## CHAPTER

## 12 <br> Areas Related to Circles

## TOPICS

Perimeter and Area of a circle.
Area of sector and semgnet of a circle.
MIND MAPING


## KEY POINTS

Circle: A circle is the locus of a point which moves in a plane in such a way that its distance from a fixed point always remains the same. The fixed point is called the
centre and the constant distance is known as the radius of the circle.
If $r$ is radius of a circle, then
(i) Circumference $=2 \pi \mathrm{r}$ or $\pi d$ where $\mathrm{d}=2 \mathrm{r}$ is the diameter of the circle
(ii) Area $=\pi r^{2}$ or $\frac{\pi d^{2}}{4}$
(iii) Area of semi circle $=\frac{\pi r^{2}}{2}$
(iv) Area of quadrant of a circle $=\frac{\pi r^{2}}{4}$

Area enclosed by two concentric circles: If R and r are radii of two concentric circles, then area enclosed by the two circles $=\pi R^{2}-\pi r^{2}$


$$
=\pi\left(\mathrm{R}^{2}-\mathrm{r}^{2}\right)
$$

$$
=\pi(\mathrm{R}+\mathrm{r})(\mathrm{R}-\mathrm{r})
$$

(i) If two circles touch internally, then the distance between their centres is equal to the difference of their radii.
(ii) If two circles touch externally, then distance between their centres is equal to the sum of their radii.
(iii) Distance moved by rotating wheel in one revolution is equal to the circumference of the wheel.
(iv) The number of revolutions completed by a rotating wheel in

$$
\text { one minute }=\frac{\text { Distance moved in one minute }}{\text { Circumference of the wheel }}
$$

Segment of a Circle: The portion (or part) of a circular region enclosed between a chord and the corresponding arc is called a segment of the circle. In adjacent fig. APB is minor segment and $A Q B$ is major segment.


## Mathematics-X

Area of segment $\mathrm{APB}=$ Area of the sector $\mathrm{OAPB}-$ Area of $\triangle \mathrm{OAB}$

$$
\begin{aligned}
& =\frac{\theta}{360^{\circ}} \times \pi r^{2}-\frac{1}{2} r^{2} \sin \theta \text { or } \\
& =\frac{\theta}{360^{\circ}} \pi r^{2}-r^{2} \sin \frac{\theta}{2} \cos \frac{\theta}{2}
\end{aligned}
$$



Sector of a circle: The portion (or part) of the circular region enclosed by the two radii and the corresponding arc is called a sector of the circle.
In adjacent figure OAPB is minor sector and OAQB is the major sector.


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

$$
=\frac{1}{2} \times \text { length of arc } \times \text { radius }=\frac{1}{2} l r
$$

Length of an arc of a sector of angle $\theta=\frac{\theta}{360} \times 2 \pi \mathrm{r}$
(i) The sum of the arcs of major and minor sectors of a circle is equal to the circumference of the circle.
(ii) The sum of the areas of major and minor sectors of a circle is equal to the area of the circle.
(iii) Angle described by minute hand in 60 minutes $=360^{\circ}$

Angle described by minute hand in one minute $=\frac{360^{\circ}}{60^{\circ}}=6^{\circ}$
Thus minute hand rotates through an angle of $6^{\circ}$ in one minute
(iv) Angle described by hour hand in 12 hours $=360^{\circ}$

Angle described by hour hand in one hour $=\frac{360^{\circ}}{12^{\circ}}=30^{\circ}$
Angle described by hour hand in one minute $=\frac{30^{\circ}}{60^{\circ}}=\left(\frac{1}{2}\right)$
Thus, hour hand rotates through an angle of $\left(\frac{1}{2}\right)$ in one minute.

## VERY SHORT ANSWER QUESTIONS

1. If the diameter of a semi circular protactor is 14 cm , then find its perimeter.
2. If circumference and the area of a circle are numerically equal, find the diameter of the circle.
3. Find the area of the circle 'inscribed' in a square of side $a \mathrm{~cm}$.
4. Find the area of a sector of a circle whose radius is $r$ and length of the arc is $l$.
5. The radius of a wheel is 0.25 m . Find the number of revolutions it will make to travel a distance of 11 kms .
6. If the area of circle is $616 \mathrm{~cm}^{2}$, then what is its circumference?
7. What is the area of the circle that can be inscribe in a square of side 6 cm ?
8. What is the diameter of a circle whose area is equal to the sum of the areas of two circles of radii 24 cm and 7 cm ?
9. A wire can be bent in the form of a circle of radius 35 cm . If it is bent in the form of a square, then what will be its area?
10. What is the angle subtended at the centre of a circle of radius 6 cm by an arc of length $3 \pi \mathrm{~cm}$ ?
11. Write the formula for the area of sector of angle $\theta$ (in degrees) of a circle of radius $r$.
12. If the circumference of two circles are in the ratio $2: 3$, what is the ratio of their areas?

