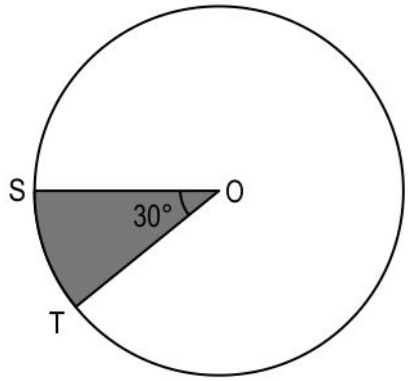
Chapter - 5
Areas related to circles

Multiple Choice Questions

Q: 1 **Shown below is a circle with centre O. The area of the minor sector SOT is 7 cm^2.**



(Note: The figure is not to scale.)

What is the area of the circle?

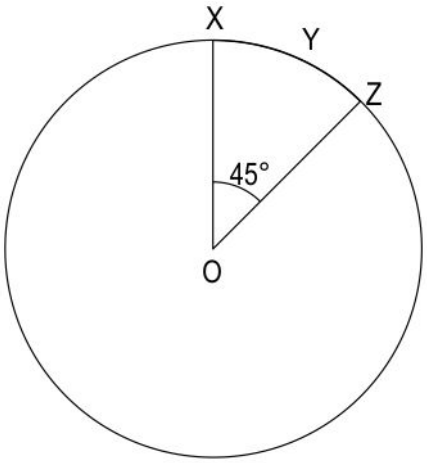
1 $84\pi\ cm^2$

2 $\frac{84}{11}\ cm^2$

3 $84\ cm^2$

4 $\frac{\sqrt{84}}{\sqrt{\pi}}\ cm^2$

Q: 2 **In the figure given below, O is the centre of the circle. XYZ is an arc on the circle subtending an angle of 45° at the centre.**

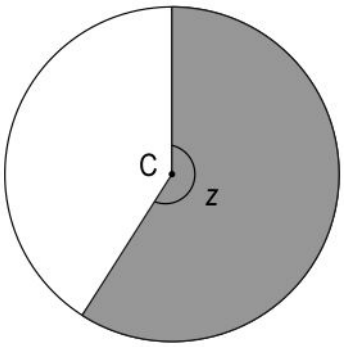


(Note: The figure is not to scale.)

If the radius of the circle is 32 cm, then what is the length of the arc XYZ?

1 4π cm **2** 8π cm **3** 64π cm **4** 128π cm

Q: 3 **In the figure shown below, C is the centre of the circle. The area of the shaded sector is $\frac{5}{8}$ of the area of the circle.**

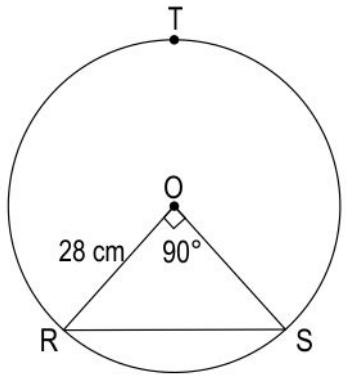


(Note: The figure is not to scale.)

What is the measure of angle *z* ?

1 135°
2 200°
3 225°
4 (cannot be determined as the radius of circle is not given)

Q: 4 **Shown below is a circle with centre O and radius 28 cm. Chord RS subtends an angle of 90° at O.**



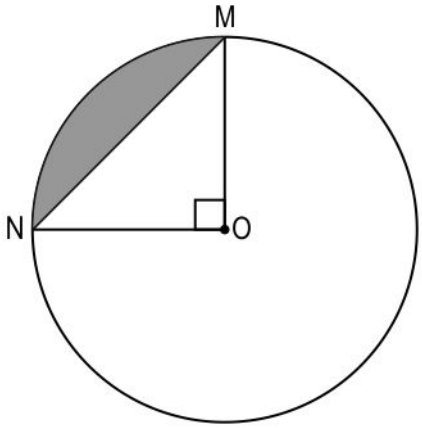
(Note: The figure is not to scale.)

What is the area of the segment RTS?

(Note: Take π as $\frac{22}{7}$.)

1 224 cm^2 **2** 616 cm^2
3 1848 cm^2 **4** 2240 cm^2

Q: 5 **In the circle shown below, O is the centre. MN is a chord which subtends an angle of 90° at the centre. The area of the shaded region is 72 cm^2.**



What is the radius of the circle?

