



CLASS X: MATHS  
Chapter 11: Areas Related to Circles

Questions and Solutions | Exercise 11.1 - NCERT Books

**Q1.** Find the area of a sector of a circle with radius 6 cm if angle of the sector is  $60^\circ$ .

**Sol.** Radius,  $r = 6$  cm; sector angle,  $\theta = 60$  degrees

Area of the sector

$$= \frac{\theta}{360} \times \pi r^2 = \frac{60}{360} \times \frac{22}{7} \times (6)^2 \text{ cm}^2$$

$$= \frac{1}{6} \times \frac{22}{7} \times (6)^2 \text{ cm}^2 = \frac{132}{7} \text{ cm}^2$$

**Q2.** Find the area of a quadrant of a circle whose circumference is 22 cm.

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

$$\therefore 2\pi r = 22$$

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

$$\Rightarrow r = 22 \times \frac{7}{22} \times \frac{1}{2} = \frac{7}{2} \text{ cm}$$

Here,  $\theta = 90^\circ$

$\therefore$  Area of the  $\left(\frac{1}{4}\right)^{\text{th}}$  quadrant of the circle,

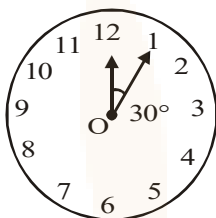
$$= \frac{\theta}{360} \times \pi r^2 = \frac{90^\circ}{360^\circ} \times \frac{22}{7} \left(\frac{7}{2}\right)^2 \text{ cm}^2$$

$$= \frac{1}{4} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} \text{ cm}^2 = \frac{77}{8} \text{ cm}^2$$



**Q3.** The length of the minute hand of a clock is 14 cm. Find the area swept by the minute hand in 5 minutes.

**Sol.** We know that in 1 hour (i.e., 60 minutes), the minute hand rotates  $360^\circ$ .



In 5 minutes, minute hand will rotate

$$= \frac{360^\circ}{60} \times 5 = 30^\circ$$

Therefore, the area swept by the minute hand in 5 minutes will be the area of a sector of  $30^\circ$  in a circle of 14 cm radius.

$$\text{Area of sector of angle } \theta = \frac{\theta}{360^\circ} \times \pi r^2$$

$$\text{Area of sector of } 30^\circ = \frac{30^\circ}{360^\circ} \times \frac{22}{7} \times 14 \times 14$$

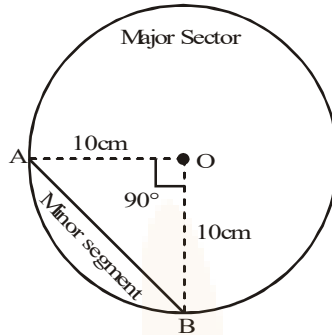
$$= \frac{22}{12} \times 2 \times 14 = \frac{11 \times 14}{3} = \frac{154}{3} \text{ cm}^2$$

Therefore, the area swept by the minute hand in 5 minutes is  $\frac{154}{3} \text{ cm}^2$

**Q4.** A chord of a circle of radius 10 cm subtends a right angle at the centre. Find the area of the corresponding: (i) minor segment (ii) major sector. (Use  $\pi = 3.14$ )

**Sol.** Here, the radius of the circle is  $r = 10 \text{ cm}$ .

Sector angle of the minor sector made corresponding to the chord AB is  $90^\circ$



$$\begin{aligned} \text{Now, the area of the minor sector} &= \frac{90}{360} \times \pi r^2 \\ &= \frac{1}{4} \times \pi \times (10)^2 \text{ cm}^2 = \frac{1}{4} \times 3.14 \times 100 \text{ cm}^2 \\ &= \frac{314}{4} \text{ cm}^2 = 78.5 \text{ cm}^2 \end{aligned}$$

Then, the area of the minor segment

= The area of the minor sector

– The area of the  $\triangle OAB$

$$\begin{aligned} &= 78.5 \text{ cm}^2 - \frac{1}{2} \times OA \times OB (\because \angle AOB = 90^\circ) \\ &= 78.5 \text{ cm}^2 - \frac{1}{2} \times 10 \times 10 \text{ cm}^2 \\ &= (78.5 - 50) \text{ cm}^2 = 28.5 \text{ cm}^2 \end{aligned}$$

