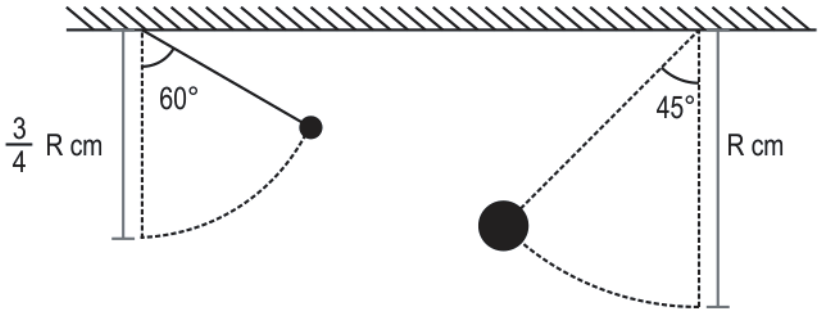
Chapter - 12
Areas Related to Circle

Q: 1 **Shown below are two pendulums of different lengths attached to a bar.**



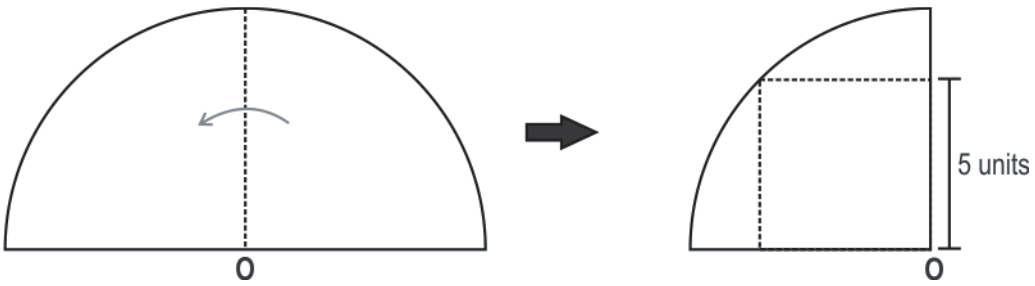
Pendulum 1 Pendulum 2

(Note: The figure is not to scale.)

Based on the figure shown above, the arc length of pendulum 1 is _____ the arc length of pendulum 2.

1 greater than
2 lesser than
3 equal to
4 (cannot be answered without knowing the value of R.)

Q: 2 **Shown below is a semicircular sheet of paper with centre O which is folded in half. A square of length 5 units is cut from it.**

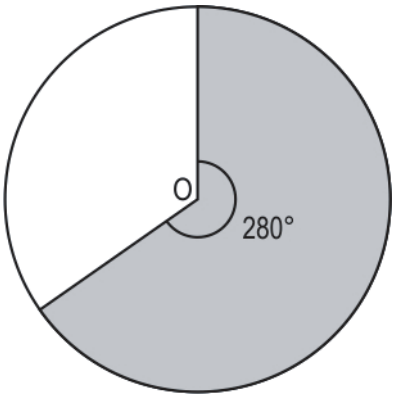


(Note: The figures are not to scale.)

What is the area of paper left?

1 25(π - 1) sq units
2 25(π - 2) sq units
3 25(2π - 2) sq units
4 25($\frac{1}{2}$ π - 1) sq units

Q: 3 **Shown below is a circle with centre O. The shaded sector has an angle of 280° and area A cm^2.**



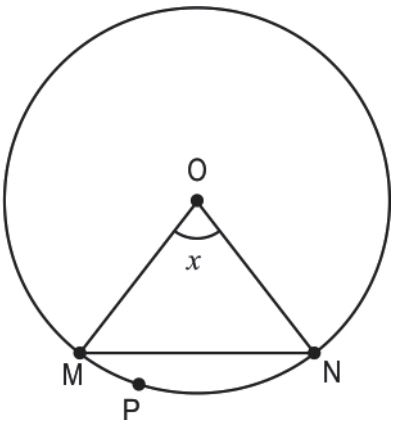
(Note: The figure is not to scale.)

Which of these is the area of the UNSHADED sector?