(Note: Take π as $\frac{22}{7}$.)

1 6√7 cm **2** 6√28 cm **3** 84 cm **4** 252 cm

Q: 6 **A circular pond needs to be fenced along its circumference. One-fourth of the fencing is already done, which cost Rs 750 at the rate of Rs 50 per metre.**

How many metres of the pond still need to be fenced?

1 15 **2** 20 **3** 45 **4** 60

Q: 7 **Which of the following information is NOT sufficient to differentiate between minor and major sector of a circle?**

1 the angle subtended at the centre
2 the radius of the circle
3 the area of the sector
4 the length of the arc

Free Response Questions

Q: 8 **In a circular agricultural field, a sector subtending an angle of 120° at the centre is dedicated to growing sugarcane.** **[1]**

If the radius of the circular field is 30 meters, what is the area of the land used for growing sugarcane? Show your work.

(Note: Take π as 3.14.)

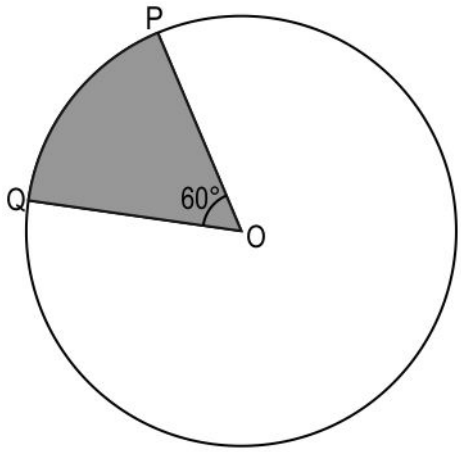
Q: 9 **Anjali got the following question in her class test.** **[1]**

"*A 13 cm chord of a circle subtends an angle of 60° at the centre. Find the area of the minor segment.*"

After the test, she went to the teacher and said, "The question cannot be answered as it doesn't mention the radius of the circle".

Is Anjali right or wrong? Give a valid reason for your answer.

Q: 10 **Shown below is a circle with centre O. The area of the shaded region is 294π cm^2.** **[1]**



(Note: The figure is not to scale.)

What is the area of the circle? Show your work.

Q: 11 **Find the length of an arc which subtends an angle of 80° at the centre of a circle with radius 63 cm. Show your work.** **[1]**

(Note: Take π as $\frac{22}{7}$.)

Q: 12 **The length of an arc of a circle is 22 cm and its radius is 21 cm.** **[2]**

What is the area of the sector formed by the arc? Show your work.

(Note: Use π as $\frac{22}{7}$.)

Q: 13 **Find the perimeter of a sector with a radius of 18 cm subtending an angle of 70° at the centre. Show your work.** **[2]**

(Note: Use π as $\frac{22}{7}$.)

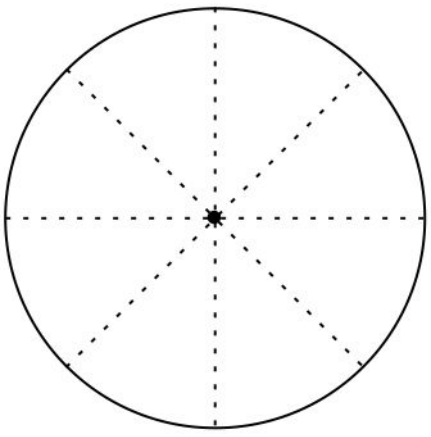
Q: 14 **A sector of a circle with radius 6 cm subtends an angle of 30° at the centre.** **[2]**

Find:
i) the length of the arc.
ii) the area of the corresponding major sector.

Show your work.

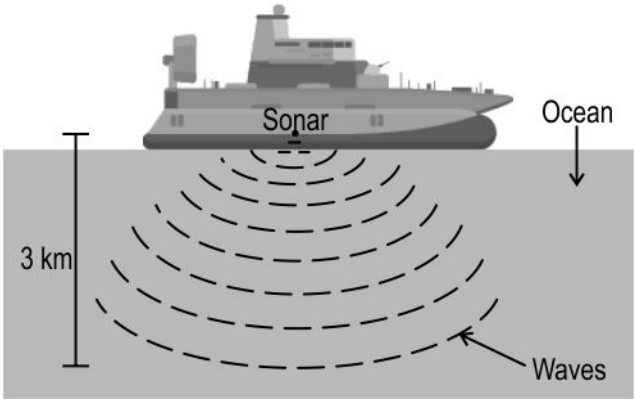
(Note: Take π as $\frac{22}{7}$.)

