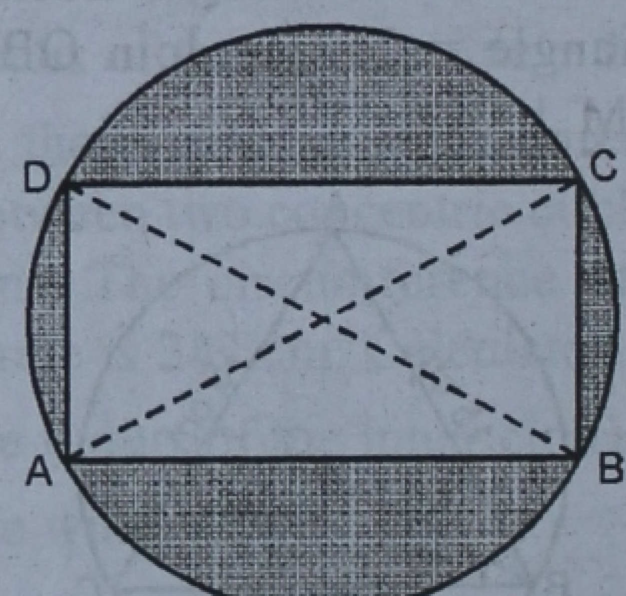
= 14·25 cm$^2$ **Ans.**

**Q. 30.** In the given figure, ABCD is a rectangle inscribed in a circle. If two adjacent sides of the rectangle be 8 cm and 6 cm. Calculate :

(*i*) the radius of the circle and

(*ii*) the area of the shaded region.

[Take π = 3·14].




**Sol.** A rectangle ABCD is inscribed in a circle, sides of rectangle are 8 cm and 6 cm.

(*i*) Radius of the circle = $\frac{1}{2}\times$ diagonal of the rectangle

$$= \frac{1}{2}\sqrt{l^2+b^2}$$

$$= \frac{1}{2}\sqrt{8^2+6^2} = \frac{1}{2}\times\sqrt{(64+36)}\text{ cm}$$

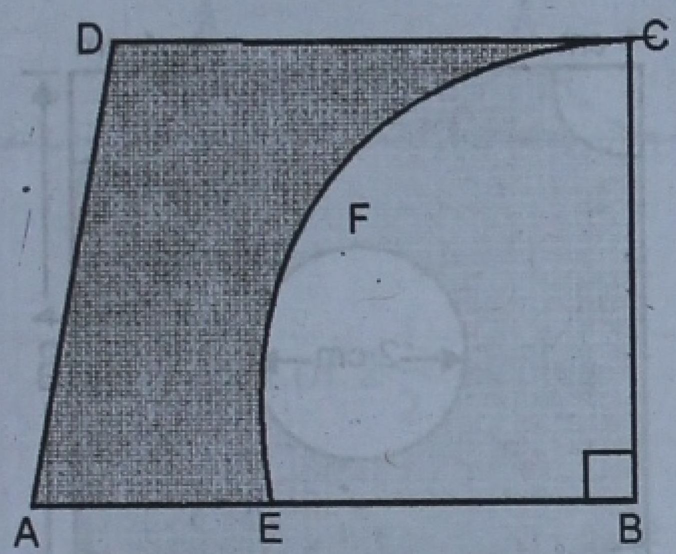
$$= \frac{1}{2}\times\sqrt{100} = \frac{1}{2}\times10 = 5\text{cm.}$$

(*ii*) Area of circle = $\pi r^2 = 3{\cdot}14 \times (5)^2$ cm$^2$
$= 3{\cdot}14 \times 25 = 78{\cdot}5$ cm$^2$

Area of rectangle = $l \times b$
$= 8 \times 6 = 48$ cm$^2$

$\therefore$ Area of shaded region = $78{\cdot}5 - 48{\cdot}0$
$= 30{\cdot}5$ cm$^2$ **Ans.**

**Q. 31.** In the given figure, ABCD is a piece of cardboard in the shape of a trapezium in which AB || DC, $\angle ABC = 90°$.
From this piece, quarter circle BEFC is removed.
Given DC = BC = 4·2 cm
and, AE = 2 cm.
Calculate the area of the remaining piece of the cardboard.




