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CLASS X · MATHEMATICS STANDARD (041) · CBSE BOARD EXAMINATION 2027

CHAPTER 11

Areas Related to Circles

Chapter Practice Booklet · Questions only · Answers in the separate Answer Booklet

49 practice questions | 4 case studies | Board question index | Original diagrams

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STUDENT DETAILS

NAME _____

CLASS & SECTION _____

ROLL NO. _____

BOOKLET STARTED ON _____

CHAPTER TEST SCORE _____ / 20

1 Chapter Notes

READ THIS FIRST

The whole chapter in short-note form: every definition, formula, method and model answer. Revise from here – you should not need the textbook again.

1 Circle: perimeter and area

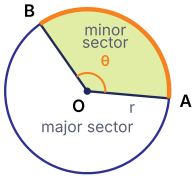
For a circle of radius r (diameter $d = 2r$): circumference $C = 2\pi r = \pi d$ and area $A = \pi r^2$.

- **Semicircle:** area $\frac{1}{2}\pi r^2$; perimeter $\pi r + 2r$ (the arc plus the diameter).
- **Ring** between circles of radii R and r: area $\pi(R^2 - r^2)$.
- **Wheel:** one turn covers one circumference, so number of turns = distance ÷ circumference. Change km and m to cm first.
- Use $\pi = \frac{22}{7}$ unless the question says 3.14. $\frac{22}{7}$ is easiest when r is a multiple of 7.

EXAMPLE

A wheel of diameter 56 cm: $C = \frac{22}{7} \times 56 = 176$ cm. For 8.8 km = 880000 cm it turns $880000 \div 176 = 5000$ times.

2 Sector and arc



A **sector** is the region between two radii and the arc joining their ends. If the angle at the centre is θ, the sector is that fraction $\frac{\theta}{360^\circ}$ of the whole circle.

$$\text{Arc length } l = \frac{\theta}{360^\circ} \times 2\pi r$$

$$\text{Area} = \frac{\theta}{360^\circ} \times \pi r^2 = \frac{1}{2} l\, r$$

- Perimeter of a sector = $2r + l$ (two radii and the arc).
- Major sector: angle $360^\circ - \theta$, area $\pi r^2 -$ minor sector.

EXAMPLE

$r = 21$ cm, $\theta = 60^\circ$: $l = \frac{1}{6} \times 132 = 22$ cm, area = $\frac{1}{6} \times 1386 = 231$ cm² ($= \frac{1}{2} \times 22 \times 21$), perimeter = $42 + 22 = 64$ cm.

3 Easy fractions and clock hands

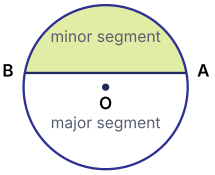
Angle θ	30°	45°	60°	72°	90°	120°	180°
$\frac{\theta}{360^\circ}$	$\frac{1}{12}$	$\frac{1}{8}$	$\frac{1}{6}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{1}{3}$	$\frac{1}{2}$

- **Minute hand:** 360° in 60 minutes, so 6° per minute. It sweeps a sector whose radius is its length.
- **Hour hand:** 30° per hour, so ½° per minute.
- The distance moved by the tip of a hand is an arc length.

EXAMPLE

A minute hand 7 cm long, in 20 minutes: $\theta = 120^\circ$, area swept $= \frac{1}{3} \times 154 \approx 51.33$ cm², and the tip moves $\frac{1}{3} \times 44 \approx 14.67$ cm.

4 Segment of a circle

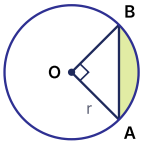


A **segment** is the region between a chord and its arc. The smaller one is the **minor segment**, the larger one the **major segment**.