Q: 15 **A circular sheet of paper with a diameter of 16 inches is divided into 8 equal pieces as shown below.** **[2]**



What is the area of each piece of the paper in terms of π? Show your work.

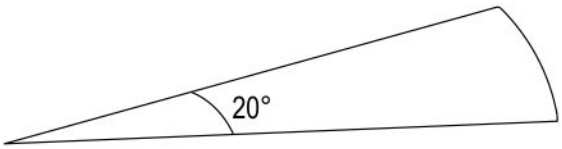
Q: 16 **A SONAR system is deployed in a maritime environment to detect and alert submarines about potential underwater obstacles. The SONAR covers a sector with a central angle of 120° and has a maximum detection range of 3 kilometres under water.** **[2]**



Approximately, how much area is covered by the SONAR during the monitoring period? Show your work.

(Note: Take π as 3.14 if required.)

Q: 17 **The arc length of the sector below is 11 cm.** **[3]**

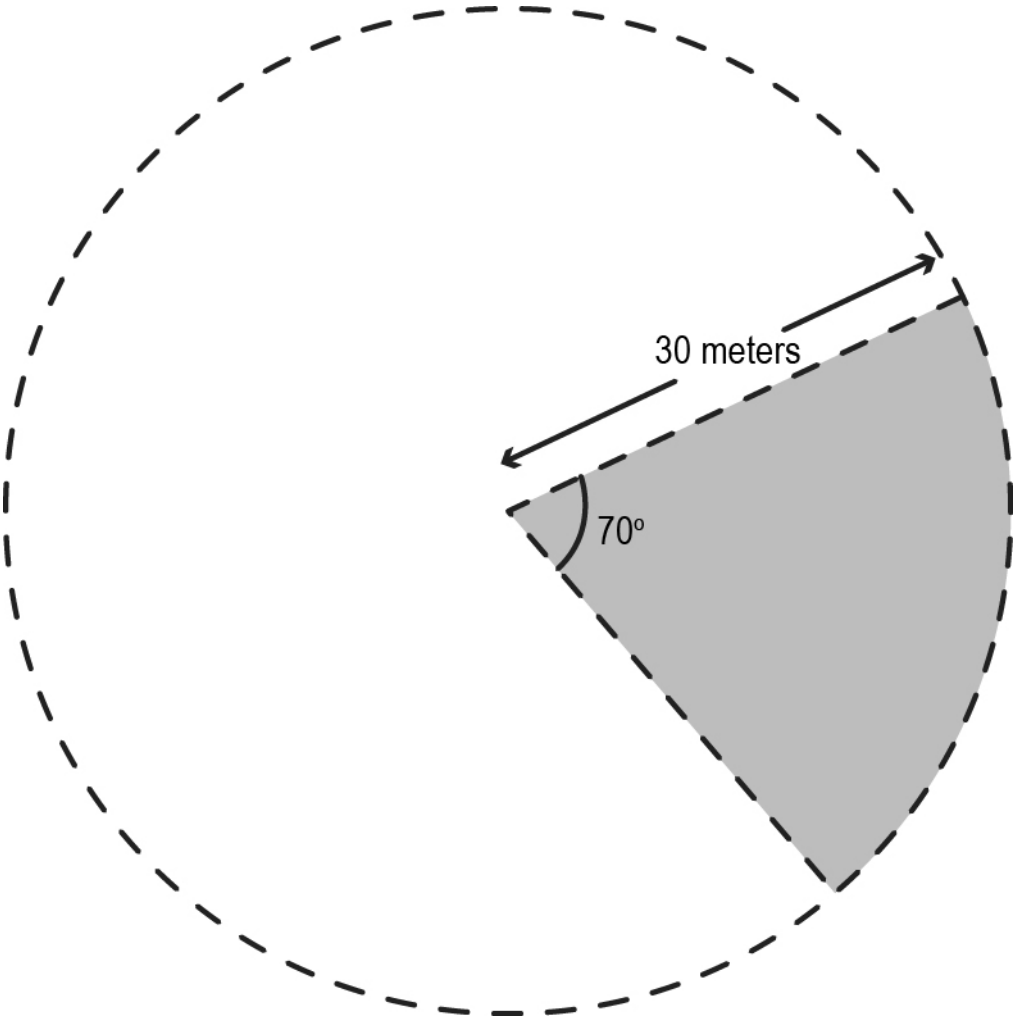


(Note: The figure is not to scale.)