The area of the major sector

$$\begin{aligned} &= \left( \frac{360 - 90}{360} \right) \times \pi r^2 = \frac{270}{360} \times 3.14 \times (10)^2 \text{ cm}^2 \\ &= \frac{3}{4} \times 314 \text{ cm}^2 = \frac{3 \times 157}{2} \text{ cm}^2 = 235.5 \text{ cm}^2 \end{aligned}$$

**Q5.** In a circle of radius 21 cm, an arc subtends an angle of  $60^\circ$  at the centre. Find:

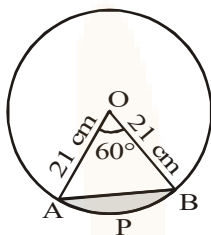
- (i) the length of the arc
- (ii) area of the sector formed by the arc
- (iii) area of the segment formed by the corresponding chord



**Sol.** Here, radius = 21 cm and  $\theta = 60^\circ$

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

$$= 2 \times \frac{22}{7} \times 21 \text{ cm} = 2 \times 22 \times 3 \text{ cm} = 132 \text{ cm}$$



$\therefore$  Length of arc APB

$$= \frac{\theta}{360^\circ} \times 2\pi r = \frac{60^\circ}{360^\circ} \times 132 \text{ cm}$$

$$= \frac{1}{6} \times 132 \text{ cm} = 22 \text{ cm}$$

(ii) Area of the sector with sector angle  $60^\circ$

$$= \frac{60^\circ}{360^\circ} \times \pi r^2 = \frac{60^\circ}{360^\circ} \times \frac{22}{7} \times 21 \times 21 \text{ cm}^2$$

$$= 11 \times 21 \text{ cm}^2 = 231 \text{ cm}^2$$

(iii) Area of the segment APB = [Area of the sector AOB] – [Area of  $\Delta$ AOB]

.....(1)

In  $\Delta$ AOB, OA = OB = 21 cm

$$\therefore \angle A = \angle B = 60^\circ \quad [\because \angle O = 60^\circ]$$

$\Rightarrow$  AOB is an equilateral  $\Delta$ .

$$\therefore AB = 21 \text{ cm}$$

$$\therefore \text{area of } \Delta\text{AOB} = \frac{\sqrt{3}}{4} (\text{side})^2$$



$$= \frac{\sqrt{3}}{4} \times 21 \times 21 \text{ cm}^2 = \frac{441\sqrt{3}}{4} \text{ cm}^2 \dots(2)$$

From (1) and (2), we have

$$\text{Area of segment} = [231 \text{ cm}^2] - \left[ \frac{441\sqrt{3}}{4} \text{ cm}^2 \right] = \left( 231 - \frac{441\sqrt{3}}{4} \right) \text{ cm}^2$$

**Q6.** A chord of a circle of radius 15 cm subtends an angle of  $60^\circ$  at the centre. Find the areas of the corresponding minor and major segments of the circle. (Use  $\pi = 3.14$  and  $\sqrt{3} = 1.73$ )

**Sol.** Here, radius ( $r$ ) = 15 cm and

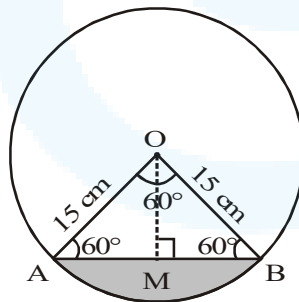
Sector angle ( $\theta$ ) =  $60^\circ$

$\therefore$  Area of the sector

$$\begin{aligned} &= \frac{\theta}{360^\circ} \times \pi r^2 = \frac{60^\circ}{360^\circ} \times \frac{314}{100} \times 15 \times 15 \text{ cm}^2 \\ &= \frac{11775}{100} \text{ cm}^2 = 117.75 \text{ cm}^2 \end{aligned}$$

Since  $\angle O = 60^\circ$  and  $OA = OB = 15 \text{ cm}$

$\therefore$   $\triangle AOB$  is an equilateral triangle.