1 $\frac{2}{7}$ A cm^2 **2** $\frac{1}{3}$ A cm^2

3 $\frac{2}{3}$ A cm^2 **4** $\frac{7}{9}$ A cm^2

Q: 4 **Shown below is a circle with centre O. Chord MN subtends an angle at O.**



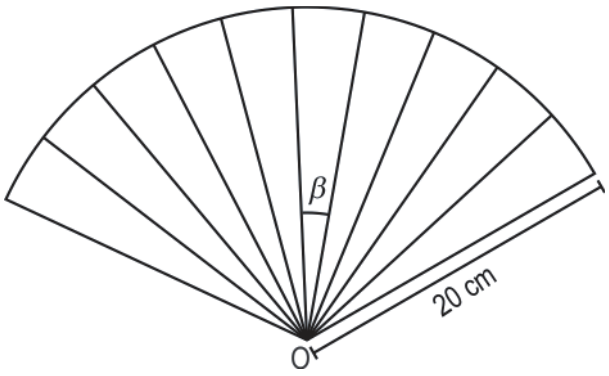
Which of these is true for the above circle?

I. $\frac{x}{360°} = \frac{\text{length of arc MPN}}{\text{circumference of the circle}}$

II. $\frac{x}{360°} = \frac{\text{minor sector area}}{\text{area of the circle}}$

1 only I **2** only II **3** both I and II **4** neither I nor II

Q: 5 **The figure below is a part of a circle with centre O. Its area is $\frac{1250\pi}{9}$ cm^2 and the 10 sectors are identical.** **[2]**



(Note: The figure is not to scale.)

Find the value of β, in degrees. Show your steps.

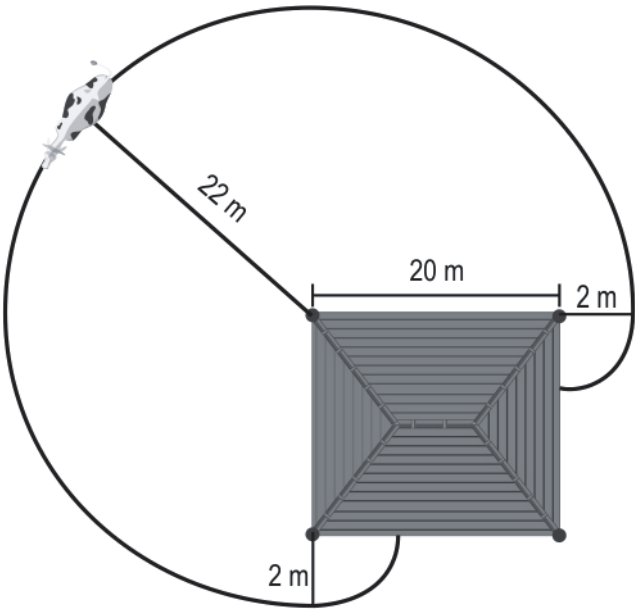
Q: 6 **Avikant bought a pair of glasses with wiper blades. He was curious to know the area being cleaned by each of the wiper blades. With the help of a ruler and a protractor, he found the length of each blade as 3 cm and the angle swept as 60°.** **[2]**

(Note: The figure is for visual representation only.)

i) Find the area that each wiper cleans in one swipe, in terms of π.
ii) If the diameter of each circular glass is 5 cm, what percent of the area of the glass will be cleaned by the blade in one swipe?

Show your work.

Q: 7 **A cow is tied at one of the corners of a square shed. The length of the rope is 22 m. The cow can only eat the grass outside the shed as shown below.** **[3]**



(Note: The figure is not to scale.)

What is the area that the cow can graze on? Show your steps.

(Note: Give the answer in terms of π.)

Q: 8 **A circle has radius 5 cm. Three chords of lengths 6 cm, 8 cm and 10 cm are drawn.** **[1]**

Which chord subtends the largest angle on its minor arc?

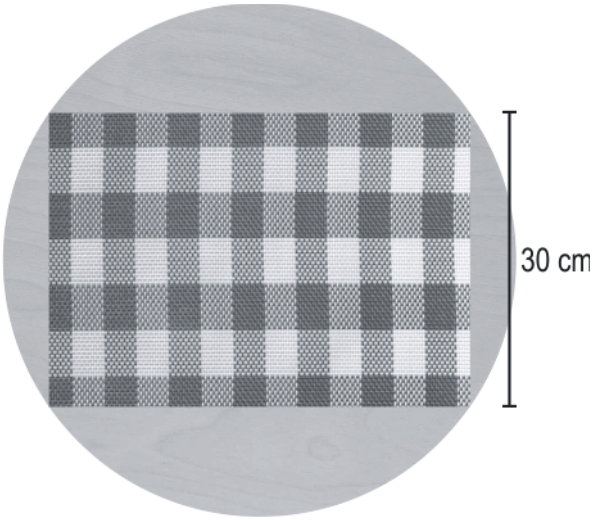
Q: 9 **Ramit drew two circles of different radii. Each of them had an arc that subtended an equal angle at the centre.** **[2]**

He said, "Both arcs are of the same length".

i) Is Ramit right?
ii) If both radii and angles subtended by the two arcs are different, can the arc lengths be the same?