**Sol.** ABCD is a trapezium in which AB || DC. $\angle ABC = 90°$, DC = BC = 4·2 cm and AE = 2cm

$\therefore$ AB = AE + EB = AE + BC
$= 2 + 4{\cdot}2 = 6{\cdot}2$cm

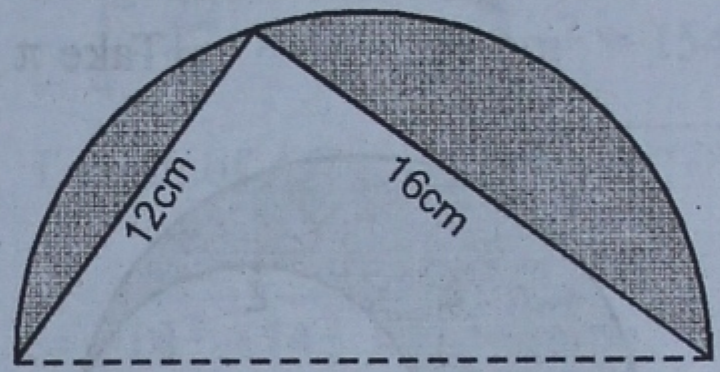
Now, area of the trapezium
$= \frac{1}{2}$ (AB + DC) × BC
$= \frac{1}{2}$ (6·2 + 4·2) × 4·2 cm$^2$
$= \frac{1}{2} \times 10{\cdot}4 \times 4{\cdot}2$ cm$^2$ = 21·84 cm$^2$

Radius of quarter circle = BC = 4·2 cm

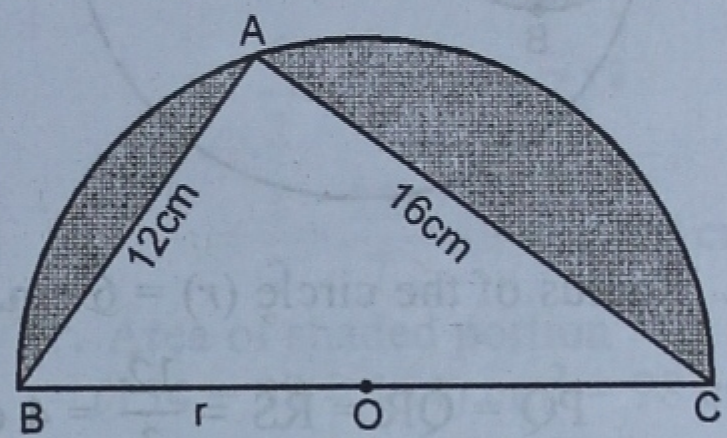
Area of quarter circle $= \frac{1}{4}\pi r^2$
$= \frac{1}{4} \times \frac{22}{7} \times (4{\cdot}2)^2$ cm$^2$
$= \frac{11}{14} \times 4{\cdot}2 \times 4{\cdot}2$ cm$^2$ = 13·86 cm$^2$

$\therefore$ Area of shaded portion
= (21·84 – 13·86) cm$^2$
= 7·98 cm$^2$ **Ans.**

**Q. 32.** Find the perimeter and area of the shaded region in the given figure
[Take $\pi$ = 3·142].




**Sol.** ABC is a right triangle whose $\angle A = 90°$
(Angle in a semicircle)




$\therefore$ BC$^2$ = AB$^2$ + AC$^2$
= (12)$^2$ + (16)$^2$
= 144 + 256 = 400 = (20)$^2$

$\Rightarrow$ BC = 20 cm

Radius of the semi-circle (*r*)
$= \frac{1}{2} \times BC = \frac{1}{2} \times 20 = 10$ cm

(*i*) Area of semi circle $= \frac{1}{2}\pi r^2$
$= \frac{1}{2} \times 3{\cdot}142 \times (10)^2$
$= \frac{1}{2} \times 3{\cdot}142 \times 100 = 157{\cdot}1$ cm$^2$

Area of triangle $= \frac{1}{2} \times AB \times AC$
$= \frac{1}{2} \times 12 \times 16$ cm$^2$ = 96 cm$^2$

$\therefore$ Area of shaded portion = 157·1 – 96·0
= 61·1 cm$^2$

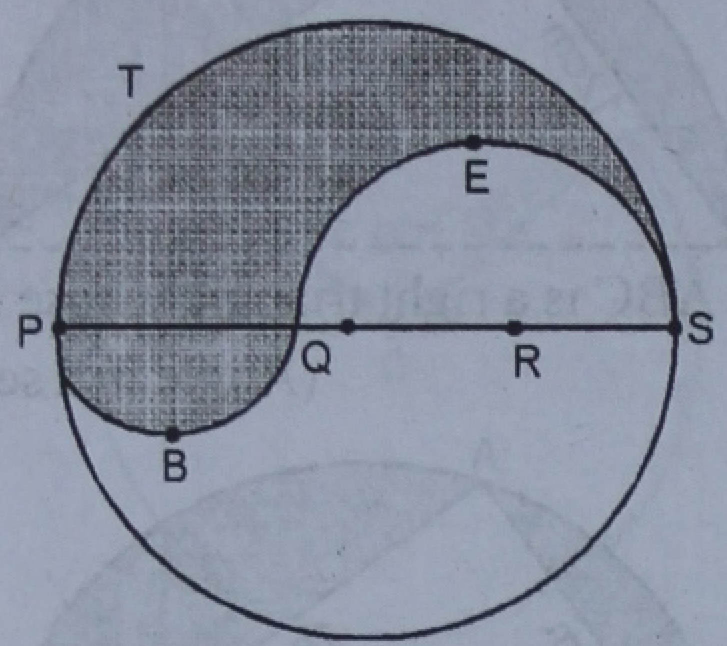
(*ii*) Circumference of semi-circle = $\pi r$
= 3·142 × 10 = 31·42 cm