$\Rightarrow AB = 15 \text{ cm}$  and  $\angle A = 60^\circ$

Draw  $OM \perp AB$ , in  $\triangle AMO$

$$\therefore \frac{OM}{OA} = \sin 60^\circ = \frac{\sqrt{3}}{2}$$

$$\Rightarrow OM = OA \times \frac{\sqrt{3}}{2} = \frac{15\sqrt{3}}{2} \text{ cm}$$

$$\text{Now, ar}(\Delta AOB) = \frac{1}{2} \times AB \times OM$$

$$= \frac{1}{2} \times 15 \times 15 \frac{\sqrt{3}}{2} \text{ cm}^2 = \frac{225\sqrt{3}}{4} \text{ cm}^2$$

$$= \frac{225 \times 1.73}{4} \text{ cm}^2 = 97.3125$$

Now area of the minor segment

$$= (\text{Area of minor sector}) - (\text{ar } \Delta AOB)$$

$$= (117.75 - 97.3125) \text{ cm}^2 = 20.4375 \text{ cm}^2$$

Area of the major segment

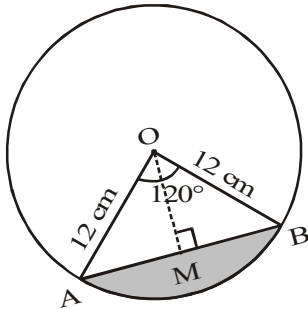
$$= [\text{Area of the circle}] - [\text{Area of the minor segment}]$$

$$= \pi r^2 - 20.4375 \text{ cm}^2 = \left[ \frac{314}{100} \times 15^2 \right] - 20.4375 \text{ cm}^2 = 706.5 - 20.4375 \text{ cm}^2 = 686.0625 \text{ cm}^2$$

**Q7.** A chord of a circle of radius 12 cm subtends an angle of  $120^\circ$  at the centre. Find the area of the corresponding segment of the circle. (Use  $\pi = 3.14$  and  $\sqrt{3} = 1.73$ )

**Sol.** Here  $\theta = 120^\circ$  and  $r = 12$  cm

$$\begin{aligned} \therefore \text{Area of the sector} &= \frac{\theta}{360^\circ} \times \pi r^2 \\ &= \frac{120}{360} \times \frac{314}{100} \times 12 \times 12 \text{ cm}^2 \\ &= \frac{314 \times 4 \times 12}{100} \text{ cm}^2 = \frac{15072}{100} \text{ cm}^2 \\ &= 150.72 \text{ cm}^2 \quad \dots(1) \end{aligned}$$



$$\text{Now, area of } \Delta AOB = \frac{1}{2} \times AB \times OM \quad \dots(2) \quad [\because OM \perp AB]$$

$$\text{In } \Delta OAB, \angle O = 120^\circ$$

$$\Rightarrow \angle A + \angle B = 180^\circ - 120^\circ = 60^\circ$$

$$\because OB = OA = 12 \text{ cm}$$

$$\Rightarrow \angle A = \angle B = 30^\circ$$

$$\text{So, } \frac{OM}{OA} = \sin 30^\circ = \frac{1}{2} \quad \Rightarrow OM = OA \times \frac{1}{2}$$

$$\Rightarrow OM = 12 \times \frac{1}{2} = 6 \text{ cm}$$

$$\text{and } \frac{AM}{OA} = \cos 30^\circ = \frac{\sqrt{3}}{2}$$

$$\Rightarrow AM = \frac{\sqrt{3}}{2} OA = \frac{\sqrt{3}}{2} \times 12 = 6\sqrt{3} \text{ cm}$$

$$\therefore AB = 2(AM) = 12\sqrt{3} \text{ cm.}$$

Now, from (2),

$$\text{Area of } \Delta AOB = \frac{1}{2} \times AB \times OM$$

$$= \frac{1}{2} \times 12\sqrt{3} \times 6 \text{ cm}^2 = 36\sqrt{3} \text{ cm}^2$$

$$= 36 \times 1.73 \text{ cm}^2 = 62.28 \text{ cm}^2 \quad \dots(3)$$

From (1) and (3)

Area of the minor segment

$$= [\text{Area of sector}] - [\text{Area of } \Delta AOB]$$

$$= [150.72 \text{ cm}^2] - [62.28 \text{ cm}^2] = 88.44 \text{ cm}^2$$

- Q8.** A horse is tied to a peg at one corner of a square shaped grass field of side 15 m by means of a 5 m long rope. Find



