Mathematics

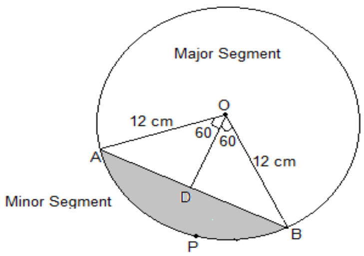
AREAS RELATED TO CIRCLES

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

Soln: Radius, r = 12 cm

Now, draw a perpendicular OD on chord AB, and it will bisect chord AB.

So, AD = DB



Now, the area of the minor sector = $(\theta/360°)\times\pi r^2$

$= (120/360)\times(22/7)\times12^2$

$= 150.72\ cm^2$

Consider the ΔAOB,

$\angle OAB = 180°-(90°+60°) = 30°$

Now, cos 30° = AD/OA

$\sqrt{3}/2 = AD/12$

Or, $AD = 6\sqrt{3}$ cm

We know OD bisects AB. So,

$AB = 2\times AD = 12\sqrt{3}$ cm

Now, sin 30° = OD/OA

Or, ½ = OD/12

∴ OD = 6 cm

So, the area of ΔAOB = ½ × base × height

Here, base = AB = $12\sqrt{3}$ and

Height = OD = 6

So, area of $\Delta AOB = ½\times12\sqrt{3}\times6 = 36\sqrt{3}$ cm

$= 62.28\ cm^2$

∴ area of the corresponding Minor segment =

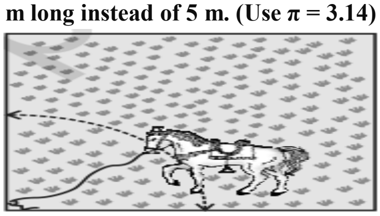
= Area of the Minor sector – Area of ΔAOB

$= 150.72\ cm^2 - 62.28\ cm^2 = 88.44\ cm^2$

8. 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 (see Fig. 12.11). 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 $\pi = 3.14$)



Soln: As the horse is tied at one end of a square field, it will graze only a quarter (i.e. sector with θ = 90°) of the field with a radius 5 m.

Here, the length of the rope will be the radius of the circle, i.e. r = 5 m

It is also known that the side of the square field=15m

(i) Area of circle = $\pi r^2 = 22/7 \times 5^2 = 78.5\ m^2$

Now, the area of the part of the field where the horse can graze = ¼ (the area of the circle) = 78.5/4

$= 19.625\ m^2$

(ii) If the rope is increased to 10 m,

Area of circle will be = $\pi r^2 = 22/7\times10^2 = 314\ m^2$

Now, the area of the part of the field where the horse can graze = ¼ (the area of the circle)

$= 314/4 = 78.5\ m^2$

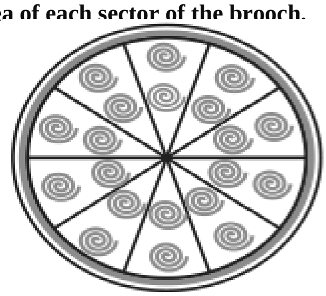
∴ increase in the grazing area = $78.5\ m^2 - 19.625\ m^2$

$= 58.875\ m^2$

9. A brooch is made with silver wire in the form of a circle with a diameter 35 mm. The wire is also used in making 5 diameters which divide the circle into 10 equal sectors, as shown in Fig. 12.12. Find:

(i) the total length of the silver wire required.

(ii) the area of each sector of the brooch.



Soln: Diameter (D) = 35 mm

Total number of diameters to be considered = 5

Now, the total length of 5 diameters that would be required = 35×5 = 175

Circumference of the circle = $2\pi r$

Or, $C = \pi D = 22/7\times35 = 110$

Area of the circle = πr^2

Or, $A = (22/7)\times(35/2)^2 = 1925/2\ mm^2$

(i) Total length of silver wire required = Circumference of the circle + Length of 5 diameter = 110+175 = 285 mm

(ii) Total Number of sectors in the brooch = 10

So, the area of each sector = total area of the circle/number of sectors

∴ Area of each sector = $(1925/2)\times1/10 = 385/4\ mm^2$

10. An umbrella has 8 ribs which are equally spaced (see Fig. 12.13). Assuming the umbrella to be a flat circle of radius 45 cm, find the area between the two consecutive ribs of the umbrella.

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