## Mathematics-X

13. If the difference between the circumference and radius of a circle is 37 cm , then find the circumference of the circle. ( Use $\pi=\frac{22}{7}$ )
14. If diameter of a circle is increased by $40 \%$, find by how much percentage its area increases?
15. The hour hand of a clock is 6 cm long. Find the area swept by it between $11: 20 \mathrm{am}$ and 11:55 am.
16. What is the diameter of a circle whose area is equal to the sum of areas of two circles of radii 24 cm and 7 cm .
(NCERTExemplar)
17. What is the area of the circel that can be incresed in a square of side 6 cm .
(NCERT Exemplar)
18. The length of the minute hand of a clock is 14 cm . Find the area swept by the minute hand in one minute.
19. Tied the correct Answer

If the peremeter and the area of a circle are numercally equal, then the radius of the circle is:
(a) 2 units
(b) 11 units
(c) 4 units
(d) 7 units
20. Circumference of a circle of radius $r$ is $\qquad$ .
21. Area of a circle of radius $s$ is $\qquad$ ,
22. Length of an arc of a sector of a circle with radius $r$ and angle $\theta$ is $\qquad$ .
23. Area of a sector with radius $r$ and angle with degrees measure $\theta$ is $\qquad$ .
24. Area of segment of a circle $=$ Area of the corresponding sector $\qquad$ .

## SHORT ANSWER TYPE I QUESTIONS

25. Find the area of a quadrant of a circle whose circumference is 22 cm .
26. What is the angle subtended at the centre of a circle of radius 10 cm by an arc of length $5 \pi \mathrm{~cm}$ ?
27. If a square is inscribed in a circle, what is the ratio of the area of the circle and the square?
28. Find the radius of semicircle if its perimeter is 18 cm .
29. If the perimeter of a circle is equal to that of square, then find the ratio of their areas.
30. What is the ratio of the areas of a circle and an equilateral triangle whose diameter and a side are respectively equal?
31. In fig., O is the centre of a circle. The area of sector OAPB is $\frac{5}{18}$ of the area of the circle. Find $x$.

32. Find the perimeter of a given fig, where $A E D$ is a semicircle and $A B C D$ is a rectangle.
(CBSE, 2015)

33. In fig. OAPBO is a sector of a circle of radius 10.5 cm . Find the perimeter of the sector.

34. In the given fig, APB and CQD are semi circles of diameter 7 cm each, while ARC and BSD are semicircles of diameter 14 cm each. Find the perimeter of the shaded region. (Use $\pi=\frac{22}{7}$ )
(Delhi, 2011)

## Mathematics-X



## SHORT ANSWER TYPE II QUESTIONS

35. Area of a sector of a circle of radius 36 cm is $54 \pi \mathrm{~cm}^{2}$. Find the length of the corresponding arc of the sector.
36. The length of the minute hand of a clock is 5 cm . Find the area swept by the minute hand during the time period 6:05 am to 6:40 am.
37. In figure ABCD is a quadrant of a circle of a radius 28 cm and a semi circles BEC is drawn with BC as diameter find the area of shaded region:

38. In fig, OAPB is a sector of a circle of radius 3.5 cm with the centre at O and $\angle A O B=120^{\circ}$. Find the length of OAPBO.

39. Circular footpath of width 2 m is constructed at the rate of $₹ 20$ per square meter, around a circular park of radius 1500 m . Find the total cost of construction of the foot path. (Take $\pi=3.14$ )
40. A boy is cycling such that the wheels of the cycle are making 140 revolutions per minute. If the diameter of the wheel is 60 cm . Calculate the speed of cycle.
41. In a circle with centre $O$ and radius 4 cm , and of angle $30^{\circ}$. Find the area of minor sector and minor sector AOB. $(\pi=3.14)$
42. Find the area of the largest triangle that can be inscribed in a semi circle of radius $r$ unit.
(NCERTExempler)
43. Figure ABCD is a trapezium of area 24.5 cm in it $\mathrm{AD} \| \mathrm{BC},\left\lfloor\mathrm{DAB}=90^{\circ}, \mathrm{AD}=10\right.$ $\mathrm{cm}, \mathrm{BC}=4 \mathrm{~cm}$. If ABE is a quadrant of a circle. Find the area of the shaded region $(\pi$ $=\frac{22}{7}$ )

44. From each of the two opposite corners of a square of side 8 cm , a quadrant of a circle of radius 1.4 cm is cut. Another circle of radius 4.2 cm is also cut from the centre as shown in fig. Find the area of the shaded portion. (Use $\pi=\frac{22}{7}$ ).