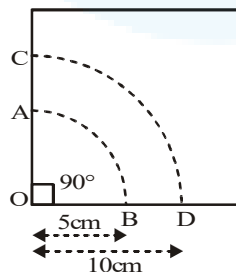
- (i) the area of that part of the field in which the horse can graze.  
 (ii) the increase in the grazing area if the rope were 10 m long instead of 5 m. (Use  $\pi = 3.14$ )

**Sol.** (i)  $r = 5$  m,  $\theta = 90^\circ$

The required area (Grazing area for horse)  
 = The sector area of the sector OAB

$$= \frac{90}{360} \times \pi r^2 = \frac{1}{4} \times 3.14 \times (5)^2 \text{ m}^2$$

$$= \frac{1}{4} \times 78.50 \text{ m}^2 = 19.625 \text{ m}^2$$







- (ii) Now, the radius for the sector  $OCD = 10 \text{ m}$   
and sector angle  $= 90^\circ$

The area of the sector  $OCD$

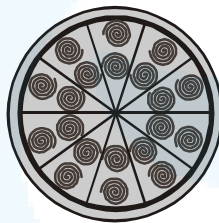
$$= \frac{90}{360} \times \pi \times (10)^2 \text{ m}^2 = \frac{1}{4} \times 3.14 \times 100 \text{ m}^2 = 78.5 \text{ m}^2$$

Therefore, the increase of grazing area

$$\begin{aligned} &= \text{The area of sector } OCD \\ &- \text{The area of sector } OAB \\ &= 78.5 \text{ m}^2 - 19.625 \text{ m}^2 \\ &= 58.875 \text{ m}^2 \end{aligned}$$

- Q9.** A brooch is made with silver wire in the form of a circle with diameter  $35 \text{ mm}$ . The wire is also used in making 5 diameters which divide the circle into 10 equal sectors as shown in fig. Find:

- (i) the total length of the silver wire required.  
(ii) the area of each sector of the brooch.



**Sol.** Diameter of the circle  $= 35 \text{ mm}$

$$\therefore \text{Radius } (r) = \frac{35}{2} \text{ mm}$$

- (i) Circumference  $= 2\pi r$

$$= 2 \times \frac{22}{7} \times \frac{35}{2} \text{ mm} = 22 \times 5 = 110 \text{ mm}$$

Length of 1 piece of wire used to make diameter to divide the circle into 10 equal sectors  $= 35 \text{ mm}$

$$\therefore \text{Length 5 pieces} = 5 \times 35 = 175 \text{ mm}$$

$$\begin{aligned} \therefore \text{Total length of the silver wire} \\ &= 110 + 175 \text{ mm} = 285 \text{ mm} \end{aligned}$$

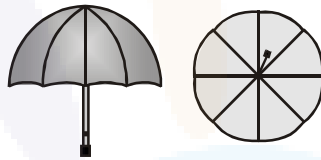
(ii) Since the circle is divided into 10 equal sectors,

$$\therefore \text{Sector angle } \theta = \frac{360^\circ}{10} = 36^\circ$$

$\Rightarrow$  Area of each sector

$$\begin{aligned} &= \frac{\theta}{360^\circ} \times \pi r^2 = \frac{36^\circ}{360^\circ} \times \frac{22}{7} \times \frac{35}{2} \times \frac{35}{2} \text{ mm}^2 \\ &= \frac{11 \times 35}{4} \text{ mm}^2 = \frac{385}{4} \text{ mm}^2 \end{aligned}$$

**Q10.** An umbrella has 8 ribs which are equally spaced. Assuming umbrella to be a flat circle of radius 45 cm, find the area between the two consecutive ribs of the umbrella.



**Sol.** Here, radius ( $r$ ) = 45 cm

Since circle is divided in 8 equal parts,

$\therefore$  Sector angle corresponding to each part

$$\theta = \frac{360^\circ}{8} = 45^\circ$$

$\Rightarrow$  Area of a sector (part)

$$= \frac{\theta}{360^\circ} \times \pi r^2 = \frac{45^\circ}{360^\circ} \times \frac{22}{7} \times 45 \times 45 \text{ cm}^2$$

$$= \frac{11 \times 45 \times 45}{4 \times 7} \text{ cm}^2 = \frac{22275}{28} \text{ cm}^2$$

$\therefore$  The required area between the two ribs

$$= \frac{22275}{28} \text{ cm}^2$$

**Q11.** A car has two wipers which do not overlap. Each wiper has a blade of length 25 cm sweeping through an angle of  $115^\circ$ . Find the total area cleaned at each sweep of the blades.

