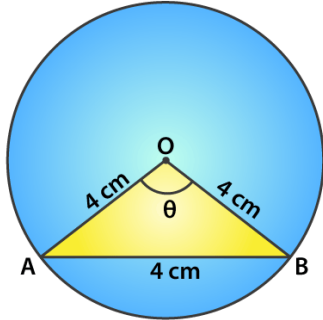


Exercise 15.3

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1. AB is a chord of a circle with centre O and radius 4 cm. AB is of length 4 cm and divides the circle into two segments. Find the area of the minor segment.

Solution:



Given,

Radius of the circle with centre 'O', $r = 4 \text{ cm} = OA = OB$

Length of the chord $AB = 4 \text{ cm}$

So, OAB is an equilateral triangle and angle $AOB = 60^\circ$

Thus, the angle subtended at centre $\theta = 60^\circ$

Area of the minor segment = (Area of sector) - (Area of triangle AOB)

$$= \frac{\theta}{360} \times \pi r^2 - \frac{\sqrt{3}}{4} (\text{side})^2$$

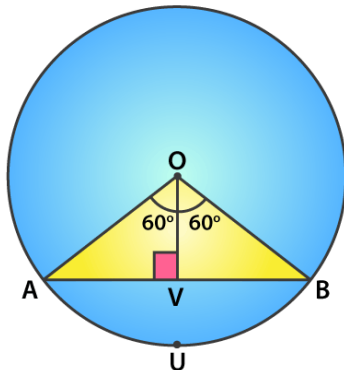
$$= \frac{60}{360} \times \pi 4^2 - \frac{\sqrt{3}}{4} (4)^2$$

$$= (8\pi/3 - 4\sqrt{3}) = 8.37 - 6.92 = 1.45 \text{ cm}^2$$

Therefore, the required area of the segment is $(8\pi/3 - 4\sqrt{3}) \text{ cm}^2$

2. A chord PQ of length 12 cm subtends an angle 120° at the centre of a circle. Find the area of the minor segment cut off by the chord PQ.

Solution:



Given, $\angle POQ = 120^\circ$ and $PQ = 12 \text{ cm}$

Draw $OV \perp PQ$,

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$$PV = PQ \times (0.5) = 12 \times 0.5 = 6 \text{ cm}$$

Since, $\angle POV = 120^\circ$

$$\angle POV = \angle QOV = 60^\circ$$

In triangle OPQ, we have

$$\sin \theta = PV / OA$$

$$\sin 60^\circ = 6 / OA$$

$$\sqrt{3}/2 = 6 / OA$$

$$OA = 12 / \sqrt{3} = 4\sqrt{3} = r$$

Now, using the above we shall find the area of the minor segment

We know that,

Area of the segment = area of sector OPUQO – area of $\triangle OPQ$

$$= \theta/360 \times \pi r^2 - \frac{1}{2} \times PQ \times OV$$

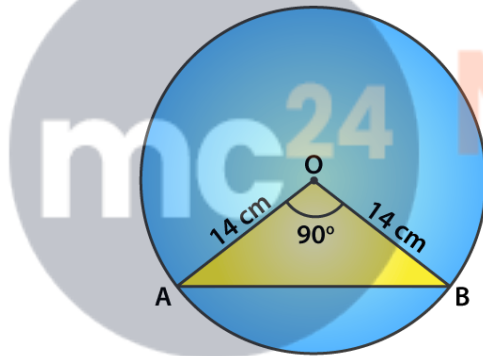
$$= 120/360 \times \pi (4\sqrt{3})^2 - \frac{1}{2} \times 12 \times 2\sqrt{3}$$

$$= 16\pi - 12\sqrt{3} = 4(4\pi - 3\sqrt{3})$$

Therefore, the area of the minor segment = $4(4\pi - 3\sqrt{3}) \text{ cm}^2$

3. A chord of a circle of radius 14 cm makes a right angle at the centre. Find the areas of the minor and major segments of the circle.