45. A sector of $100^{\circ}$ cut off from a circle contains area $70.65 \mathrm{~cm}^{2}$. Find the radius of the circle. $(\pi=3.14)$
46. In fig. ABCD is a rectangle with $\mathrm{AB}=14 \mathrm{~cm}$ and $\mathrm{BC}=7 \mathrm{~cm}$. Taking $\mathrm{DC}, \mathrm{BC}$ and AD as diameter, three semicircles are drawn. Find the area of the shaded portion.


## Mathematics-X

47. A square water tank has its each side equal to 40 m . There are four semi circular grassy plots all around it. Find the cost of turfing the plot at Rs 1.25 per sq. m. (Use $\pi=3.14$ )
48. Find the area of the shaded region shown in the fig. (NCERT - Exemplar)

49. Find the area of the minor segment of a circle of radius 21 cm , when the angle of the corresponding sector is $120^{\circ}$.
50. A piece of wire 11 cm long is bent into the form of an arc of a circle subtending an angle of $45^{\circ}$ at its centre. Find the radius of the circle.
51. Find the area of the flower bed (with semicircular ends). (NCERT Exampler)

52. In fig. from a rectangular region ABCD with $\mathrm{AB}=20 \mathrm{~cm}$, a right triangle AED with $\mathrm{AE}=9 \mathrm{~cm}$ and $\mathrm{DE}=12 \mathrm{~cm}$, is cut off. On the other end, taking BC as diameter, a semi circle is added on outside the region. Find the area of the shaded region.

53. The circumference of a circle exceeds the diameter by 16.8 cm . Find the radius of the circle.
54. Find the area of the shaded region.


## LONG ANSWER TYPE QUESTIONS

55. Two circles touch externally. The sum of their areas is $130 \pi \mathrm{sq}$. cm and the distance between their centres is 14 cm . Find the radii of the circles.
56. Three circles each of radius 7 cm are drawn in such a way that each of their touches the other two. Find the area enclosed between the circles. (All India 2010)
57. Find the number of revolutions made by a circular wheel of area $6.16 \mathrm{~m}^{2}$ in rolling a distance of 572 m .
58. All the vertices of a rhombus lie on a circle. Find the area of the rhombus, if area of the circle is $2464 \mathrm{~cm}^{2}$.
59. With vertices $A, B$ and $C$ of a triangle $A B C$ as centres, arcs are drawn with radius 6 cm each in fig. If $\mathrm{AB}=20 \mathrm{~cm}, \mathrm{BC}=48 \mathrm{~cm}$ and $\mathrm{CA}=52 \mathrm{~cm}$, then find the area of the shaded region.

60. ABCDEF is a regular hexagon. With vertices $\mathrm{A}, \mathrm{B}, \mathrm{C}, \mathrm{D}, \mathrm{E}$ and F as the centres, circles of same radius ' $r$ ' are drawn. Find the area of the shaded portion shown in the given figure.

## Mathematics-X


61. $A B C D$ is a diameter of a circle of radius 6 cm . The lengths $A B, B C$ and $C D$ are equal. Semicircles are drawn on AB and BD as diameter as shown in the fig. Find the perimeter and area of the shaded region.

62. A poor artist on the street makes funny cartoons for children and earns his living. Once he made a comic face by drawing a circle within a circle, the radius of the bigger circle being 30 cm and that of smaller being 20 cm as shown in the figure. What is the area of the cap given in this figure?

63. In a given figure $A B C D$ is a trapzium with $A B \| D C$, $\mathrm{AB}=18 \mathrm{~cm}, \mathrm{DC}=32 \mathrm{~cm}$ and distance between $A B$ and $D C=14 \mathrm{~cm}$. If arc of equal radii 7 cm with centres $\mathrm{AB}, \mathrm{C}$ and D have been drawn, then find the area of shaded region.