**Sol.** Here, one blade of a wiper sweeps a sector area of a circle of radius 25 cm.

The sector angle =  $115^\circ$

i.e.,  $r = 25$  cm

and  $\theta = 115^\circ$

The area covered by one blade

$$= \frac{115}{360} \times \pi \times (25)^2 \text{ cm}^2$$

Then, the area covered by two blades

$$= 2 \times \frac{115}{360} \times \frac{22}{7} \times 625 \text{ cm}^2$$

$$= \frac{23}{18} \times \frac{11}{7} \times 625 \text{ cm}^2$$

$$= \frac{158125}{126} \text{ cm}^2$$

**Q12.** To warn ships for underwater rocks, a lighthouse spreads a red coloured light over a sector of angle  $80^\circ$  to a distance of 16.5 km. Find the area of the sea over which the ships are warned. (Use  $\pi = 3.14$ )

**Sol.** Here, Radius ( $r$ ) = 16.5 km and

Sector angle ( $\theta$ ) =  $80^\circ$

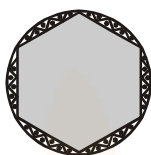
$\therefore$  Area of the sea surface over which the ships are warned

$$= \frac{\theta}{360^\circ} \times \pi r^2 = \frac{80^\circ}{360^\circ} \times \frac{314}{100} \times \frac{165}{10} \times \frac{165}{10} \text{ km}^2$$

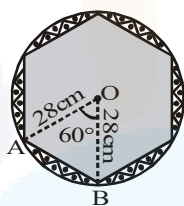
$$= \frac{157 \times 11 \times 11}{100} \text{ km}^2 = \frac{18997}{100} \text{ km}^2$$

$$= 189.97 \text{ km}^2$$

**Q13.** A round table cover has six equal designs as shown in fig. If the radius of the cover is 28 cm, find the cost of making the designs at the rate of Rs 0.35 per  $\text{cm}^2$ . (Use  $\sqrt{3} = 1.7$ )



**Sol.** Here,  $r = 28$  cm.  $\theta = \frac{360^\circ}{6} = 60^\circ$



In the figure  $\Delta OAB$  is equilateral having side 28 cm.

The area of one shaded designed portion

= The area of the sector OAB

– The area of the  $\Delta OAB$

$$= \left\{ \frac{60}{360} \times \pi \times (28)^2 - \frac{\sqrt{3}}{4} \times (28)^2 \right\} \text{cm}^2$$

$$= \left\{ \frac{1}{6} \times \frac{22}{7} \times 28 \times 28 - \frac{1.7}{4} \times 28 \times 28 \right\} \text{cm}^2$$

$$= \left\{ \frac{11}{3} \times 112 - 1.7 \times 196 \right\} \text{cm}^2$$

$$= \left\{ \frac{1232}{3} - 333.2 \right\} \text{cm}^2$$



The total area of six designed portions

$$= 6 \times \left\{ \frac{1232}{3} - 333.2 \right\} \text{cm}^2$$

$$= 2464 - 1999.2 \text{ cm}^2 = 464.8 \text{ cm}^2$$

The total cost of making the designs at the rate of Rs. 0.35 per  $\text{cm}^2$

$$= \text{Rs. } 0.35 \times 464.8 = \text{Rs. } 162.68.$$

**Q14.** Tick the correct answer in the following :

Area of a sector of angle  $p$  (in degree) of a circle with radius  $R$  is.

(A)  $\frac{p}{180} \times 2\pi R$

(B)  $\frac{p}{180} \times \pi R^2$

(C)  $\frac{p}{360} \times 2\pi R$

(D)  $\frac{p}{720} \times 2\pi R^2$

**Sol.** (D) Here, radius ( $r$ ) =  $R$

Angle of sector ( $\theta$ ) =  $p^\circ$

$\therefore$  Area of the sector

$$= \frac{\theta}{360} \times \pi r^2 = \frac{p}{360^\circ} \times \pi R^2$$

$$= \frac{2}{2} \times \left( \frac{p}{360^\circ} \times \pi R^2 \right) = \frac{p}{720^\circ} \times 2\pi R^2$$