



Class 9 Maths – Ganita Manjari



Chapter 6: Measuring Space – Perimeter and Area

★ Important Questions with Answer Key

New Syllabus 2026–27

Chapter 6 covers **perimeter, circumference, arc length, areas of plane figures, Heron's formula, area of a circle, sectors, segments and Brahmagupta's formula.**



A. BASIC CONCEPTS

1. What is the perimeter of a shape?
 2. Find the perimeter of a square of side 8 cm.
 3. Find the perimeter of an equilateral triangle of side 12 cm.
 4. Write the formula for the perimeter of a rectangle of length l and breadth b .
 5. What is the perimeter of a circle called?
 6. Write the formula for the circumference of a circle.
 7. What is the value of π used approximately in the chapter?
 8. What happens to the perimeter of a square if its side is doubled?
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B. CIRCUMFERENCE AND ARC LENGTH

9. Find the circumference of a circle of radius 7 cm.

10. The circumference of a circle is 44 cm. Find its radius.
11. Find the circumference of a circle of radius 10 cm, correct to 3 significant figures.
12. Find the circumference of a circle of radius 12 cm, correct to 3 significant figures.
13. Find the length of an arc of a circle with radius 3.5 cm and central angle 60° .
14. Find the length of an arc with radius 6.3 m and central angle 120° .
15. Write the formula for the length of an arc subtending θ° at the centre.
16. Find the perimeter of a sector of radius 14 cm and sector angle 75° .

The textbook's Exercise Set 6.1 specifically includes circumference, arc-length and sector-perimeter problems.

C. ATHLETICS TRACK

17. A 400 m athletics track has two straight sections of 84.39 m each and two semicircular portions. Find the total distance travelled in one complete circuit.
18. Why are staggered starting positions required in an athletics track?
19. An athlete runs along the curved part of a track. Why does a runner in an outer lane travel a greater distance than a runner in an inner lane?

The textbook uses the 400 m athletics track to develop the relationship between straight lengths, semicircles and circumference.

D. AREAS OF PLANE FIGURES

20. Write the formula for the area of a triangle.
21. Find the area of a triangle with base 12 cm and height 8 cm.
22. The parallel sides of a trapezium are 40 cm and 20 cm. Its equal non-parallel sides are 26 cm each. Find its area.
23. Find the area of a triangle whose sides are 8 cm and 11 cm and whose perimeter is 32 cm.

- 24.** The sides of a triangular plot are in the ratio 3 : 5 : 7. Its perimeter is 300 m. Find its area.
- 25.** One diagonal of a rhombus is twice the other. If its area is 128 cm^2 , find the shorter diagonal.
- 26.** Two triangles have the same base and lie between the same parallel lines. Compare their areas.
- 27.** Prove that joining the midpoints of the sides of a quadrilateral forms a parallelogram whose area is half the area of the original quadrilateral.

Questions 22–27 are based on the types of problems in Exercise Set 6.2.

E. HERON'S FORMULA

- 28.** State Heron's formula for the area of a triangle.
- 29.** What is the semi-perimeter of a triangle with sides a , b and c ?
- 30.** Find the area of a triangle with sides 3 cm, 4 cm and 5 cm using Heron's formula.
- 31.** Find the area of a triangle with sides 5 cm, 12 cm and 13 cm using Heron's formula.
- 32.** Find the area of a triangle with sides 8 cm, 11 cm and 13 cm.
- 33.** Why is Heron's formula useful when the height of a triangle is not directly known?

The chapter introduces Heron's formula for finding the area when the three side lengths are known.

F. AREA OF A CIRCLE

- 34.** Write the formula for the area of a circle.
- 35.** Find the area of a circle of radius 7 cm.
- 36.** Find the area of a circle whose diameter is 14 cm.
- 37.** Find the radius of a circle whose area is 154 cm^2 .

38. Explain why the area of a circle is πr^2 .

The textbook develops the area of a circle through rearranging increasingly small sectors into a parallelogram-like shape with base πr and height r .