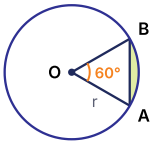
$$\text{Minor segment} = \text{sector } OAB - \triangle OAB$$

$$\text{Major segment} = \pi r^2 - \text{minor segment}$$

The syllabus keeps segment questions to $\theta = 60^\circ$ and $\theta = 90^\circ$ only:



θ = 90°: △OAB = ½r²



θ = 60°: △OAB = (√3/4)·r²

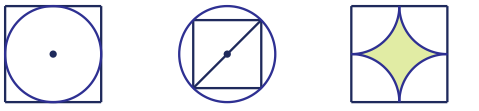
- **90°:** $\triangle OAB$ is right-angled at O, area $\frac{1}{2}r^2$.
- **60°:** $OA = OB$ and the angle between them is 60°, so $\triangle OAB$ is equilateral: $AB = r$ and area $\frac{\sqrt{3}}{4}r^2$.

5 Model answer: segment with 90° (3 marks)

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

1. Area of sector $OAB = \frac{1}{4} \times \frac{22}{7} \times 14^2 = 154$ cm² 1
2. Area of $\triangle OAB = \frac{1}{2} \times 14 \times 14 = 98$ cm² (right angle at O) 1
3. Minor segment $= 154 - 98 = 56$ cm²; major segment $= 616 - 56 = 560$ cm² 1

6 Shaded regions



- Name each shape in the figure. Shaded area = (outer shape) − (unshaded parts), or the sum of the shaded parts.
- **Circle in a square** of side a: $r = \frac{a}{2}$. **Square in a circle:** its diagonal is $2r$, so its area is $\frac{1}{2}(2r)^2 = 2r^2$.
- Four quadrants at the corners of a square, each of radius half the side, make one full circle.

EXAMPLE
A square of side 28 cm with quadrants of radius 14 cm at its corners: shaded $= 784 - 616 = 168$ cm².

7 Model answer: area from the arc (2 marks)

A sector of a circle of radius 10.5 cm has an arc of length 22 cm. Find its area.

1. Area of a sector $= \frac{1}{2} \times$ arc $\times$ radius (or find $\theta = 120^\circ$ first) 1
2. Area $= \frac{1}{2} \times 22 \times 10.5 = 115.5$ cm² 1

8 Checks that save marks

- Write the formula first, then put in the numbers.
- Use the value of π (and $\sqrt{3}$) that the question gives.
- Give lengths in cm or m and areas in cm² or m².
- Perimeter of a sector includes both radii; the arc alone is not the perimeter.
- Segment = sector − triangle. Do not subtract the triangle from the whole circle.
- Round only at the last step, to two decimal places.

Exam snapshot

What the board asks, and how to prepare

SYLLABUS 2026–27

- Area of sectors and segments of a circle.
- Problems on the areas and perimeters (circumferences) of these figures.
- Segment questions use a central angle of **60° or 90° only**. Figures combine triangles, simple quadrilaterals and circles.

BOARD WEIGHTAGE

10 / 80

Unit V Mensuration (Areas Related to Circles and Surface Areas and Volumes) together. In the papers checked, this chapter gave two 1-mark questions in most years, plus a 4-mark case study on sectors (2025, 2026) or a 5-mark segment question (2024): about 4–7 marks.

MOST ASKED IN BOARD PAPERS, 2024–2026 + SAMPLE PAPER 2026–27 (4 PAPERS CHECKED)

How often	Question type	Marks	Papers
★★★	1 mark: sector area or arc length, radius from them, clock-hand angle, wheel turns	1	3 of 4
★★☆	4 marks: case study on equal sectors (a brooch made of wire)	4	2 of 4
★☆☆	2 marks: area of a sector from its arc length	2	1 of 4
★☆☆	5 marks: arc length and minor segment with 60°	5	1 of 4

MISTAKES THAT COST MARKS

- Using $\frac{\theta}{360} \times 2\pi r$ (arc) when the area is asked, or the other way round.
- Leaving out the two radii in the perimeter of a sector.
- Taking the area of an equilateral triangle as $\frac{1}{2}r^2$; it is $\frac{\sqrt{3}}{4}r^2$.
- Forgetting to change km to cm in wheel questions.
- Rounding the sector area too early, so the segment comes out wrong.
- Writing cm for an area, or cm² for a length.