Find the area of the sector. Show your work.

(Note: Take π as $\frac{22}{7}$.)

Q: 18 **Raju is a farmer who owns a portion of land in the shape of a sector. He wishes to install a new irrigation system on his land. The radius of his sector of land is 30 metres, it subtends an angle of 70° at the centre as shown below.** **[3]**



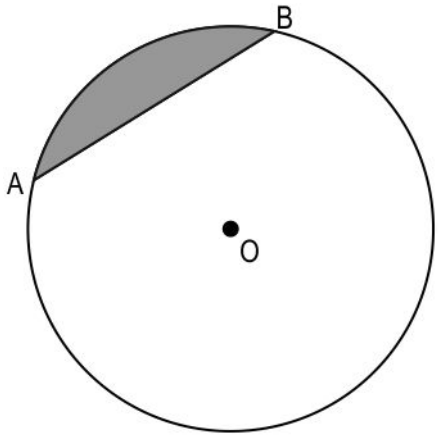
(Note: The figure is not to scale.)

The cost of installing the new irrigation system is Rs 250 per m^2. Raju has kept aside a budget of Rs 1,20,000 for it.

Will Raju be able to install the new irrigation system with his budget? Explain your answer with proper working.

(Note: Take π as $\frac{22}{7}$.)

Q: 19 **Shown below is a circle with centre O. The area of the circle is 154 cm^2. The length of chord AB is $7\sqrt{2}$ cm and it subtends an angle of 90° at the centre.** **[3]**

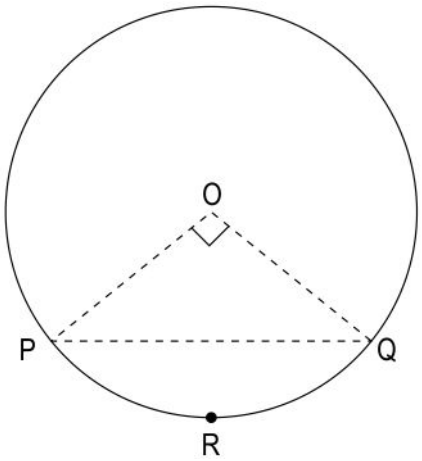


(Note: The figure is not to scale.)

Find the area of the shaded segment. Show your work.

(Note: Take π as $\frac{22}{7}$.)

Q: 20 **Given below is a circle with centre O. The length of arc PRQ is 22 cm and it subtends an angle of 90° at the centre. A triangle POQ is cut along the dotted lines as shown below.** **[3]**



(Note: The figure is not to scale.)

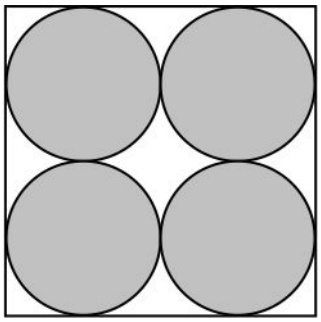
Find the area of the remaining circle after the triangle is cut. Show your work.

(Note: Take π as $\frac{22}{7}$.)

Q: 21 **A chord of length 18 cm subtends an angle of 60° at the centre of a circle.** **[3]**

Find the area of the corresponding major segment in terms of π and roots. Show your work.

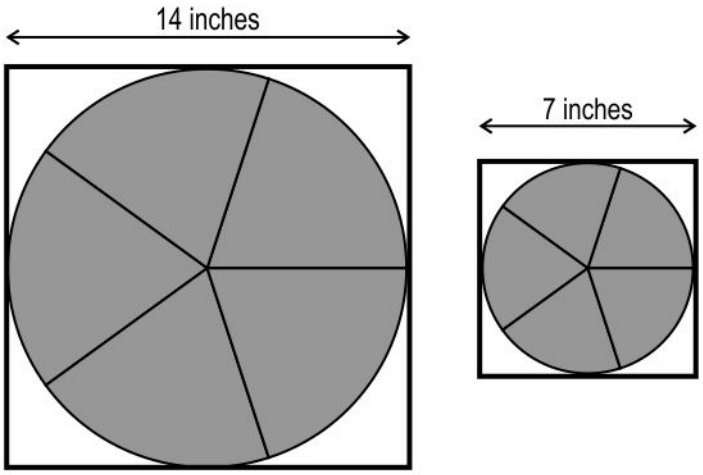
Q: 22 **On a white sheet of square paper, 4 identical yellow circles are drawn such that the circles inside the square touch the boundaries of two other circles and the two sides of the square as shown below:** **[3]**



If the area of the square sheet is 576 cm^2, what is the area that is NOT covered by the circles? Show your work.

