



CLASS 9 MATHEMATICS



CHAPTER 6 – MEASURING SPACE: PERIMETER AND AREA



FREE WORKSHEET | New NCERT Ganita Manjari | 2026–27

This worksheet is aligned with the **actual Chapter 6 of your Ganita Manjari textbook**, which begins on page 118. The chapter covers **perimeter, circumference, π , arc length, area of triangles and other plane figures, Heron's formula, area of a circle, sectors, segments, Brahmagupta's formula and applications of perimeter and area.**

Name: _____

Class: IX Section: _____

Date: _____



Instructions

- Attempt all questions.
 - Show complete working.
 - Use $\pi = 22/7$ unless another value is specified.
 - Write units with your answers.
 - **Total Marks: 40**
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SECTION A – MCQs

1 × 8 = 8 marks

1. The perimeter of a rectangle of length l and breadth b is:

- A. $l + b$
 - B. $2(l+b)$
 - C. lb
 - D. $4(l+b)$
-

2. The circumference of a circle of radius r is:

- A. πr^2
 - B. πr
 - C. $2\pi r$
 - D. $2\pi r^2$
-

3. The area of a triangle with base b and height h is:

- A. bh
 - B. $2bh$
 - C. $\frac{1}{2}bh$
 - D. $\frac{1}{4}bh$
-

4. The semi-perimeter of a triangle with sides a , b and c is:

- A. $a+b+c$
 - B. $(a+b+c)/2$
 - C. $2(a+b+c)$
 - D. $abc/2$
-

5. Which formula gives the area of a circle?

- A. $2\pi r$
 - B. πd
 - C. πr^2
 - D. $2\pi r^2$
-

6. The length of an arc subtending θ° at the centre of a circle of radius r is:

- A. $\frac{\theta}{180} \times \pi r$
- B. $\frac{\theta}{360} \times 2\pi r$
- C. $\frac{\theta}{360} \times \pi r^2$
- D. $2\pi r^2$

7. The area of a sector of angle θ° and radius r is:

- A. $\frac{\theta}{360} \times 2\pi r$
 - B. $\frac{\theta}{360} \times \pi r^2$
 - C. $2\pi r^2$
 - D. πr
-

8. The area of a segment of a circle is:

- A. Area of sector + area of triangle
 - B. Area of circle – area of sector
 - C. Area of sector – area of triangle
 - D. Area of triangle – area of sector
-

SECTION B – FILL IN THE BLANKS

1 × 6 = 6 marks

- 9. The total distance around the boundary of a shape is called its _____.
 - 10. The constant ratio of circumference to diameter of a circle is called _____.
 - 11. The circumference of a circle with diameter d is _____.
 - 12. The area of a parallelogram is _____ × _____.
 - 13. A line segment joining a vertex of a triangle to the midpoint of the opposite side is called a _____.
 - 14. A four-sided figure whose vertices lie on a circle is called a _____ 4-gon.
-

SECTION C – SHORT ANSWER QUESTIONS

2 × 5 = 10 marks

15. Find the perimeter of a square whose side is 12 cm.

16. Find the circumference of a circle whose radius is 7 cm.

17. A parallelogram has base 15 cm and perpendicular height 8 cm.

Find its area.

18. A triangle has base 14 cm and height 9 cm.

Find its area.

19. Explain why a median of a triangle divides the triangle into two triangles having equal areas.

SECTION D – APPLICATION QUESTIONS

3 × 4 = 12 marks

20.  Arc Length

A circle has radius 14 cm. Find the length of an arc that subtends an angle of 90° at the centre.

Use:

$$\text{Arc length} = (\theta/360^\circ) \times 2\pi r$$

21.  Heron's Formula

The sides of a triangle are:

13 cm, 14 cm and 15 cm

Find its area using **Heron's formula**.

Use:

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

and

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

22. Area of a Sector

A sector of a circle has radius 21 cm and central angle 120° .

Find its area.