HOW TO USE THIS BOOKLET

1. **Day 1:** Notes, then Part A (NCERT) and Part B (Exemplar). Do every MUST DO question first.
2. **Day 2:** Part C (board pattern) and Part D (case studies).
3. **Day 3:** Part E (challenge) and the real board questions in Part F.
4. **Sun 10 Jan: Sunday chapter test on Circles and Areas Related to Circles – 20 marks in 40 minutes, without the booklet.**
5. Check every answer in the Answer Booklet. Write each mistake on the My Mistakes page.

RULES AT A GLANCE

Circle	$C = 2\pi r$, $A = \pi r^2$
Arc	$l = \frac{\theta}{360^\circ} \times 2\pi r$
Sector	$\frac{\theta}{360^\circ} \times \pi r^2 = \frac{1}{2}lr$; perimeter $2r + l$
Segment	sector − triangle ($\frac{1}{2}r^2$ at 90°, $\frac{\sqrt{3}}{4}r^2$ at 60°)
Clock	minute hand 6°/min, hour hand ½°/min

PART A · NCERT PRACTICE

A NCERT Practice

The same skills as the NCERT examples and exercises, with new numbers. Finish every question before moving on.

Sectors and arcs

A1. The area of a sector of angle θ (in degrees) of a circle of radius R is: [1]

(a) $\frac{\theta}{360} \times 2\pi R$ (b) $\frac{\theta}{90} \times \pi R$ (c) $\frac{\theta}{180} \times \pi R^2$ (d) $\frac{\theta}{360} \times \pi R^2$

A2. Find the area of a sector of a circle of radius 7 cm with central angle 72°. MUST DO [2]

A3. The circumference of a circle is 88 cm. Find the area of a quadrant of the circle. MUST DO [2]

A4. The minute hand of a clock is 7 cm long. Find the area swept by it in 15 minutes. [2]

A5. A circle has radius 42 cm. For a central angle of 60°, find (i) the arc length, (ii) the area of the sector, (iii) the area of the minor segment. (Use $\sqrt{3} = 1.73$.) MUST DO [3]

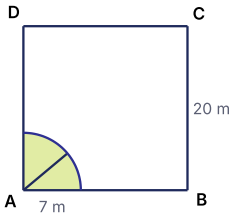
Segments (60° and 90°)

A6. A chord of a circle of radius 21 cm subtends a right angle at the centre. Find the areas of the minor and major segments. MUST DO [3]

A7. A chord of a circle of radius 10 cm subtends an angle of 60° at the centre. Find the areas of the minor and major segments. (Use $\pi = 3.14$, $\sqrt{3} = 1.73$.) [3]

Sectors in daily life

A8. A cow is tied with a 7 m rope at one corner of a square field of side 20 m. Find (i) the area of the field it can graze, (ii) the increase in this area if the rope were 14 m long. MUST DO [3]



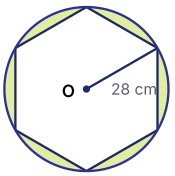
A9. A wire wheel of diameter 42 cm has a rim and 3 diameters that divide it into 6 equal sectors. Find (i) the total length of wire used, (ii) the area of each sector. [3]

A10. An umbrella has 10 equally spaced ribs. Treating it as a flat circle of radius 42 cm, find the area between two consecutive ribs. [2]

A11. A car has two wipers that do not overlap. Each blade is 21 cm long and sweeps through 100°. Find the total area cleaned in one sweep. [3]

A12. A lighthouse sends a warning light over a sector of 72° up to a distance of 10 km. Find the area of sea covered. (Use $\pi = 3.14$.) [2]

A13. A circular table mat of radius 28 cm has 6 equal designs, as shown. Each design is a segment cut off by a chord that subtends 60° at the centre. Find the total area of the designs and the cost of embroidering them at ₹0.50 per cm². (Use $\sqrt{3} = 1.73$.) [3]



B Exemplar Practice

PART B · EXEMPLAR PRACTICE

Exemplar-style questions on the same ideas, one step harder. Give a reason for every 2-mark answer.