$\therefore$ Perimeter of the shaded portion

$= 31{\cdot}42 + 12 + 16 = 59{\cdot}42$ cm **Ans.**

**Q. 33.** In the given figure, PQRS is a diameter of a circle of radius 6 cm. The lengths PQ, QR and RS are equal. Semi-circles are drawn on PQ and QS as diameters. If PS = 12 cm, find the perimeter and the area of the shaded region.

[Take $\pi = 3{\cdot}14$].




**Sol.** Radius of the circle ($r$) = 6 cm.

$$PQ = QR = RS = \frac{12}{3} = 4 \text{ cm}$$

and PS = $2r = 2 \times 6 = 12$ cm.

($i$) Area of circle = $\pi r^2$

$= 3{\cdot}14 \times (6)^2 \text{ cm}^2 = 3{\cdot}14 \times 36 \text{ cm}^2$

$= 113{\cdot}04 \text{ cm}^2$

Area of semi-circle PBQ

$$= \frac{1}{2}\pi\left(\frac{1}{2}PQ\right)^2 = \frac{1}{2}\times 3{\cdot}14 \times\left(\frac{4}{2}\right)^2 \text{ cm}^2$$

$$= \frac{1}{2}\times 3{\cdot}14 \times 4 \text{cm}^2 = 6{\cdot}28 \text{ cm}^2$$

Area of semi-circle PTS $= \frac{1}{2}\pi(6)^2$

$$= \frac{1}{2}\times 3{\cdot}14 \times 36 \text{ cm}^2 = 56{\cdot}52 \text{ cm}^2$$

Area of semi-circle QES

$$= \frac{1}{2}\pi\left(\frac{1}{2}QS\right)^2 = \frac{1}{2}(3{\cdot}14)\left(\frac{8}{2}\right)^2 \text{ cm}^2$$

$$= \frac{1}{2}\times 3{\cdot}14 \times 4 \times 4 = 25{\cdot}12 \text{ cm}^2$$

Now, area of shaded portion = Area of semi-circle PBQ + area of semi-circle PTS – area of semicircle QES

$= 6{\cdot}28 + 56{\cdot}52 - 25{\cdot}12$

$= 62{\cdot}80 - 25{\cdot}12 = 37{\cdot}68 \text{ cm}^2$

($ii$) Perimeter of shaded portion = length of (arc PTS + arc PBQ + arc QES)

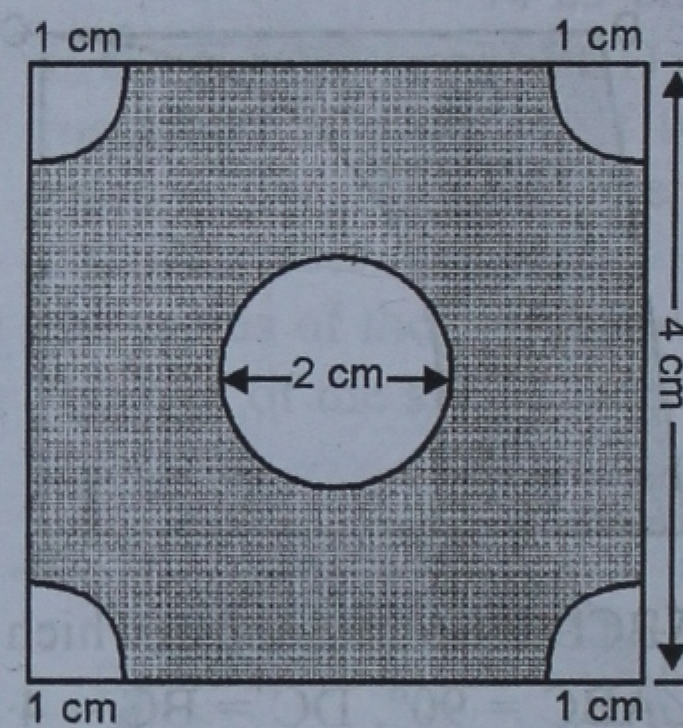
$$= \frac{1}{2}\times 2\pi\times\frac{PS}{2} + \frac{1}{2}\times 2\pi\times\left(\frac{PQ}{2}\right) + \frac{1}{2}\times 2\pi\times\left(\frac{QS}{2}\right)$$

$= 3{\cdot}14 \times 6 + 3{\cdot}14 \times 2 + 3{\cdot}14 \times 4$

$= 3{\cdot}14\,(6 + 2 + 4) = 3{\cdot}14 \times 12$

$= 37{\cdot}68$ cm **Ans.**

**Q. 34.** Find the perimeter and area of the shaded region shown in the figure. The four corners are circle quadrants and at the centre, there is a circle. [Take $\pi = 3{\cdot}14$].