(Note: Take π as 3.14.)

Q: 23 **Sameer and Madhur drew two circles circumscribed by squares of side 14 and 7 inches respectively. Both the circles are divided into 5 equal sectors as shown below.** **[5]**



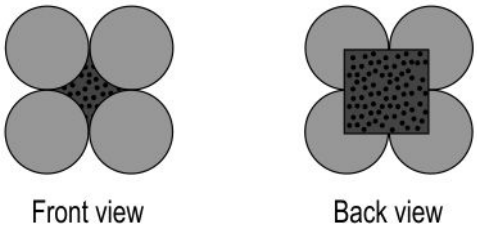
i) Determine the area occupied by one sector of the larger circle.

ii) Sameer says, "The area occupied by 2 sectors of the larger circle is equal to the area occupied by 4 sectors of the smaller circle, as the side of the larger square is twice of the smaller square."

Do you agree with the statement? Justify your answer.

(Note: Take π as $\frac{22}{7}$ if required.)

Q: 24 **Pragati made a flower using 4 identical circles and a dotted square. The front view and back view of the flower is as shown below.** **[5]**



The diameter of each circle is the same as the length of the side of the square, 42 mm.

i) Find the perimeter of the flower. Show your work.

ii) Find the area of the dotted region from the front view. Show your work.

iii) Is the area of the flower the same from the front and back views? Justify your answer with proper working.

(Note: Take π as $\frac{22}{7}$.)

Case Study

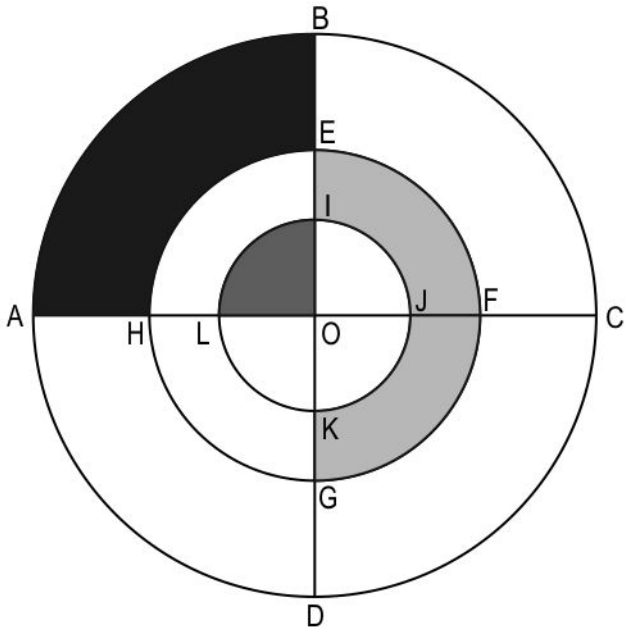
Answer the questions based on the given information.

An archery target board consists of three concentric circles with centre O as shown below. The innermost circle has a radius of 7 cm, the middle circle has a radius of 14 cm, and the outer circle has a radius of 28 cm. The target board is divided into four equal parts by AC and BD, which are the diameters of the outermost circles. The scoring system for the game is as follows:

Area LIO: 10 points

Area KJIEFG: 7 points

Area ABEH: 4 points



(Note: Take π as $\frac{22}{7}$ if required.)

Q: 25 **Find the area of the sector in which 10 points can be scored. Show your work.** **[1]**

Q: 26 **If the target lands on the boundary of the 4 points scoring area, a deduction of 1 point occurs, resulting in a score of 3 points.** **[2]**

Find the length of the boundary in which 3 points can be scored. Show your work.