64. Find the area of the shaded region in the given figure.


## ANSWERS AND HINTS

1. $\pi r+d=\frac{22}{7} \times 7+14=36 \mathrm{~cm}$
2. $2 \pi r=\pi r^{2} \Rightarrow 4$ units.
3. Side of the square is equal to diameter of the circle,

$$
\pi r^{2}=\pi \times \frac{a^{2}}{4}\left(\text { side }=a, \text { radius }=\frac{a}{2}\right)
$$

4. $l=\frac{\theta}{360^{\circ}} \times 2 \pi r$, Area $=\frac{\theta}{360^{\circ}} \times \pi r^{2} \Rightarrow \frac{l \times \pi r^{2}}{2 \pi r}=\frac{l r}{2}$ sq. units
5. $\frac{\text { distance }}{\text { circumference }}=\frac{11 \times 1000 \times 7 \times 100}{2 \times 22 \times 25}=7000$
6. $\pi r^{2}=616 \Rightarrow r=14 \mathrm{~cm}$ or $2 \pi r=88 \mathrm{~cm}$
7. Side of the square is equal to the diameter of the circle

$$
\Rightarrow \quad \mathrm{r}=3 \mathrm{~cm} \text { or } \pi r^{2}=\pi(3)^{2}=9 \pi \mathrm{~cm}^{2} .
$$

8. $\pi R^{2}=\pi r_{1}^{2}+\pi r_{2}^{2} \Rightarrow R=25$ and diameter $=50 \mathrm{~cm}$.
9. $2 \pi r=2 \times \frac{22}{7} \times 35=220 \mathrm{~cm}$, Side of square $\frac{220}{4}=55 \mathrm{~cm}$

Area of square $=55 \times 55=3025 \mathrm{~cm}^{2}$

## Mathematics-X

10. $l=\frac{\theta}{360} \times 2 \pi r \Rightarrow 3 \pi=\frac{\theta}{360} \times 2 \pi \times 6 \quad \Rightarrow \quad \theta=90^{\circ}$
11. $\frac{\theta}{360} \times 2 \pi r$
12. $\frac{2 \pi r_{1}}{2 \pi r_{2}}=\frac{2}{3} \Rightarrow r_{1}=\frac{2}{3} r_{2}$ or $\frac{\pi r_{1}^{2}}{\pi r_{2}^{2}}=\frac{\left(\frac{2}{3} r_{1}\right)^{2}}{r_{2}^{2}}=\frac{\frac{4}{9} r_{2}^{2}}{r_{2}^{2}}=4: 9$
13. $(2 \pi r-r)=37$ or $r=7, \quad 2 \pi r=2 \times \frac{22}{7} \times 7=44 \mathrm{~cm}$
14. $\frac{\pi d_{1}}{\pi d_{2}}=\frac{100}{140} \Rightarrow \frac{2 \pi r_{1}}{2 \pi r_{2}}=\frac{5}{7}, \quad \frac{\pi r_{1}^{2}}{\pi r_{2}^{2}}=25: 49 \frac{24}{25} \times 100=96 \%$
15. $\frac{210 \times 22 \times 6 \times 6}{360 \times 7}=66 \mathrm{~cm}^{2}\left(\theta=210^{\circ}\right)(11: 20$ to $11: 55=35$ minutes $)$
16. $\pi R^{2}=\pi r_{1}^{2}+\pi r_{2}^{2} \Rightarrow R=25$
17. $\underset{\mathrm{cm}^{2}}{\text { Diameter of the circle }=\text { Side of square or } 3 \mathrm{~cm} \text { radius, area of circle }=\pi r^{2}=9 \pi}$
18. $10.27 \mathrm{~cm}^{2}$
19. 2 units.
20. $2 \pi r$
21. $\pi s^{2}$
22. $\frac{\theta}{360} \times 2 \pi r$
23. $\frac{\theta}{360} \times \pi r^{2}$
24. Area of the corresponding triangle
25. $2 \pi r=22, r=\frac{7}{2}$

Area of quadrant $=\frac{\pi r^{2}}{4}=\frac{22 \times 7 \times 7}{7 \times 4 \times 2 \times 2}=9.625 \mathrm{~cm}^{2}$
26. $l=\frac{\theta}{360} \times 2 \pi r \Rightarrow 5 \pi=\frac{\theta}{360} \times 2 \pi \times 10 \Rightarrow \theta=90^{\circ}$
27.


If side of square is 1 unit by Pythagoras
Diameter or dianotla $=\sqrt{2}$ unit.
Area of square $=1 \times 1=1$ sq units.
Area of Circle $=\pi r^{2}=\pi \times \frac{\sqrt{2}}{2} \times \frac{\sqrt{2}}{2}=\frac{\pi}{2}$

$$
=\frac{22}{7} \times \frac{\sqrt{2}}{2} \times \frac{\sqrt{2}}{2}=\frac{11}{7}
$$

So, $4: \pi$ or $11: 7$
28.

$$
\pi r+2 r=18 \mathrm{~cm}
$$

$$
\begin{aligned}
\frac{22}{7} r+2 r & =18 \\
r\left(\frac{22}{7}+2\right) & =18 \\
r & =\frac{7}{2} \quad \text { or } \quad 3.5 \mathrm{~cm}
\end{aligned}
$$