**Sol.** Side of square = 4 cm

$\therefore$ Area of square = $(4)^2 = 16 \text{ cm}^2$

Radius of each quadrant = 1 cm

$\therefore$ Area of 4 quadrants $= 4\times\frac{1}{4}\pi r^2$

$= 3{\cdot}14 \times 1^2 = 3{\cdot}14 \text{ cm}^2$

Area of central circle = $\pi r^2$

$= 3{\cdot}14 \times (1)^2 = 3{\cdot}14 \text{ cm}^2$

$\therefore$ Area of shaded portion = Area of square – Area of 4 quadrants – area of central circle = $16 - (3{\cdot}14 + 3{\cdot}14) \text{ cm}^2$

$= 16 - 6{\cdot}28 = 9{\cdot}72 \text{ cm}^2$

($ii$) Perimeter of shaded portion

= Length of area of 4 quadrant + circumference of circle + 2 cm × 4

$$= 4\times\frac{1}{4}(2\pi r) + 2\pi r + 2 \text{ cm} \times 4$$

$= 2\pi r + 2\pi r + 8$ cm

$= 4\pi r + 8$ cm $= 4 \times 3{\cdot}14 \times 1 + 8$ cm

$= 12{\cdot}56 + 8$ cm $= 20{\cdot}56$ cm. **Ans.**

**Q. 35.** In the given figure, find the area of the unshaded portion within the rectangle. (Take $\pi = 3.14$)

**Sol.** In the figure radius of each circle = 3 cm

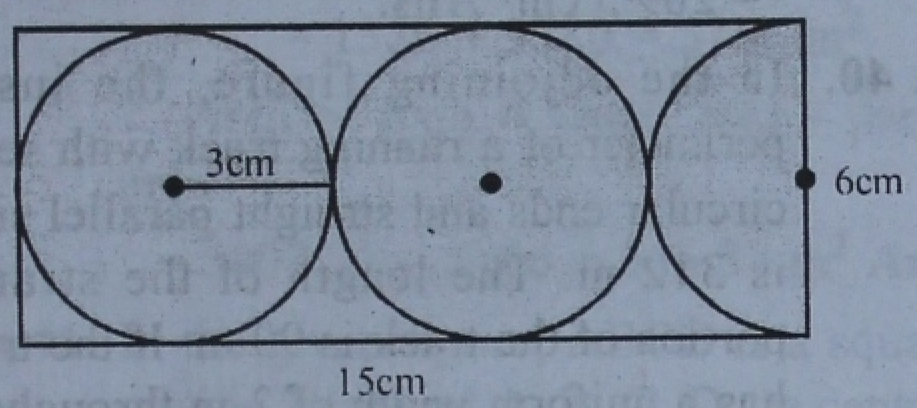
$\therefore$ Diameter = 2 × 3cm = 6 cm

$\therefore$ Length of rectangle ($l$) = 6 + 6 + 3 = 15 cm

and breadth ($b$) = 6 cm

Now, area of the rectangle = $l \times b$

$= 15 \times 6 = 90$ cm$^2$




and area of $2\frac{1}{2}$ circles

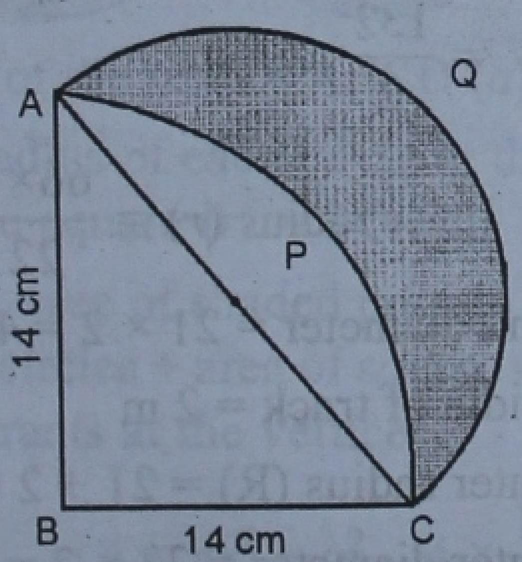
$= \frac{5}{2}\pi r^2 = \frac{5}{2} \times 3.14 \times 3 \times 3$ cm$^2$

$= 5 \times 1.57 \times 9 = 70.65$ cm$^2$

$\therefore$ Area of unshaded portion $= 90 - 70.65$

$= 19.35$ cm$^2$

**Q. 36.** In the given figure, ABCP is a quadrant of a circle of radius 14 cm. With AC as diameter, a semi-circle is drawn. Find the area of the shaded region.