G. SECTORS AND SEGMENTS

39. What is a sector of a circle?

40. Write the formula for the area of a sector of angle θ° and radius r .

41. Find the area of a sector of radius 7 cm and angle 60° .

42. Find the area of a quadrant whose circumference is 44 cm.

43. The minute hand of a clock is 7 cm long. Find the area swept by it in 10 minutes.

44. A chord of a circle of radius 10 cm subtends 90° at the centre. Find the area of the corresponding minor sector.

45. For the same circle, find the area of the major sector.

46. A chord of a circle of radius 15 cm subtends 60° at the centre. Find the areas of the corresponding minor and major segments.

47. Two car wipers each have a blade of length 28 cm and sweep through 120° . If they do not overlap, find the total area cleaned in one sweep.

These are directly aligned with the chapter's Exercise Set 6.3.

H. BRAHMAGUPTA'S FORMULA

48. What is a cyclic quadrilateral?

49. Why is the area of a general quadrilateral not determined only by knowing its four side lengths?

50. State Brahmagupta's formula for the area of a cyclic quadrilateral.

51. Write the formula for the semi-perimeter of a cyclic quadrilateral with sides a , b , c and d .

52. Find the area of a cyclic quadrilateral whose sides are 5 cm, 5 cm, 12 cm and 12 cm.

53. Show that Brahmagupta's formula gives the correct area for a rectangle.

54. Explain the relationship between Brahmagupta's formula and Heron's formula.

The textbook explains that a quadrilateral's four side lengths alone do not determine its area in general, but a cyclic quadrilateral has a special formula discovered by Brahmagupta.



I. HIGH-ORDER THINKING QUESTIONS

55. A square is inscribed in a circle of radius r . Show that the ratio of the area of the square to the area of the circle is $2/\pi$.

56. An equilateral triangle is inscribed in a circle of radius r . Show that the ratio of the area of the triangle to the area of the circle is $3\sqrt{3}/(4\pi)$.

57. A hexagon is inscribed in a circle of radius r . Show that the ratio of its area to the area of the circle is $3\sqrt{3}/(2\pi)$.

58. Explain why the area of a cyclic quadrilateral can be determined from its four sides, while the area of a general quadrilateral cannot.

59. Explain how Heron's formula can be obtained as a special case of Brahmagupta's formula.

The chapter explicitly connects Heron's and Brahmagupta's formulas, treating Heron's formula as a special case of the latter.



ANSWER KEY



Basic Concepts

1. Total length around the boundary of a shape.

2. 32 cm

3. 36 cm

4. $P = 2(l + b)$

5. Circumference

6. $C = 2\pi r$

7. $\pi \approx 22/7$ or 3.14

8. It doubles.

Circumference & Arc

9. 44 cm

10. 7 cm

11. ≈ 62.8 cm

12. ≈ 75.4 cm

13. $11/3$ cm ≈ 3.67 cm

14. ≈ 13.2 m

15. Arc length = $(\theta/360^\circ) \times 2\pi r$

16. ≈ 46.33 cm

Athletics Track

17. 400 m

18. Because runners in outer lanes travel a greater distance around the curved portions.

19. The outer lane has a **larger radius**, so its curved path has a greater circumference.

Areas

20. Area = $1/2 \times \text{base} \times \text{height}$

21. 48 cm^2

22. 480 cm^2

23. 39.69 cm^2 approximately

24. Sides = 60 m, 100 m, 140 m

Semi-perimeter = 150 m

Area = $\approx 2,898.28 \text{ m}^2$

25. Let shorter diagonal = x .

Longer diagonal = $2x$.

$$\frac{1}{2} \times x \times 2x = 128$$

$$x^2 = 128$$

$$x = 8\sqrt{2} \text{ cm}$$

26. Their areas are equal.

27. Area of formed parallelogram = $\frac{1}{2} \times$ area of original quadrilateral.

Heron's Formula

28.