Give valid reasons.

Q: 10 **Sneha had a rectangular tablecloth with one side measuring 30 cm which she wanted to keep on her circular table of radius 25 cm. After keeping it on the table, she realised that the corners of the tablecloth just touched the edge of the circular table as shown in the figure.** **[3]**

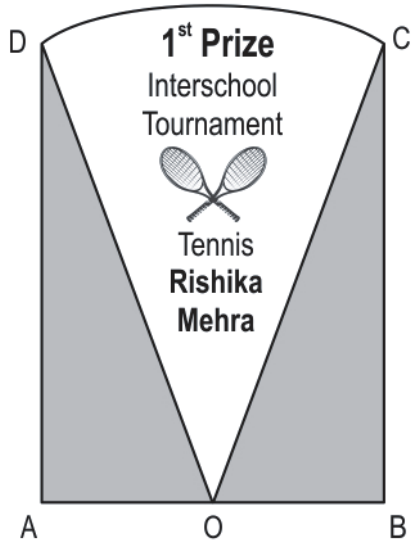


(Note: The figure is not to scale.)

Find the area of the table not covered by the tablecloth. Show your steps with valid reasons.

(Note: Use π = 3.14.)

Q: 11 **Shown below is the trophy shield Rishika received on winning an interschool tennis tournament.** **[5]**



(Note: The figure is not to scale.)

The trophy is made of a glass sector DOC supported by identical wooden right triangles, ΔDAO and ΔCOB. AO = 7 cm and AO:DA = 1:√3.

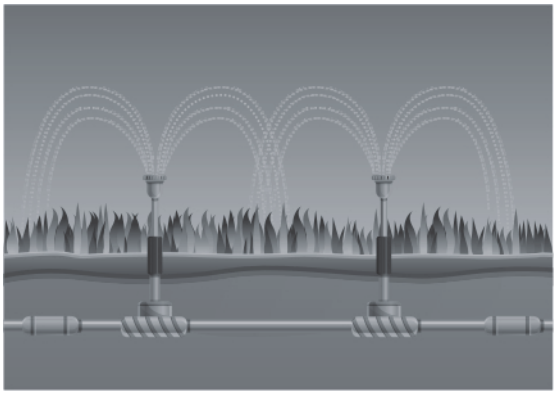
Find the area of:
i) the glass sector correct to 2 decimal places.
ii) the wooden triangles correct to 2 decimal places.

Show your steps.

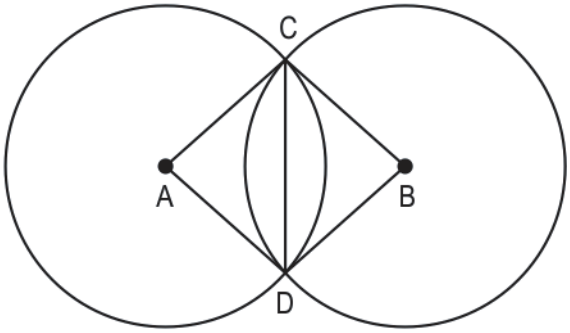
(Note: Take π as $\frac{22}{7}$ and √3 as 1.73.)

Q: 12 **Sprinklers are crop irrigation equipment which rotate around a center and spay water on the crops in the circular region.** **[3]**

Two such high power sprinklers, occupying negligible area are installed in a straight line in a field such that they spray water on an common area. Shown below are the side and top views where points A and B are the sprinklers.



Side view of the sprinklers



Top view of the region sprayed

(Note: The figures are not to scale.)

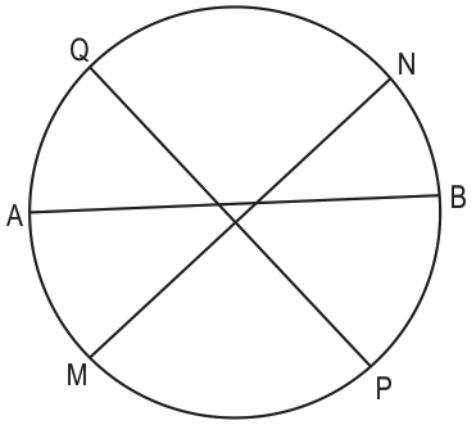
Both the sprinklers spray over an equal area. It is given that, CD = 400 m and ∠CAD = ∠CBD = 90°.

i) Find the radius of the circular region sprayed by the sprinkler.
ii) Find the area of the overlapping region.

Show your work.

(Note: Use π = 3.14.)