**Sol.** ABCP is quadrant of radius 14 cm.

AQC is semi-circle on AC as diameter.

$\therefore$ Area of shaded portion

= Area of semi-circle + area of $\Delta$ABC – area of quadrant

Area of $\Delta ABC = \frac{1}{2} \times 14 \times 14 = 98$ cm$^2$

Area of quadrant $= \frac{1}{4} \times \pi r^2$

$= \frac{1}{4} \times \frac{22}{7} \times 14 \times 14$ cm$^2$ = 154 cm$^2$

Length of AC $= \sqrt{AB^2 + BC^2}$

$= \sqrt{14^2 + 14^2} = 14 \times \sqrt{2}$ cm

Area of semi-circle $= \frac{1}{2}\pi r^2$

$= \frac{1}{2} \times \frac{22}{7} \times (7\sqrt{2})^2$

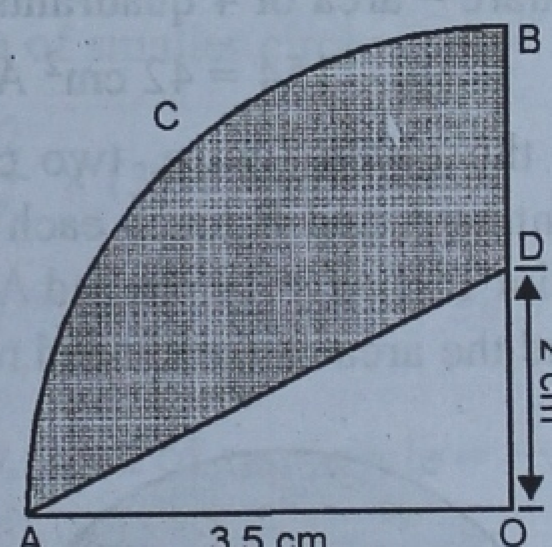
$= \frac{1}{2} \times \frac{22}{7} \times 49 \times 2 = 154$ cm$^2$

$\therefore$ Area of shaded portion

= (154 + 98 – 154) cm$^2$ = 98 cm$^2$ **Ans.**

**Q. 37.** In the given figure, OACB is a quadrant of a circle. The radius OA = 3.5 cm, OD = 2 cm. (2005)

Calculate the area of the shaded portion.




**Sol.** Area of quadrant whose radius is 3·5 cm

$= \frac{1}{4} \times \pi r^2 = \frac{1}{4} \times \frac{22}{7} \times (3{\cdot}5)^2$ cm$^2$

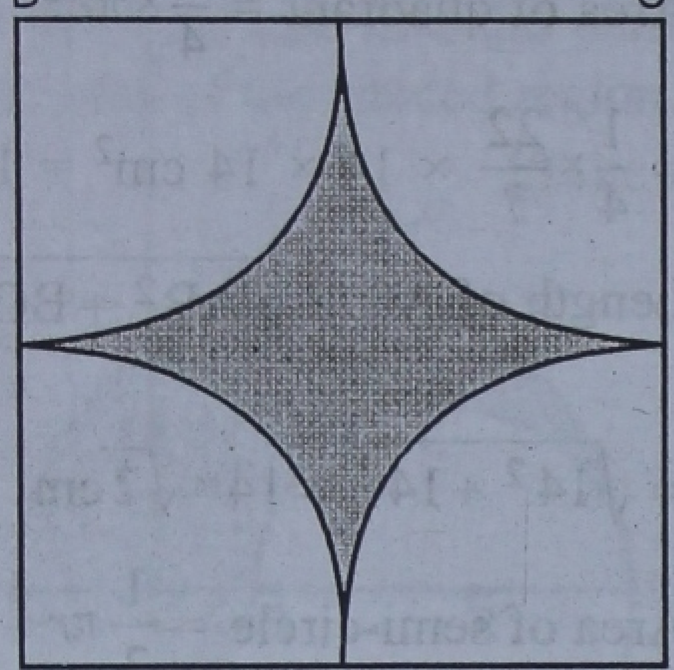
$= \frac{1}{4} \times \frac{22}{7} \times 12{\cdot}25 = 9{\cdot}625$ cm$^2$

Area of right $\Delta AOD$, $= \frac{1}{2} \times 3{\cdot}5 \times 2$ cm$^2$ $= 3{\cdot}5$ cm$^2$

$\therefore$ Area of shaded portion = Area of quadrant – area of triangle

$= 9{\cdot}625 - 3{\cdot}500 = 6{\cdot}125$ cm$^2$ **Ans.**

**Q. 38.** In the given figure, ABCD is a square of side 14 cm and A, B, C, D are centres of circular arcs, each of radius 7 cm. Find the area of the shaded region.