29. $2 \pi r=4$ unit $\quad$ or $\frac{2 \pi r}{4 \text { unit }}=\frac{\text { Perimeter of circle }}{\text { Perimeter of square }}$

$$
\mathrm{r}=\frac{7}{11} \text { unit }
$$

$$
\frac{\pi r^{2}}{1}=\frac{22}{7} \times \frac{7}{11} \times \frac{7}{11}=\frac{14}{11} \quad \text { or } \quad 14: 11
$$

30. Area of equilateral triangle $=\frac{\sqrt{3}}{4} a^{2}$

## Mathematics-X

Area of circle required $=\pi\left(\frac{a}{2}\right)^{2}$

$$
\text { ratio }=\frac{\frac{\sqrt{3}}{4} a^{2}}{\pi\left(\frac{a}{2}\right)^{2}}=\pi: \sqrt{3}
$$

31. $\frac{\theta}{360} \pi r^{2}=\pi r^{2} \times \frac{5}{18}$

$$
\theta=100^{\circ}
$$

32. $20 \mathrm{~cm}+14 \mathrm{~cm}+20 \mathrm{~cm}+\pi r$

$$
20 \mathrm{~cm}+14 \mathrm{~cm}+20 \mathrm{~cm}+\frac{22}{7} \times 7=76 \mathrm{~cm}
$$

33. $\frac{\theta}{360} \times 2 \pi r=\frac{60 \times 2 \times 22 \times 105}{360 \times 7 \times 10}=11 \mathrm{~cm}$

Perimeter $=10.5+10.5+11 \mathrm{~cm}=32 \mathrm{~cm}$
34. Perimeter of shaded region $=$ Perimeters of semi circles,

$$
\begin{aligned}
& =\mathrm{ARC}+\mathrm{APB}+\mathrm{BSD}+\mathrm{CQD} \\
& =\pi\left(r_{1}+r_{2}+r_{3}+r_{4}\right) \\
& =\frac{22}{7}\left[7+\frac{7}{2}+7+\frac{7}{2}\right]=\frac{22}{7} \times 21=66 \mathrm{~cm}
\end{aligned}
$$

35. 

$$
\begin{aligned}
54 \pi & =\frac{\theta \times \pi \times 36 \times 36}{360} \\
\theta & =15^{\circ} \\
l & =\frac{\theta}{360} \times 2 \pi r=\frac{15 \times 2 \times \pi \times 36}{360}=3 \pi
\end{aligned}
$$

36. Area $=\frac{\theta}{360} \times \pi r^{2}=\frac{210 \times 22 \times 5 \times 5}{360 \times 7}=\frac{1650}{36}=45 \cdot \frac{5}{6} \mathrm{~cm}^{2}$ ( $\theta=210^{\circ}$ in 35 minutes)
37. $\mathrm{AC}=28 \mathrm{~cm}, \mathrm{BC}=28 \sqrt{2} \mathrm{~cm}$ (by Pythagoras).

$$
\begin{aligned}
\text { radius } & =14 \sqrt{2} \mathrm{~cm} \\
\text { Shaded region } & =\text { Area of semicircle }- \text { Area of segment } \mathrm{BCD}
\end{aligned}
$$

$$
\begin{aligned}
& =\frac{1}{2} \pi(14 \sqrt{2})^{2}-\frac{90^{\circ}}{360^{\circ}} \times \pi(28)^{2}+\frac{1}{2} \times 28 \times 28 \\
& =392 \mathrm{~cm}^{2}
\end{aligned}
$$

38. 

$$
\begin{aligned}
l & =\frac{240 \times 2 \times 22 \times 35}{360 \times 7 \times 10}=14.6 \\
\mathrm{O} & =14.6+3.5+3.5 \\
& =21.6 \mathrm{~cm}
\end{aligned}
$$

$$
\text { Length of OAPBO }=14.6+3.5+3.5
$$

39. 

$$
\begin{aligned}
\pi\left(r_{1}^{2}-r_{1}^{2}\right) & =\pi\left[(1502)^{2}-(1500)^{2}\right] \times 20 \\
& =3.14\left[(1502)^{2}-(1500)^{2}\right] \times 20 \\
& =₹ 3770.51 .2
\end{aligned}
$$

40. $\quad$ Circumference of cycle $=2 \pi r$

$$
\begin{aligned}
& =2 \times \frac{22}{7} \times 30 \mathrm{~cm} \\
& =188.57 \mathrm{~cm} \\
\text { Speed of cycle } & =\frac{18857 \times 140 \times 60}{100 \times 100000} \\
& =15.84 \mathrm{~km} / \mathrm{h}
\end{aligned}
$$