Q: 27 **Find the area KJIEFG. Show your work.** **[2]**

Q.No	Correct Answers
1	3
2	2
3	3
4	4
5	1
6	3
7	2

Q.No	What to look for	Marks
8	Finds the area of the sector used for growing sugarcane as: $\frac{120°}{360°} \times 3.14 \times 30 \times 30 = 942\ m^2$	1
9	Writes that Anjali is wrong and gives a reason. For example, since the chord extends an angle of 60° at the centre, it forms an equilateral triangle with the radii and hence, the radius is 13 cm.	1
10	Identifies that the shaded sector occupies $\frac{1}{6}$ th of the area of circle. Hence, finds the area of the circle as: $294\pi \times 6 = 1764\pi\ cm^2$ (Award full marks if radius is calculated first and then the area of the circle.)	1
11	Finds the length of the arc as $\frac{80°}{360°} \times 2 \times \frac{22}{7} \times 63 = 88$ cm.	1
12	Assumes the angle of the sector as θ and writes the equation as: $22 = \frac{\theta}{360} \times 2 \times \frac{22}{7} \times 21$ $\Rightarrow \theta = 60°$	1
	Finds the area of the sector as: $\frac{60}{360} \times \frac{22}{7} \times 21 \times 21 = 231\ cm^2$	1
13	Finds the length of the arc of the sector as: $\frac{70°}{360°} \times 2 \times \frac{22}{7} \times 18 = 22$ cm	1
	Finds the perimeter of the sector as 22 + 18 + 18 = 58 cm.	1
14	i) Finds the length of the arc as: $\frac{30°}{360°} \times 2 \times \frac{22}{7} \times 6 = \frac{22}{7}$ cm	1

Q.No	What to look for	Marks
	ii) Finds the area of the major sector as: $\frac{330°}{360°} \times \frac{22}{7} \times (6)^2 = \frac{726}{7}\ cm^2$ **(Award full marks if the area of major sector is found by subtracting the area of minor sector from the area of circle.)**	**1**
15	**Identifies that 8 equal pieces mean each sector will have a central angle of** $\frac{360°}{8} = 45°$	**1**
	Uses the above to find the area of each sector as: $\frac{45°}{360°} \times \pi \times 8 \times 8 = 8\pi\ in^2$	**1**
16	**Expresses the underwater sector's area covered by SONAR as:** $\frac{120°}{360°} \times 3.14 \times 3 \times 3$	**1**
	Solves the above expression and finds the area covered as 9.42 km^2**.**	**1**
17	**Assumes the radius of the sector as** r **cm and writes the equation for the arc length as:** $\frac{20°}{360°} \times 2 \times \frac{22}{7} \times r = 11$	**1**
	Solves the above equation to find the value of r **as** $\frac{63}{2}$ **cm.**	**0.5**
	Writes the expression for the area of the sector as: $\frac{20°}{360°} \times \frac{22}{7} \times (\frac{63}{2})^2$	**1**
	Evaluates the above expression to find the area of the sector as $\frac{693}{4}\ cm^2$**.**	**0.5**
18	**Writes the expression to find the area of the sector as:** $\frac{70°}{360°} \times \frac{22}{7} \times 30 \times 30$	**1**

Q.No	What to look for	Marks
	Solves and finds the area of the sector as 550 m^2.	1
	Finds the cost of installing the irrigation system as 550 × 250 = Rs 1,37,500.	0.5
	Concludes that Raju will not be able to install the new irrigation system as the cost which is Rs 1,37,500 exceeds his budget of Rs 1,20,000.	0.5
19	Finds the area of the minor sector AOB as $\frac{1}{4} \times 154 = 38.5\ cm^2$.	0.5
	Finds radius (r) of the circle by applying pythagoras theorem in △AOB as: $r^2 + r^2 = (7\sqrt{2})^2$ $\Rightarrow r = 7$ cm (Award full marks if the radius is found correctly using area of the circle.)	1
	Identifies that △AOB has base = 7 cm and height = 7 cm. Finds the area of △AOB as $\frac{1}{2} \times 7 \times 7 = 24.5\ cm^2$.	1
	Finds the area of the shaded segment as 38.5 - 24.5 = 14 cm^2.	0.5
20	Finds the radius of the circle by using the equation for arc length as: $\frac{90°}{360°} \times 2 \times \frac{22}{7} \times r = 22$ $\Rightarrow r = 14$ cm	1
	Finds the area of △POQ as: $\frac{1}{2} \times 14 \times 14 = 98\ cm^2$	1
	Finds the area of circle as $\frac{22}{7} \times 14^2 = 616\ cm^2$.	0.5
	Subtracts area of triangle from area of circle to get the remaining area as: 616 - 98 = 518 cm^2	0.5