Multiple choice

1 mark each

B1. The circumference of a circle equals the perimeter of a square. The ratio of the area of the circle to the area of the square is: [1]

(a) 11 : 14 (b) 14 : 11 (c) 22 : 7 (d) 7 : 22

B2. The area of the largest circle that can be drawn inside a square of side 14 cm is: [1]

(a) 154 cm² (b) 196 cm² (c) 616 cm² (d) 44 cm²

B3. If the circumference and the area of a circle are numerically equal, its radius is: [1]

(a) 1 unit (b) 4 units (c) π units (d) 2 units

B4. A wheel of diameter 70 cm rolls 1.1 km. The number of turns it makes is: [1]

(a) 250 (b) 1000 (c) 5000 (d) 500

B5. An arc of length 11 cm is in a circle of radius 21 cm. The angle it subtends at the centre is: [1]

(a) 60° (b) 45° (c) 30° (d) 15°

B6. ASSERTION–REASON [1]

Assertion (A): The area of a sector of angle 90° of a circle of radius 14 cm is 154 cm².

Reason (R): The area of a sector of angle θ is $\frac{\theta}{360} \times \pi r^2$.

B7. ASSERTION–REASON [1]

Assertion (A): The perimeter of a sector of radius 7 cm and angle 90° is 25 cm.

Reason (R): The perimeter of a sector is the length of its arc.

B8. ASSERTION–REASON [1]

Assertion (A): The minute hand of a clock turns through 90° in 15 minutes.

Reason (R): The hour hand of a clock turns through 30° in one hour.

Short answer with reasons

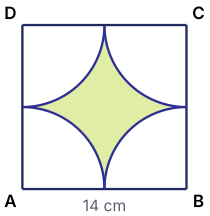
2–3 marks

B9. Find the perimeter of a quadrant of a circle of radius 14 cm. [2]

B10. Find the area of the ring between two concentric circles of radii 21 cm and 7 cm. [2]

B11. Is the area of a sector of angle 60° of a circle of radius 6 cm equal to the area of a circle of radius $\sqrt{6}$ cm? Give reasons. [2]

B12. $ABCD$ is a square of side 14 cm. Quadrants of radius 7 cm are drawn at its four corners. Find the area of the shaded region. MUST DO [3]



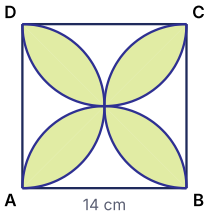
B13. The wheels of a car have diameter 70 cm. How many complete turns does each wheel make in 10 minutes when the car moves at 66 km/h? [3]

Long answer

3–5 marks

B14. A chord AB of a circle of radius 14 cm subtends $60°$ at the centre O. Find (i) the length of the arc AB, (ii) the area of the minor segment, (iii) the perimeter of the minor segment, (iv) the area of the major segment. (Use $\sqrt{3} = 1.73$.) MUST DO [5]

B15. $ABCD$ is a square of side 14 cm. Semicircles are drawn inside it on each side as diameter, forming four petals. Find the area of the shaded petals. [3]



C

PART C · BOARD PATTERN

Board Pattern Practice

Question types from real 2024–2026 board papers and the 2026–27 Sample Paper, grouped by type. ★★★ = asked in 3 or 4 of the 4 papers checked · ★★ = 2 papers · ★ = 1 paper.

ASSERTION–REASON: HOW TO ANSWER

(a) Both A and R are true, and R is the correct explanation of A.
(b) Both A and R are true, but R is not the correct explanation of A.
(c) A is true, but R is false.
(d) A is false, but R is true.

Sector area, arc length, clock hands and wheels

★★★ 3 of 4 papers · 1–2 marks

C1. The length of the arc of a sector of angle $45°$ in a circle of radius 14 cm is: MUST DO [1]

(a) 22 cm (b) 11 cm (c) 44 cm (d) 5.5 cm

C2. A sector of angle $75°$ has area 30π cm². The radius of the circle is: MUST DO [1]

(a) 6 cm (b) 24 cm (c) 12 cm (d) 144 cm

C3. The arc of a sector has length 4π cm and the sector has area 12π cm². The radius is: [1]