41. Area of Minor sector $=\frac{\theta}{360} \times \pi r^{2}$

$$
\begin{aligned}
& =\frac{30}{360} \times 3.14 \times 4 \times 4 \mathrm{~cm}^{2} \\
& =4.19 \mathrm{~cm}^{2}
\end{aligned}
$$



$$
\begin{aligned}
\text { Area of major sector } & =\frac{\theta}{360} \times \pi r^{2} \\
& =\frac{330}{360} \times 3.14 \times 4 \times 4
\end{aligned}
$$

## Mathematics-X

$$
=46.1 \mathrm{~cm}^{2} \quad \text { (approx) }
$$

42. 

$$
\text { Area of } \begin{aligned}
\Delta & =\frac{1}{2} \text { base } \times \text { height } \\
& =\frac{1}{2} A B \times O C \\
& =\frac{1}{2} 2 r \times r \\
& =r^{2} \text { square unit }
\end{aligned}
$$

43. Let $\mathrm{AB}=h \mathrm{~cm}$

$$
\begin{aligned}
\text { Area of tropezium } & =\frac{1}{2}(A D+B C) \times A B \\
24.5 & =\frac{1}{2}(10+4) \times 4 \\
h & =3.5 \mathrm{~cm} \\
\text { Area of quadrant } \mathrm{ABE} & =\frac{90^{\circ}}{360^{\circ}} \times \pi(3.5)^{2} \mathrm{sq} . \mathrm{m} \\
& =9.625 \mathrm{sq} . \mathrm{m} \\
\text { Area of shaded region } & =24.5-9.625 \\
& =14.875 \mathrm{sq} . \mathrm{m}
\end{aligned}
$$

44. Area of shaded portion $=$

Area of square - Area of circle - (Area of 2 quadrauts) or Area of Semicircle.

$$
\begin{aligned}
& =64-\frac{22 \times 42 \times 42}{7 \times 10 \times 10}-\frac{22 \times 14 \times 14 \times 1}{7 \times 10 \times 10 \times 2} \\
& =64-55.44-3.08 \\
& =5.48 \mathrm{~cm}^{2}
\end{aligned}
$$

45. 

$$
\begin{aligned}
\frac{7065}{100} & =\frac{100 \times 314 \times r^{2}}{360 \times 100} \\
\frac{7065 \times 360}{100 \times 314} & =r^{2} \\
9 & =r \\
r & =9 \mathrm{~cm} .
\end{aligned}
$$

46. Area of shaded portion is $=$ One circle and Area of rectangle - semicircle of diamter DC,

$$
\begin{aligned}
\text { Area of shaded portion } & =\pi r^{2}\left[A B \times B C-\frac{\pi\left(\frac{D C}{2}\right)^{2}}{2}\right] \\
& =\frac{22}{7} \times(3.5)^{2}+\left[98-\frac{22 \times 7 \times 7}{7 \times 2}\right] \\
& =38.5+[98-77] \\
& =38.5+21 \\
& =59.5 \mathrm{~cm}^{2}
\end{aligned}
$$

47. Four semicircluar means 2 circles,

$$
\begin{aligned}
\text { Area of } 2 \text { circles } & =2 \pi r^{2} \\
& =2 \times 3.14 \times 20 \times 20 \\
& =2512 \\
& =2512 \times 1.25 \\
& =₹ 3140
\end{aligned}
$$

48. Redraw the figure and decide in into well known shapes,

One semi circle + Rectangle

$$
\begin{aligned}
\text { Area of shaded region } & =l \times b+\frac{\pi r^{2}}{2} \\
& =8 \times 4+\pi \times \frac{2 \times 2}{2} \\
& =(32+2 \pi) \mathrm{cm}^{2}
\end{aligned}
$$

49. $\quad$ Area of the segment $=$ Area of sector - Area of $\Delta$

$$
\begin{aligned}
\text { Area of sector } & =\frac{120}{360} \times \frac{22}{7} \times 21 \times 21=462 \mathrm{~cm}^{2} \\
\text { Area of } \Delta & =\frac{441}{4} \sqrt{3} \mathrm{~cm}^{2}(\text { NCERT example }-3) \\
\text { Area of segment } & =\left(462-\frac{441}{4} \sqrt{3}\right) \mathrm{cm}^{2}
\end{aligned}
$$

## Mathematics-X

$$
=\frac{21}{4}(88-21 \sqrt{3}) \mathrm{cm}^{2}
$$

50. 

$$
\begin{aligned}
l & =\frac{\theta}{360} \times 2 \pi r \\
11 & =\frac{45}{360} \frac{2 \times 22 \times r}{7} \\
14 & =r \\
r & =14 \mathrm{~cm}
\end{aligned}
$$