Q.No	What to look for	Marks
21	Identifies that the triangle formed will be an equilateral triangle. Finds the area of triangle as $\frac{\sqrt{3}}{4} \times 18^2 = 81\sqrt{3}$ cm^2.	1
	Finds the area of the minor sector as $\frac{60°}{360°} \times \pi \times 18 \times 18 = 54\pi$ cm^2.	1
	Finds the area of the circle as $\pi \times 18^2 = 324\pi$ cm^2.	0.5
	Finds the area of the corresponding major segment as $324\pi - (54\pi - 81\sqrt{3}) = 270\pi + 81\sqrt{3}$ cm^2.	0.5
22	Writes that if the area of square sheet is 576 cm^2, then the side of square is $\sqrt{576} = 24$ cm.	1
	Finds the radius of each circle as $\frac{24}{4} = 6$ cm.	0.5
	Finds the area of the circles as $= 3.14 \times 6 \times 6 = 113.04$ cm^2.	0.5
	Finds the area of the square sheet not covered by the circles as: $576 - (4 \times 113.04) = 123.84$ cm^2	1
23	i) Identifies that the radius of the larger circle will be $\frac{14}{2} = 7$ inches as the circle is circumscribed in the square of 14 inches.	0.5
	Writes the following or an equivalent expression to get the area of a sector of the larger circle: $\frac{1}{5} \times \frac{22}{7} \times 7 \times 7 = \frac{154}{5}$ or 30.8 sq inches	1.5
	ii) Calculates the area of 2 sectors of the larger circle as: $2 \times 30.8 = 61.6$ sq inches	1
	Identifies that radius of the smaller circle is $\frac{7}{2}$ inches. Writes the following expression to get the area of 4 sectors: $\frac{4}{5} \times \frac{22}{7} \times \frac{7}{2} \times \frac{7}{2} = \frac{154}{5}$ or 30.8 sq inches	1.5

Q.No	What to look for	Marks
	Concludes that Sameer's statement is wrong, as area of 2 sectors of larger circle (61.6 sq inches) is more than 4 sectors of smaller circle (30.8 sq inches). **(Award full marks only if areas of both are calculated and given as justification for the statement being wrong.)**	**0.5**
24	**i) Finds the perimeter of flower as:** $(4 \times 2\pi r) - (4 \times \frac{1}{4} \times 2\pi r) = 6\pi r$ $6 \times \frac{22}{7} \times 21 = 396$ mm	**1**
	ii) Finds the area of the dotted region from the front as: $(42)^2 - (\frac{22}{7} \times (21)^2) = 378$ mm^2	**1**
	iii) Finds the area of the flower from the front view as: $378 + (4 \times \frac{22}{7} \times 21^2) = 5922$ mm^2	**1**
	Finds the area of the flower from the back view as: $(42)^2 + (4 \times \frac{3}{4} \times \frac{22}{7} \times 21^2) = 5922$ mm^2	**1**
	Compares the area of the front and back views and concludes that the area remains the same.	**1**
25	**Uses the expression for the area of a sector to find the area of the part LIO as:** $\frac{1}{4} \times \frac{22}{7} \times 7 \times 7 = \frac{77}{2}$ **or** 38.5 cm^2	**1**
26	**Finds the length of arc of middle circle as:** $\frac{1}{4} \times 2 \times \frac{22}{7} \times 14 = 22$ cm	**0.5**
	Finds the length of arc of outer circle as: $\frac{1}{4} \times 2 \times \frac{22}{7} \times 28 = 44$ cm	**0.5**

Q.No	What to look for	Marks
	Finds the length of boundary in which 3 points can be scored as: **44 + 22 + 2(28 - 14) = 94 cm**	**1**
27	**Finds the area of the semicircle in the middle region as:** $\frac{1}{2} \times \frac{22}{7} \times 14 \times 14 = 308\ cm^2$	**0.5**
	Finds the area of the innermost semicircle as: $\frac{1}{2} \times \frac{22}{7} \times 7 \times 7 = 77\ cm^2$	**0.5**
	Finds the area KJIEFG as (308 - 77) = 231 cm^2.	**1**