Q: 13 **Shown below is a circle with multiple chords. One of the chords is the diameter of the circle.** **[3]**

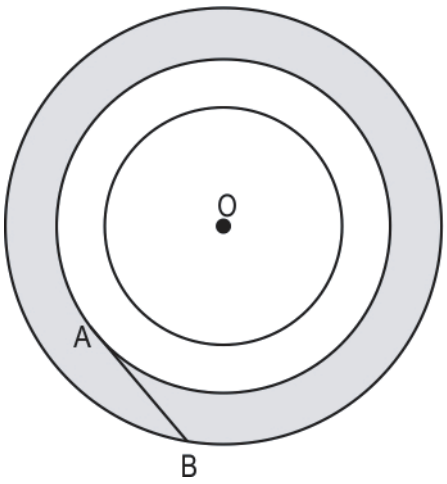


AB = 13.9 cm
MN = 14 cm
PQ = 14.1 cm

(Note: The figure is not to scale.)

Find the measure of the angle subtended by a 4.7π cm arc at the circumference of the circle. Show your work and give valid reasons.

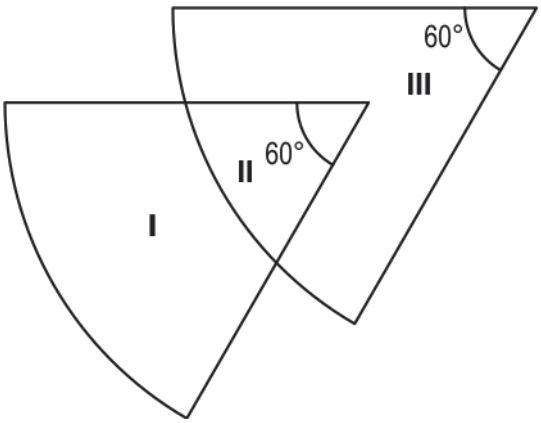
Q: 14 **Shown below are 3 concentric circles with centre O. The tangent to the second circle, AB, has a length of 5 cm.** **[2]**



(Note: The figure is not to scale.)

Find the area of the shaded region in terms of π. Draw a rough figure and show your work.

Q: 15 **Shown below are two overlapping sectors of a circle. The radii of the sectors are 6 cm and 8 cm. The figure is divided into three regions - I, II and III.** **[2]**



(Note: The figure is not to scale.)

Find the difference in the areas of regions I and III. Show your work.

(Note: Take $\pi = \frac{22}{7}$.)

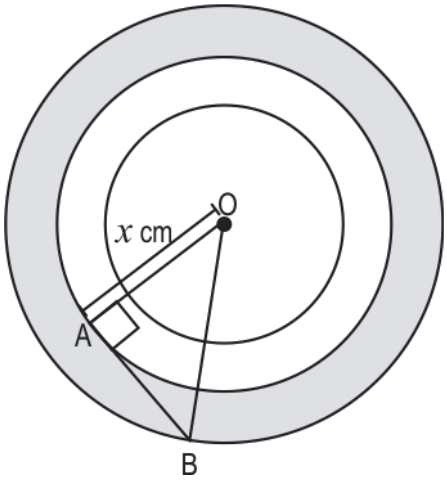
The table below gives the correct answer for each multiple-choice question in this test.

Q.No	Correct Answers
1	3
2	2
3	1
4	3

Q.No	Teacher should award marks if students have done the following:	Marks
5	Equates the area occupied by the figure to the area of a sector as: $\frac{1250\pi}{9} = \frac{\theta}{360} \times \pi \times 20^2$ where, θ is the angle of the entire sector in degrees.	0.5
	Solves the above equation to find the value of θ as 125°.	1
	Finds the value of β as $\frac{125}{10}$ = 12.5°.	0.5
6	i) Finds the area that each wiper cleans in one swipe as $\frac{60°}{360°} \times \pi \times (3)^2 = \frac{3}{2}\pi$ or 1.5π cm^2. (Award 0.5 marks if only the formula for area of a sector is correctly written.)	1
	ii) Finds the area of the glass as $\pi \times \frac{5}{2} \times \frac{5}{2} = \frac{25\pi}{4}$ cm^2.	0.5
	Finds the percentage of the area cleaned by the wiper blade in one swipe as $\frac{1.5\pi \times 4}{25\pi} \times 100 = 24\%$.	0.5
7	Writes the total area as: Total area = (3 quarters sector with radius 22 m) + (2 × one-quarter sector with radius 2 m)	1
	Finds the total area as: Total area = $(\frac{3}{4} \times \pi \times 22^2) + (2 \times \frac{1}{4} \times \pi \times 2^2)$ => Total area = $363\pi + 2\pi = 365\pi$ m^2	2
8	Writes that the chord of length 6 cm subtends the largest angle on its minor arc.	1
9	i) Writes that Ramit is not right and gives a reason. For example, two arcs are not of the same length as arc length is directly proportional to the radius of the circle which is different.	1