51. Flower bed has two semi-circular shapes and one rectangular shape.

$$
\begin{aligned}
\text { Area } & =l \times b+\pi r^{2} \\
& =(44 \times 16+\pi \times 8 \times 8) \\
& =(704+64 \pi) \mathrm{cm}^{2}
\end{aligned}
$$

52. $\quad$ Area of shaded region $=$ Rectangle + Semicircle - Triangle

$$
\begin{aligned}
& =20 \times 15+28.12 \pi-\frac{1}{2} \times 12 \times 9 \\
& =334.39 \mathrm{~cm}^{2}
\end{aligned}
$$

53. 

$$
2 \pi r=2 r+16.8
$$

$$
2 \times \frac{22}{7} r-2 r=\frac{168}{10} \quad \text { or } \quad 2 r\left(\frac{22}{7}-1\right)=\frac{168}{10}
$$

or, $\quad 2 r\left(\frac{15}{7}\right)=\frac{168}{10} \quad$ or $\quad \frac{168 \times 7}{10 \times 2 \times 15}=\frac{1176}{300}=3.92 \mathrm{~cm}$
54. Area of shaded region $=$ Area of rectangle $-[$ Area of 2 semicircles + Area of rectangle]

$$
\begin{aligned}
& =L \times B-\left[2 \frac{\pi r^{2}}{2}+l \times b\right] \\
& =26 \times 12-[\pi \times 2 \times 2+16 \times 4] \\
& =312-4 \pi-64=(248-4 \pi) \mathrm{m}^{2}
\end{aligned}
$$

55. 

$$
\begin{align*}
& \pi r_{1}^{2}+\pi r_{2}^{2} & =130 \pi \Rightarrow r_{1}^{2}+r_{2}^{2}+130 \\
\Rightarrow & r_{1}+r_{2} & =14 \quad \ldots(2) \tag{2}
\end{align*}
$$

Substitude the value of $r_{1}$ from (2) in (1) and solve.

$$
\begin{aligned}
2 r_{2}^{2}-28 r_{2}+66 & =0 \\
r_{2}^{2}-14 \mathrm{r}+33 & =0 \quad \quad \quad \text { (Neglecting }-\mathrm{ve} \text { ) } \\
r & =11 \mathrm{~cm} \text { and } r=3 \mathrm{~cm}
\end{aligned}
$$

56. Area of shaded region $=$ Area of $\Delta-$ Area of 3 sectors.

$$
\text { area } \Delta=\frac{\sqrt{3}}{4} \times 14 \times 14=\frac{\sqrt{3}}{4} \times 196=49 \sqrt{3}
$$

$$
\begin{aligned}
\text { Area of } 3 \text { Sectors } & =3 \times \frac{60}{360} \times \frac{22}{7} \times 7 \times 7=77 \\
& =(49 \sqrt{3}-77) \quad \text { Ans. }
\end{aligned}
$$

57. 

$$
\begin{aligned}
& \pi r^{2}=\frac{616}{100} \text { or } \quad r^{2}=1.96 \quad \text { or } \quad r=1.4 \mathrm{~m} \\
& 2 \pi r=2 \times \frac{22}{7} \times \frac{14}{10}=\frac{616}{100}=8.8 \mathrm{~m}
\end{aligned}
$$

Number of revolution $=\frac{572}{8.8}=65$
58.

$$
\begin{aligned}
\pi r^{2} & =2464 \mathrm{~cm}^{2} \\
r & =28 \mathrm{~cm} \quad \text { or } \quad d=28+28=56 \mathrm{~cm}
\end{aligned}
$$

$$
\text { Area of rhombus }=\frac{1}{2} d_{1} d_{2} \text { or } \frac{1}{2} d_{2}^{2}\left(d_{1}=d_{2}\right)
$$

$$
=\frac{1}{2} \times 56 \times 56=1568 \mathrm{~cm}^{2}
$$

59. $\quad$ Area of shaded region $=$ Area of $\Delta-$ Area of 3 sectors.

$$
\begin{aligned}
& =\frac{1}{48} \times 20-\frac{\pi r^{2}}{360}\left(\theta_{1}+\theta_{2}+\theta_{3}\right) \\
& =480-\frac{22 \times 6 \times 6}{7 \times 360}\left(180^{\circ}\right) \\
& =480-56.57 \\
& =423.43
\end{aligned}
$$

## Mathematics-X

60. $2 \pi r^{2}$ (Area is equal to 2 circles.)
61. 