$$\text{Area} = \sqrt{[s(s - a)(s - b)(s - c)]}$$

where

$$s = (a + b + c)/2$$

29. $s = (a + b + c)/2$

30. 6 cm^2

31. 30 cm^2

32. $\approx 43.82 \text{ cm}^2$

33. It allows the area to be calculated using the **three side lengths without directly knowing the height.**

Area of Circle

34. $A = \pi r^2$

35. 154 cm^2

36. 154 cm^2

37. 7 cm

38. Area = $\pi r \times r = \pi r^2$.

Sectors & Segments

39. A region bounded by an arc and the two radii joining the endpoints of the arc.

40.

Area of sector = $(\theta/360^\circ) \times \pi r^2$

41. $77/3 \text{ cm}^2 \approx 25.67 \text{ cm}^2$

42. Radius = 7 cm

Area of quadrant = **38.5 cm^2**

43. 10 minutes = 60°

Area = **$77/3 \text{ cm}^2 \approx 25.67 \text{ cm}^2$**

44. $\approx 78.5 \text{ cm}^2$

45. $\approx 706.5 \text{ cm}^2$

46. Minor segment $\approx 102.0 \text{ cm}^2$

Major segment **$\approx 604.0 \text{ cm}^2$**

47. $\approx 1,025.4 \text{ cm}^2$

The textbook's Exercise Set 6.3 includes these sector, segment, clock-hand and wiper applications.

Brahmagupta's Formula

48. A quadrilateral whose four vertices lie on a circle.

49. Different quadrilaterals can have the **same four side lengths but different areas**.

50.

$$\text{Area} = \sqrt{[(s - a)(s - b)(s - c)(s - d)]}$$

where

$$s = (a + b + c + d)/2$$

51. $s = (a + b + c + d)/2$

52.

$$s = (5 + 5 + 12 + 12)/2 = 17$$

$$\text{Area} = \sqrt{[(17-5)(17-5)(17-12)(17-12)]}$$

$$= \sqrt{(12 \times 12 \times 5 \times 5)}$$

$$= 60 \text{ cm}^2$$

53. For a rectangle with sides a and b , Brahmagupta's formula simplifies to **ab** , which is the usual area of a rectangle.

54. **Heron's formula is a special case of Brahmagupta's formula** when the fourth side of the cyclic quadrilateral is taken as zero.



HIGH-PRIORITY QUESTIONS

For the **Chapter 6 Important Questions** page/PDF, I recommend giving these questions the  mark:

-  1. Circumference of a circle
-  2. Find radius when circumference is given
-  3. Arc-length problems
-  4. Athletics-track problems
-  5. Area of trapezium
-  6. Heron's formula

- ★ 7. Triangle-area problems using three sides
- ★ 8. Area of a circle
- ★ 9. Area of a sector
- ★ 10. Area of a segment
- ★ 11. Clock/wiper applications of sectors
- ★ 12. Brahmagupta's formula
- ★ 13. Cyclic quadrilateral area problems
- ★ 14. Relationship between Heron's and Brahmagupta's formulas
- ★ 15. Inscribed polygon-to-circle area ratios

Quick Formula Revision

 **Rectangle:** $P = 2(l + b)$

 **Square:** $P = 4a$

▲ **Triangle:** $A = \frac{1}{2} \times b \times h$

○ **Circumference:** $C = 2\pi r$

○ **Circle Area:** $A = \pi r^2$

🌙 **Arc Length:** $l = \left(\frac{\theta}{360^\circ}\right) \times 2\pi r$

🥧 **Sector Area:** $A = \left(\frac{\theta}{360^\circ}\right) \times \pi r^2$

▲ **Heron's Formula:** $A = \sqrt{s(s-a)(s-b)(s-c)}$

where $s = \frac{a+b+c}{2}$

◆ **Brahmagupta:** $A = \sqrt{[(s-a)(s-b)(s-c)(s-d)]}$

where $s = \frac{a+b+c+d}{2}$