(a) 6 cm (b) 3 cm (c) 12 cm (d) 24 cm

C4. The angle turned by the hour hand of a clock from 2:00 to 3:30 is: MUST DO [1]

(a) $30°$ (b) $90°$ (c) $75°$ (d) $45°$

C5. A wire 22 cm long is bent into an arc of a circle of radius 14 cm. The angle at the centre is: [1]

(a) 45° (b) 90° (c) 60° (d) 120°

C6. A wheel of radius 35 cm covers 2.2 km. The number of turns it makes is: [1]

(a) 100 (b) 500 (c) 1000 (d) 2000

C7. ASSERTION–REASON [1]

Assertion (A): The area of a quadrant of a circle of circumference 44 cm is 38.5 cm².

Reason (R): A quadrant is one-fourth of a circle.

C8. A sector of a circle of radius 21 cm has an arc of length 33 cm. Find the area of the sector. [2]

MUST DO

C9. The perimeter of a sector of a circle of radius 10.5 cm is 32 cm. Find the area of the sector. [2]

C10. The minute hand of a clock is 14 cm long. Find the area swept by it from 6:05 to 6:25. [2]

Segments and shaded regions

★☆☆ 1 of 4 papers · 5 marks

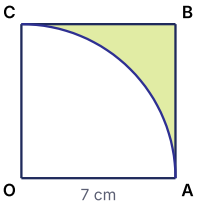
C11. Find the area of the minor segment of a circle of radius 7 cm cut off by a chord that subtends 90° at the centre. [2]

MUST DO

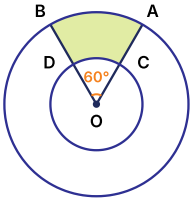
C12. A chord of a circle of radius 20 cm subtends a right angle at the centre. Find (i) the minor segment, (ii) the major sector, (iii) the major segment. (Use $\pi = 3.14$.) [3]

MUST DO

C13. $OABC$ is a square of side 7 cm and OAC is a quadrant of a circle with centre O. Find the area of the shaded region. [2]



C14. Two concentric circles with centre O have radii 14 cm and 7 cm. OA and OB make an angle of 60°, as shown. Find the area of the shaded region $ABDC$. [3]



C15. A chord AB of a circle of radius 12 cm subtends 60° at the centre. Find (i) the arc length AB, (ii) the area of the sector, (iii) the area of $\triangle OAB$, (iv) the areas of the minor and major segments. (Use $\pi = 3.14$, $\sqrt{3} = 1.73$.) [5]

D

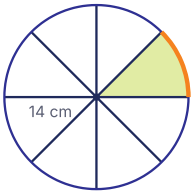
PART D · SECTION E STYLE

Case-Based Questions

Each case carries 4 marks (1 + 1 + 2), as in Section E of the board paper. Read the situation carefully before answering.

D1. Case Study · Pizza Slices [4]

A round pizza of radius 14 cm is cut into 8 equal slices along its diameters.



(i) Find the angle at the centre of each slice. [1]

(ii) Find the length of the crust (arc) of one slice. [1]

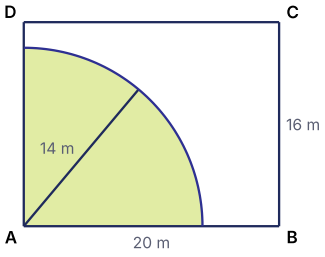
(iii) Find the area and the perimeter of one slice. [2]

OR

(iii) Three slices are eaten. Find the area of pizza left and the angle at the centre of the part left. [2]

D2. Case Study · Garden Sprinkler [4]

A sprinkler stands at corner A of a rectangular lawn 20 m long and 16 m wide. It sprays water up to 14 m and turns through 90°, watering a quadrant of the lawn.



(i) Find the area of the lawn that is watered. [1]

(ii) Find the length of the curved edge of the watered part. [1]

(iii) Find the area of the lawn that is not watered. [2]

OR

(iii) The sprinkler is moved to the middle of side AB and set to turn through 180° with a reach of 7 m. Find the area it now waters and the length of its curved edge. [2]

D3. Case Study · Clock Tower [4]

The clock on a school tower has a minute hand 21 cm long and an hour hand 14 cm long.