$$
\begin{aligned}
\text { Perimeter } & =\frac{2 \pi r_{1}}{2}+\frac{2 \pi r_{2}}{2}+\frac{2 \pi r_{3}}{2} \\
& =\left[2 \times \frac{22}{7} \times \frac{6}{2}+2 \times \frac{22}{7} \times \frac{4}{2} \times 2 \times \frac{22}{7} \times \frac{2}{2}\right] \\
& =2 \times \frac{22}{7}[3+2+1]=\frac{264}{7}=37.71 \mathrm{~cm} \\
\text { Area } & =\left[\pi \frac{r_{1}^{2}}{2}-\pi \frac{r_{2}^{2}}{2}+\pi \frac{r_{3}^{2}}{2}\right]=\frac{22}{7}(18-8+2) \\
& =31.71 \mathrm{~cm}^{2}
\end{aligned}
$$

62. Radius of bigger circle $\mathrm{O}=30 \mathrm{~cm}$

$$
\text { Radius of Smaller } \mathrm{O}^{\prime}=20 \mathrm{~cm}
$$

Difference of their radii $=(30-20)=10 \mathrm{~cm}$
AB is tangent to small circle
Radius $=\mathrm{O}^{\prime} \mathrm{C}$ i.e. $\mathrm{OD} \perp \mathrm{AB}$


$$
\therefore \quad \triangle \mathrm{OCA}=90^{\circ}=\boxed{\mathrm{OCB}}
$$

In $\triangle$ OCA by Phythagoras

$$
\begin{array}{rlrl}
\mathrm{AC} & =20 \sqrt{2} \mathrm{~cm} \\
\Rightarrow & \mathrm{AC} & =\mathrm{CB} \\
\Rightarrow \quad \mathrm{AB} & =\mathrm{AC}+\mathrm{CB} \\
\Rightarrow \quad \mathrm{AB} & =\mathrm{AC}+\mathrm{AC}=2 \mathrm{AC} \\
\mathrm{AB} & =2 \times 20 \sqrt{2} \mathrm{~cm} \\
& =40 \sqrt{2} \mathrm{~cm} \\
& \mathrm{CD} & =\text { Radius of bigger circle-OC } \\
& =30-10=20 \mathrm{~cm}
\end{array}
$$

$$
\text { Area of cap }=\frac{1}{2} \mathrm{AB} \times \mathrm{CD}
$$

$$
=\frac{1}{2} \times 40 \sqrt{2} \times 20 \mathrm{~cm}^{2}
$$

$$
=400 \sqrt{2} \mathrm{~cm}^{2}
$$

63. Area of trapezium $=\frac{1}{2} \times h(a+b)$

$$
=\frac{1}{2} \times 14 \times(18+32)=350 \mathrm{~cm}^{2}
$$

$$
\begin{aligned}
\text { Area of four sectors } & =\frac{\pi r^{2}}{360} \times(\angle A+\angle B+\angle C+\angle D) \\
& =\frac{\pi \times 7 \times 7}{360} \times 360 \\
& =49 \pi \mathrm{~cm}^{2}
\end{aligned}
$$

64. Area of shaded region $=\left(\frac{\pi r_{1}^{2}}{2}+\frac{\pi r_{2}^{2}}{2}+\frac{\pi r_{3}^{2}}{2}\right)$

$$
\begin{aligned}
& =\pi\left(\frac{17 \times 17}{7}+\frac{10 \times 10}{2}+\frac{7 \times 7}{2}\right) \\
& =688.28 \mathrm{~cm}^{2}
\end{aligned}
$$

# PRACTICE-TEST <br> AREAS RELATED TO CIRCLES 

Time : 1 Hr.
M.M.: 20

## SECTION-A

1. If the circumference of two circles are equal, then what is the ratio between their areas?
2. If the diameter of a protactor is 21 cm , then find its perimeter.
3. Area of a circle of radius $P$ is $\qquad$ .
4. Tick the correct answer.

If the perimeter and the area of a circle are numerically equal then the radius of the circle is
(a) 2 units
(b) $\pi$ units
(c) 4 units
(d) 7 units

## SECTION-B

5. The length of minute hand of a clock is 14 cm . Find the area swept by the mixutre hand in 8 minutes.
6. Find the area of a circle whose circumference is 22 cm .2
7. Find the area of a quadrant of a circle whose circumference is 44 cm .

## SECTION-C

8. A horse is tied to a pole with 28 cm long string. Find the area where the horse can graze.

3
9. In fig. two concentric circles with centre $O$, have radii 21 cm and 42 cm . If $\angle A O B=60^{\circ}$ find the area of the shaded region. (Use $\pi=\frac{22}{7}$ )


## SECTION-D

10. A chord AB of a circle of radius 10 cm makes a right angle at the centre of the circle. Find the area of the minor and major segments.