**Sol.** ABCD is a square of side 14 cm.

Radius ($r$) of each quadrant = 7 cm.

$\therefore$ Area of square $= (a)^2 = (14)^2 = 196 \text{ cm}^2$

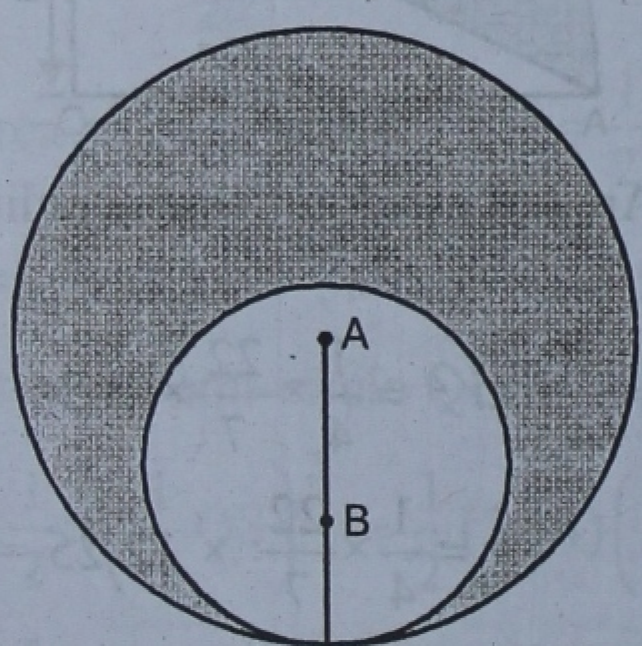
Area of 4 quadrants $= 4 \times \frac{1}{4}\pi r^2 = \pi r^2$

$= \frac{22}{7} \times 7 \times 7 = 154 \text{ cm}^2$

$\therefore$ Area of shaded portion = Area of square – area of 4 quadrants

$= 196 - 154 = 42 \text{ cm}^2$ **Ans.**

**Q. 39.** In the given figure, two circles with centres A and B touch each other at the point T. If AT = 14 cm and AB = 3·5 cm, find the area of the shaded region.




**Sol.** Two circles are touching internally at T. A and B are the centres of the circles.

Radius of bigger circle (R) = AT = 14 cm

And radius of smaller circle ($r$) = BT = AT – AB = 14·0 – 3·5 = 10·5 m

$\therefore$ Area of shaded portion = Area of bigger circle – area of smaller circle

$= \pi R^2 - \pi r^2$

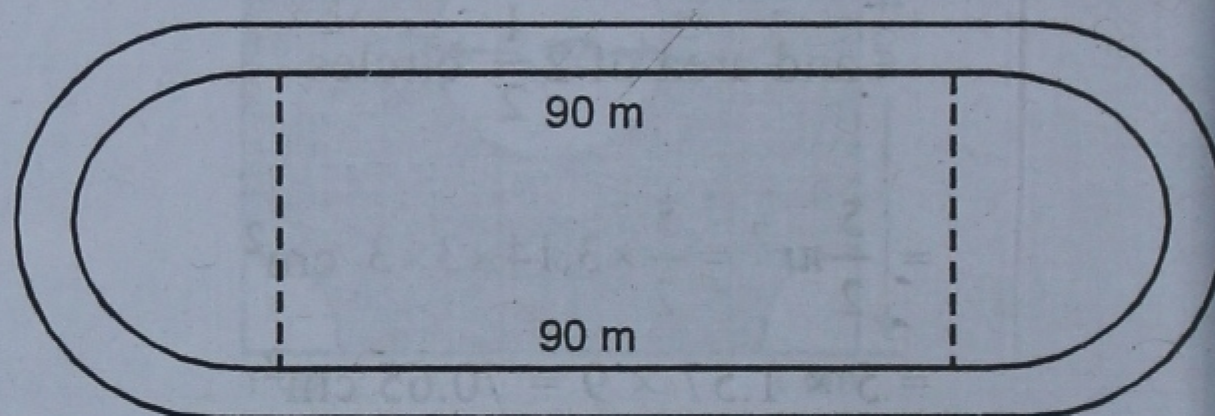
$= \pi(R^2 - r^2) = \frac{22}{7}(14^2 - 10.5^2) \text{ cm}^2$

$= \frac{22}{7}(14 + 10.5)(14 - 10.5) \text{ cm}^2$

$= \frac{22}{7} \times 24.5 \times 3.5 \text{ cm}^2$

$= 269.5 \text{ cm}^2$ **Ans.**

**Q. 40.** In the adjoining figure, the inside perimeter of a running track with semi-circular ends and straight parallel sides is 312 m. The length of the straight portion of the track is 90 m. If the track has a uniform width of 2 m throughout, find its area.