Use:

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

23. Real-Life Application

A bicycle wheel has diameter 60 cm.

How far will the bicycle travel when the wheel makes 100 complete rotations?

SECTION E – CASE-BASED QUESTION

4 marks



A Circular Garden

A circular garden has radius 14 m. A path is marked along its boundary.

24 (a). Find the circumference of the garden.
(1 mark)

24 (b). Find the area of the garden.
(1 mark)

24 (c). If a person walks around the garden twice, how far does the person walk?
(1 mark)

24 (d). If the radius is doubled, what happens to the circumference?
(1 mark)

BONUS CHALLENGE

25.  Brahmagupta's Formula

A cyclic quadrilateral has sides:

5 cm, 6 cm, 7 cm and 8 cm.

Find its semi-perimeter and then use Brahmagupta's formula:

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

where:

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

THINK & SOLVE

26.  Heron's Formula Investigation

A triangle has sides:

7 cm, 24 cm and 25 cm.

Find its area using **Heron's formula**.

Then observe whether the triangle is right-angled.

Can you find its area using the formula for a right-angled triangle as well?



ANSWER KEY



SECTION A

1. $B - 2(1+b)$
 2. $C - 2\pi r$
 3. $C - \frac{1}{2}bh$
 4. $B - (a+b+c)/2$
 5. $C - \pi r^2$
 6. $B - (\theta/360^\circ) \times 2\pi r$
 7. $B - (\theta/360^\circ) \times \pi r^2$
 8. $C - \text{Area of sector} - \text{Area of triangle}$
-



SECTION B

9. Perimeter
 10. π (pi)
 11. πd
 12. base $\times$ height
 13. median
 14. cyclic
-



SECTION C

15.

Side = 12 cm

Perimeter = $4 \times \text{side}$

$$= 4 \times 12$$

✓ 48 cm

16.

$$r = 7 \text{ cm}$$

$$\text{Circumference} = 2\pi r$$

$$= 2 \times 22/7 \times 7$$

✓ 44 cm

17.

$$\text{Area} = \text{base} \times \text{height}$$

$$= 15 \times 8$$

✓ 120 cm²

The textbook derives the parallelogram area as bh by transforming it into a rectangle with the same base and height.

18.

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

$$= 1/2 \times 14 \times 9$$

✓ 63 cm²

19.

A median joins a vertex to the midpoint of the opposite side.

Therefore, it divides the opposite side into two equal parts.

The two resulting triangles have:

- equal bases
- the same perpendicular height.

Hence their areas are equal.

✓ **A median divides a triangle into two triangles of equal area.**

This is explicitly established in the textbook.

SECTION D

20. Arc Length

$$r = 14 \text{ cm}$$

$$\theta = 90^\circ$$

$$\text{Arc length} = (90/360) \times 2 \times 22/7 \times 14$$

$$= 1/4 \times 88$$

✓ **22 cm**

The textbook gives the general arc-length formula as $l = 2\pi r \times \theta/360^\circ$.

21. Heron's Formula

Sides:

$$a = 13$$

$$b = 14$$

$$c = 15$$

First find semi-perimeter:

$$s = (13+14+15)/2$$

$$= 42/2$$

$$s = 21 \text{ cm}$$

Now:

$$\text{Area} = \sqrt{[21(21-13)(21-14)(21-15)]}$$

$$= \sqrt{(21 \times 8 \times 7 \times 6)}$$

$$= \sqrt{7056}$$

$$\checkmark 84 \text{ cm}^2$$

22. Area of Sector

$$r = 21 \text{ cm}$$

$$\theta = 120^\circ$$

$$\text{Area} = (120/360) \times 22/7 \times 21^2$$

$$= 1/3 \times 22/7 \times 441$$

$$= 1/3 \times 1386$$

$$\checkmark 462 \text{ cm}^2$$

The textbook gives the sector formula as $(\theta/360^\circ) \times \pi r^2$.