Q.No	Teacher should award marks if students have done the following:	Marks
	ii) Writes that the arc lengths can be the same and gives a reason. For example, if the product of the measure of the angle and the radius is the same for both circles, then arc lengths will be the same.	1
10	Writes that since ABCD is a rectangle, the diagonal of the tablecloth will be equal to the diameter of the circular table, which is 50 cm.	0.5
	Uses Pythagoras theorem to find the measure of the other side of the tablecloth as $\sqrt{(50^2 - 30^2)} = 40$ cm.	1
	Finds the area of the table as $3.14 \times (25)^2 = 1962.5$ cm^2.	0.5
	Finds the area of the tablecloth as $30 \times 40 = 1200$ cm^2.	0.5
	Finds the area not covered by the tablecloth as area of the table - area of the tablecloth = $1962.5 - 1200 = 762.5$ cm^2.	0.5
11	In ΔDOA, assumes ∠DOA as θ and writes that $\tan\theta = \frac{DA}{AO} = \frac{\sqrt{3}}{1}$.	0.5
	Finds the value of θ as 60°.	0.5
	Writes that ∠DOA = ∠COB = 60° and finds the measure of ∠DOC as 180 - (60 + 60) = 60°.	1
	Writes that $\frac{AO}{DO} = \cos 60°$ and finds the length of DO as 14 cm. (Award full marks if Pythagoras' theorem is used to correctly find the length of DO.)	1
	i) Finds the area of the sector as $\frac{60}{360} \times \frac{22}{7} \times 14^2 = 102.67$ cm^2.	1
	ii) Finds the area of the wooden triangles as $\frac{1}{2} \times 7 \times 7\sqrt{3} \times 2 = 84.77$ cm^2.	1
12	i) Uses Pythagoras Theorem in ΔACD to find the length of the AC as: $CD^2 = AC^2 + AD^2$ $\Rightarrow 160000 = 2AC^2$ $\Rightarrow 200\sqrt{2} = AC$	1

Q.No	Teacher should award marks if students have done the following:	Marks
	ii) Finds area of sector CAD = area of sector CBD = $\frac{90}{360} \times 3.14 \times (200\sqrt{2})^2 = 62800$ m^2.	1
	Finds the area of ΔCAD = area of ΔCBD = $\frac{1}{2} \times 200\sqrt{2} \times 200\sqrt{2} = 40000$ m^2.	0.5
	Writes that area of the overlapping region = 62800 + 62800 - 40000 - 40000 = 45600 m^2.	0.5
13	Writes that, since the diameter of a circle is the longest chord, the diameter of the given circle is 14.1 cm	0.5
	Assumes the measure of the angle subtended by a 4.7π cm arc at the centre as θ and writes the equation as: $\frac{\theta}{360} \times 2 \times \pi \times \frac{14.1}{2} = 4.7\pi$	1
	Solves the above equation to find the measure of θ as 120°.	0.5
	Writes that, the angle subtended by an arc at the centre is double the angle subtended by it at any point on the remaining part of the circle, and finds the measure of the angle subtended by the arc at the circumference of the circle as $\frac{1}{2} \times 120° = 60°$.	1

Q.No	Teacher should award marks if students have done the following:	Marks
14	Joins OA and OB to make ΔOAB and assumes the radius of the second circle as x cm. The figure may look as follows:  *(Note: The figure is not to scale.)*	0.5
	Uses Pythagoras' theorem to find the length of OB as $\sqrt{(x^2 + 25)}$ cm.	0.5
	Finds the area of the second circle as πx^2 cm^2 and the area of the largest circle as $\pi(x^2 + 25)$ cm^2.	0.5
	Finds the area of the shaded region as $\pi(x^2 + 25) - \pi x^2 = 25\pi$ cm^2.	0.5
15	Finds the area of the 8 cm sector as $\frac{60}{360} \times \pi \times 8^2 = \frac{64\pi}{6}$ cm^2.	0.5
	Finds the area of the 6 cm sector as $\frac{60}{360} \times \pi \times 6^2 = \frac{36\pi}{6}$ cm^2.	0.5
	Finds the difference in the areas of regions I and III as area of (I + II) - area of (II + III) = $\frac{28}{6} \times \frac{22}{7} = \frac{44}{3}$ cm^2.	1