**sol.** Inside perimeter = 312 m

$\therefore$ Inner circumference of each semi-circle

$= \frac{312 - (90 + 90)}{2} = \frac{312 - 180}{2}$ m

$= \frac{132}{2} = 66$ m.

$\therefore$ Inner radius ($r$) $= \frac{66 \times 7}{22} = 21$ m

And diameter = 21 × 2 = 42 m

Width of track = 2 m

Outer radius (R) = 21 + 2 = 23 m

Outer diameter = 23 × 2 = 46 m.

Outer area = Area of the outer semi-circles + area of outer rectangle.

$$= 2\times\frac{1}{2}\pi\cdot(R)^2 + 90 \times 46$$

$$= \left(\frac{22}{7}\times 23\times 23 + 90\times 46\right)m^2$$

$$= 1662\cdot57 + 4140 = 5802\cdot57\ m^2$$

Inner area = Area of two inner semicircles – Area of inner rectangle.

$$= \left(2\times\frac{1}{2}\pi r^2 + 90\times 42\right)m^2$$

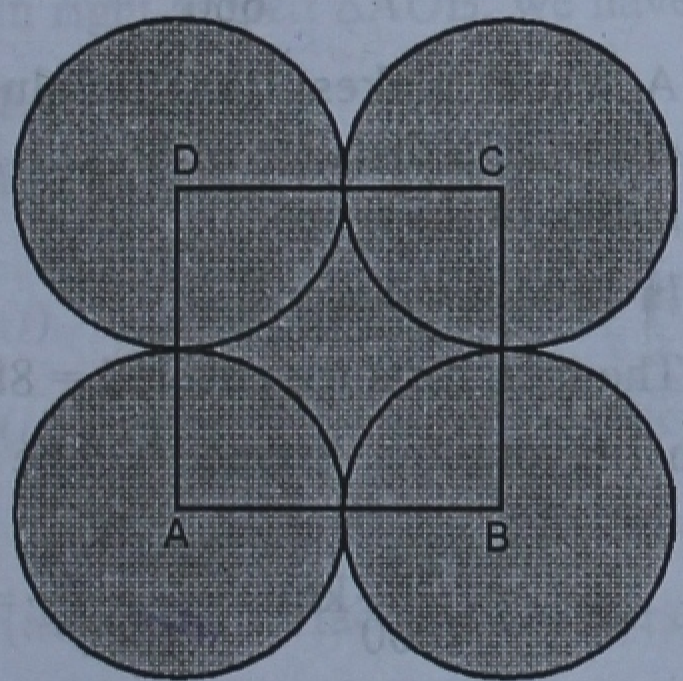
$$= \left(\frac{22}{7}\times 21\times 21 + 3780\right)m^2$$

$$= 1386 + 3780 = 5166\ m^2$$

∴ Area of path = Outer area – Inner area

$$= 5802\cdot57 - 5166 = 636\cdot57\ m^2$$ **Ans.**

**Q. 41.** In the given figure, ABCD is a square of side 7 cm and A, B, C, D are centres of equal circles which touch externally in pairs. Find the area of the shaded region.




**Sol.** Side of the square ABCD ($a$) = 7 cm

∴ Radius of each circle at the vertices of the square ($r$) = 3·5 cm

Now, area of shaded portion = Area of four circles + area of square – area of 4 quadrants at the vertices

$$= 4\times\pi r^2 + a^2 - 4\times\frac{1}{4}\pi r^2$$

$$= 4\pi r^2 - \pi r^2 + a^2 = 3\pi r^2 + a^2$$

$$= \left(3\times\frac{22}{7}\times 3\cdot5\times 3\cdot5 + 7\times 7\right)cm^2$$

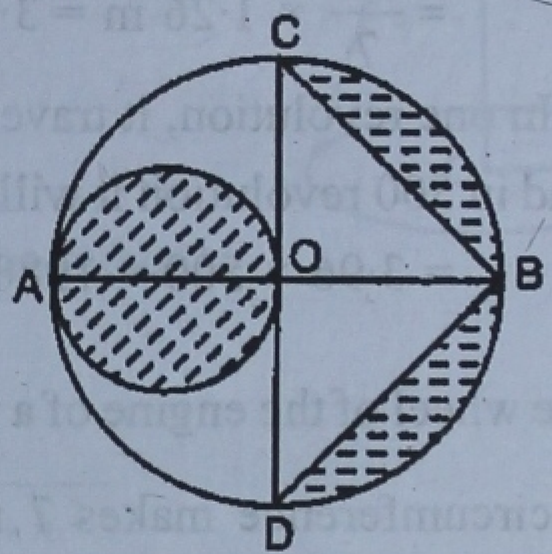
$$= 115\cdot5 + 49\cdot0 = 164\cdot5\ cm^2$$ **Ans.**

**Q. 42.** In the given figure, AB is the diameter of a circle with centre O and OA = 7 cm. Find the area of the shaded region.