(i) Through what angle does the minute hand turn in 20 minutes? [1]

(ii) How far does the tip of the minute hand move in 20 minutes? [1]

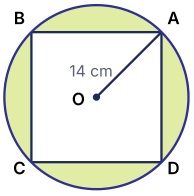
(iii) Find the area swept by the minute hand in 20 minutes. [2]

OR

(iii) Find the area swept by the hour hand from 1:00 to 4:00. [2]

D4. Case Study · Rangoli in a Circle [4]

A rangoli is drawn in a circle with centre O and radius 14 cm. A square $ABCD$ has its corners on the circle, and the four segments outside the square are coloured.



(i) What is $\angle AOB$? Give a reason. [1]

(ii) Find the area of the square. [1]

(iii) Find the total coloured area and the area of one coloured segment. [2]

OR

(iii) Find the perimeter of one coloured segment. (Use $\sqrt{2} = 1.414$.) [2]

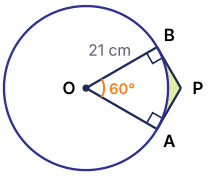
E

PART E · FOR 95+

Challenge Questions

Harder than the usual board question. Try these after Parts A–D: they stretch the same methods to the toughest 3- and 5-mark questions.

E1. An arc AB of a circle with centre O and radius 21 cm subtends 60° at O. The tangents at A and B meet at P. Find the area of the shaded region between the arc and the tangents. (Use $\sqrt{3} = 1.73$.) [3]



E2. The minute and hour hands of a clock are 14 cm and 7 cm long. Find the total distance moved by their tips from 12:00 to 3:00. [3]

E3. A chord of a circle of radius 7 cm is $7\sqrt{2}$ cm long. Find the area of the minor segment it cuts off. [3]

E4. A chord of length 20 cm subtends 60° at the centre of a circle. Find the area of the minor segment. (Use $\pi = 3.14$, $\sqrt{3} = 1.73$.) [3]

E5. Two circles touch each other externally. The sum of their areas is 130π cm² and the distance between their centres is 14 cm. Find their radii. [3]

E6. A wire in the shape of a circle of radius 28 cm is bent into a square. Which shape encloses more area, and by how much? [3]

F

PART F · REAL BOARD QUESTIONS

Board PYQ Index

Real questions from recent Maths Standard board papers and the 2026–27 Sample Paper, by type. Open the official paper and solve the listed questions.

Frequency	Question type	Marks	Where asked (year: paper code, question number)	Practise here
★★★	**Sector area, arc length, radius from a sector or arc, clock-hand angle, wheel turns**	1–2	**2026:** 30/1/1 Q14, Q15 · **2025:** 30/1/1 Q15, Q18 · **SQP 2026–27:** Q10, Q15, Q24	A1–A5, A8–A13, C1–C10, D1–D3
★★☆	**Case study on equal sectors (wire brooch)**	4	**2026:** 30/1/1 Q38 · **2025:** 30/1/1 Q37	A1–A5, A8–A13, C1–C10, D1–D3
★☆☆	**Arc length and minor segment with 60°**	5	**2024:** 30/1/1 Q32	A6–A7, B14, C11–C15, D4

PAPERS CHECKED

- **2026:** 30/1/1 (Delhi, Set 1)
- **2025:** 30/1/1 (Delhi, Set 1)
- **2024:** 30/1/1 (Delhi, Set 1)
- **CBSE Sample Paper 2026–27** (Mathematics Standard)

Sets of one code family (30/1/1, 30/1/2, 30/1/3) share most questions, so each counts as one paper. Download the official papers from cbse.gov.in → Previous Year Question Papers, and solve the exact questions listed above.

PART G · YOUR RECORD

G My Mistakes

Write down each mistake from this chapter, including the chapter test.

Every wrong answer is a free lesson. Write it here, find the rule you missed, and redo the question after three days. Bring this page to class before the next test.

Date	Part & Q No.	What went wrong	Correct rule or method	Redone ✓