23. Bicycle Wheel

Diameter:

$$d = 60 \text{ cm}$$

Distance travelled in one rotation:

= circumference

= πd

= $22/7 \times 60$

= $1320/7$ cm

For 100 rotations:

= $132000/7$ cm

≈ 18857.14 cm

Convert to metres:

≈ 188.57 m

✓ **188.57 m approximately**

SECTION E

24 (a)

Circumference = $2\pi r$

= $2 \times 22/7 \times 14$

✓ **88 m**

24 (b)

Area = πr^2

= $22/7 \times 14^2$

= 616

✓ **616 m²**

24 (c)

Two complete rounds:

$$2 \times 88$$

$$\checkmark 176 \text{ m}$$

24 (d)

If radius is doubled:

$$r \rightarrow 2r$$

New circumference:

$$2\pi(2r)$$

$$= 2 \times \text{original circumference}$$

$$\checkmark \text{ The circumference doubles.}$$

 BONUS**25.**

Sides:

$$a = 5$$

$$b = 6$$

$$c = 7$$

$$d = 8$$

Semi-perimeter:

$$s = (5+6+7+8)/2$$

$$= 26/2$$

$$s = 13 \text{ cm}$$

Brahmagupta's formula:

$$\text{Area} = \sqrt{(13-5)(13-6)(13-7)(13-8)}$$

$$= \sqrt{(8 \times 7 \times 6 \times 5)}$$

$$= \sqrt{1680}$$

$$\checkmark \approx 40.99 \text{ cm}^2$$

Brahmagupta's formula applies to a **cyclic quadrilateral**; the textbook notes that an arbitrary quadrilateral cannot have its area determined from its four side lengths alone.



THINK & SOLVE

26.

Sides:

$$7 \text{ cm}, 24 \text{ cm}, 25 \text{ cm}$$

Semi-perimeter:

$$s = (7+24+25)/2$$

$$= 56/2$$

$$s = 28 \text{ cm}$$

Heron's formula:

$$\text{Area} = \sqrt{28(28-7)(28-24)(28-25)}$$

$$= \sqrt{(28 \times 21 \times 4 \times 3)}$$

$$= \sqrt{7056}$$

$$\checkmark 84 \text{ cm}^2$$

Now check whether it is right-angled:

$$7^2 + 24^2$$

$$= 49 + 576$$

$$= 625$$

$$25^2 = 625$$

Therefore:

$$7^2 + 24^2 = 25^2$$

So the triangle is **right-angled**.

Using:

$$\text{Area} = 1/2 \times 7 \times 24$$

$$= 84 \text{ cm}^2$$

✓ Both methods give **84 cm²**.



CHAPTER 6 FORMULA BOX



Perimeter

Square:

$$P = 4a$$

Rectangle:

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

Equilateral triangle:

$$P = 3a$$

Circle

Circumference:

$$C = 2\pi r$$

or

$$C = \pi d$$

Area:

$$A = \pi r^2$$

Arc

$$\text{Arc length} = (\theta/360^\circ) \times 2\pi r$$

Sector

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

Triangle

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

Heron's Formula

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

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

Brahmagupta's Formula

For a cyclic quadrilateral:

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

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

Segment

$$\text{Area of segment} = \text{Area of sector} - \text{Area of triangle}$$



STUDENT SELF-CHECK

- ☐ I can calculate perimeter of plane figures.
- ☐ I can calculate circumference of a circle.
- ☐ I can find arc length.
- ☐ I can calculate areas of triangles and parallelograms.
- ☐ I can use Heron's formula.
- ☐ I understand why a median divides a triangle into equal areas.
- ☐ I can find the area of a circle.
- ☐ I can find the area of a sector.
- ☐ I can find the area of a segment.
- ☐ I understand Brahmagupta's formula.
- ☐ I can solve real-life perimeter and area problems.



MY SCORE: _____ / 40

35–40: 🌟 Excellent!

28–34: 👏 Very Good!

20–27: 👍 Good – keep practising!

Below 20: 📖 Revise Chapter 6 and try again!