**Sol.** Radius of bigger circle AO = 7 cm

Radius of small circle = $\frac{1}{2}$ AO

$$= \frac{1}{2}\times 7\ cm = 3.5\ cm$$




Area of smaller circle = $\pi r^2$

$$= \frac{22}{7}\times(3.5)^2\ cm^2$$

$$= 22\times 0.5\times 3.5\ cm^2 = 38.5\ cm^2$$

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

$$= \frac{1}{2}\times\frac{22}{7}\times(7)^2\ cm^2$$

$$= \frac{1}{2}\times\frac{22}{7}\times 7\times 7\ cm^2 = 11\times 7 = 77\ cm^2$$

Area of triangle $\Delta$ CDB = $\frac{1}{2}\times CD\times OB$

($\because$ Area of $\Delta = \frac{1}{2}\times$ Base $\times$ Altitude)

$= \frac{1}{2} \times 14 \times 7 \text{ cm}^2 = 49 \text{ cm}^2$

($\because$ CD = 2 × AO and AO = OB)

$\therefore$ Area of shaded portion = Area of small circle + Area of semicircle − Area of $\Delta$ CDB = 38.5 cm$^2$ + 77 cm$^2$ − 49 cm$^2$ = 115.5 cm$^2$ − 49 cm$^2$ = 66.5 cm$^2$ **Ans.**

**Q. 43.** The diameter of a wheel is 1·26 m. How far it will travel in 500 revolutions ?

**Sol.** Diameter of a wheel ($d$) = 1·26 m.

$\therefore$ Its circumference = $\pi d$

$= \frac{22}{7} \times 1{\cdot}26 \text{ m} = 3{\cdot}96 \text{ m}$

$\therefore$ In one revolution, it travels = 3·96 m

And in 500 revolution it will travel

$= 3{\cdot}96 \times 500 = 1980$ m **Ans.**

**Q. 44.** The wheel of the engine of a train $4\frac{2}{7}$ m in circumference makes 7 revolutions in 3 seconds. Find the speed of the train in km per hour.

**Sol.** Circumference of a wheel

$= 4\frac{2}{7} \text{ m} = \frac{30}{7} \text{ m}$

$\therefore$ It covers 7 revolutions in 3 seconds.

In one hour it makes revolutions

$= \frac{7}{3} \times 60 \times 60 = 8400$

$\therefore$ Distance in 8400 revolutions

$= \frac{30}{7} \times 8400 \text{ m} = 36000 \text{ m}$

$\therefore$ Speed $= \frac{36000}{1000}$ km / hour

= 36 km/hour **Ans.**

**Q. 45.** A toothed wheel of diameter 50 cm is attached to a smaller wheel of diameter 30 cm. How many revolutions will the smaller wheel make when the larger one makes 30 revolutions ?

**Sol.** Diameter of toothed wheel = 50 cm

$\therefore$ Circumference $= \pi d = \frac{22}{7} \times 50$ cm

$= \frac{1100}{7}$ cm

Distance covered in 30 revolutions

$= \frac{1100}{7} \times 30 = \frac{33000}{7}$ cm

$\therefore$ Distance covered by the small wheel

$= \frac{33000}{7}$ cm

Diameter of smaller wheel = 30 cm

$\therefore$ Circumference = $d\pi$

$= 30 \times \frac{22}{7} \text{ cm} = \frac{660}{7} \text{ cm}$

$\therefore$ No. of revolutions $= \frac{33000}{7} \div \frac{660}{7}$

$= \frac{33000}{7} \times \frac{7}{660} = 50$ **Ans.**

**Q. 46.** A wheel makes 1000 revolutions in covering a distance of 88 km. Find the radius of the wheel.

**Sol.** In 1000 revolutions,

The total distance covered = 88 km

$\therefore$ In 1 revolution, distance will be covered

$= \frac{88}{1000} \text{ km} = \frac{88 \times 1000}{1000} = 88\text{m}$

$\therefore$ Circumference of the wheel = 88 m.

Let, radius of the wheel = $r$

Then $2\pi r = 88$

$\Rightarrow \frac{2 \times 22}{7} r = 88$

$\Rightarrow r = \frac{88 \times 7}{2 \times 22} = 14\text{m}$

Hence, radius of the wheel = 14 m **Ans.**