Solution:



Given,

$$\text{Radius } (r) = 14 \text{ cm}$$

Angle subtended by the chord with the centre of the circle, $\theta = 90^\circ$

$$\text{Area of minor segment} = \theta/360 \times \pi r^2 - \frac{1}{2} \times r^2 \sin \theta$$

$$= 90/360 \times \pi (14)^2 - \frac{1}{2} \times 14^2 \sin (90)$$

$$= \frac{1}{4} \times (22/7) (14)^2 - 7 \times 14$$

$$= 56 \text{ cm}^2$$

$$\text{Area of circle} = \pi r^2$$

$$= 22/7 \times (14)^2 = 616 \text{ cm}^2$$

Thus,

The area of the major segment = Area of circle – Area of the minor segment

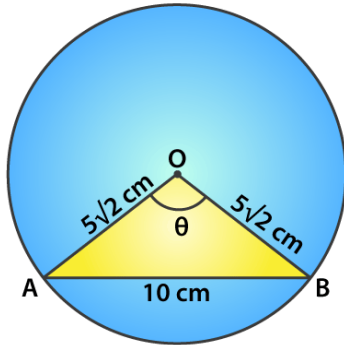
$$= 616 - 56$$

$$= 560 \text{ cm}^2$$

4. A chord 10 cm long is drawn in a circle whose radius is $5\sqrt{2}$ cm. Find the area of both the segments.

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Solution:



Given,

Radius of the circle, $r = 5\sqrt{2}$ cm = OA = OB

Length of the chord AB = 10 cm

In triangle OAB,

$$= OA^2 + OB^2$$

$$= (5\sqrt{2})^2 + (5\sqrt{2})^2$$

$$= 50 + 50$$

$$= 100$$

$$AB^2 = 100$$

We see that the Pythagoras theorem is satisfied.

So, OAB is a right angle triangle.

Angle subtended by the chord with the centre of the circle, $\theta = 90^\circ$

Area of minor segment = area of sector - area of triangle

$$= \frac{\theta}{360} \times \pi r^2 - \frac{1}{2} \times r^2 \sin \theta$$

$$= \frac{90}{360} \times (3.14) 5\sqrt{2}^2 - \frac{1}{2} \times (5\sqrt{2})^2 \sin 90$$

$$= [\frac{1}{4} \times 3.14 \times 25 \times 2] - [\frac{1}{2} \times 25 \times 2 \times 1]$$

$$= 25(1.57 - 1)$$

$$= 14.25 \text{ cm}^2$$

$$\text{Area of circle} = \pi r^2 = 3.14 \times (5\sqrt{2})^2 = 3.14 \times 50 = 157 \text{ cm}^2$$

Thus, Area of major segment = Area of circle – Area of minor segment

$$= 157 - 14.25$$

$$= 142.75 \text{ cm}^2$$

5. A chord AB of circle of radius 14 cm makes an angle of 60° at the centre of a circle. Find the area of the minor segment of the circle.

Solution:

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Areas Related To Circles**

Given,

Radius of the circle (r) = 14 cm = OA = OB

Angle subtended by the chord with the centre of the circle, $\theta = 60^\circ$

In triangle AOB, angle A = angle B [angle opposite to equal sides OA and OB = x]

By angle sum property,

$$\angle A + \angle B + \angle O = 180$$

$$x + x + 60^\circ = 180^\circ$$

$$2x = 120^\circ, x = 60^\circ$$

All angles are 60° so the triangle OAB is an equilateral with OA = OB = AB

Area of the minor segment = area of sector - area of triangle OAB

$$= \frac{\theta}{360} \times \pi r^2 - \frac{\sqrt{3}}{4} (\text{side})^2$$

$$= \frac{60}{360} \times \frac{22}{7} \times 14^2 - \frac{\sqrt{3}}{4} (14)^2$$

$$= \left[\frac{1}{6} \times 22 \times 2 \times 14 \right] - \sqrt{3} \times (7)^2$$

$$= 102.7 - 84.9 = 17.8$$

Therefore, the area of the minor segment = 17.80 cm²



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