7 AREA

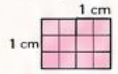
Algebra helps us explore patterns, solve puzzles and create tricks. In this chapter we use it to understand areas and number pyramids.

In This Chapter

- ✓ Area of rectangles and squares
- ✓ Why perimeter is not a measure of area
- ✓ Finding missing lengths and areas
- ✓ Area around shapes (paths)
- ✓ Number pyramids

Key Idea

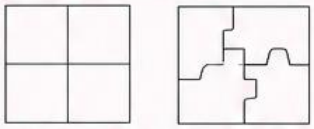
Area is the amount of surface enclosed by a shape. We measure it using unit squares.



Area of 1 square = 1 sq. cm
Area of N squares = N sq. cm or N cm²

1. RECTANGLES AND SQUARES

- Many ways to divide a square into 4 equal parts!

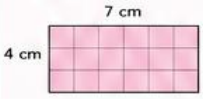


- Area can change shape but remains the same.

Area of a Rectangle

Area = length × width
(or length × breadth)
Units: sq. unit (or unit)

Example:

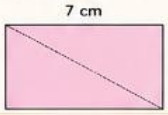


Number of unit squares = 7 × 4 = 28
Area = 28 sq. cm

Area of a Triangle

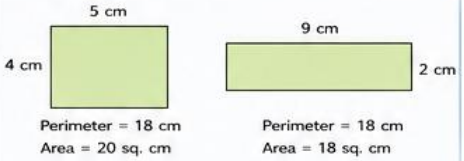
- A diagonal of a rectangle divides it into two congruent triangles.
- Area of each triangle = $\frac{1}{2}$ × length × width

Example: $\frac{1}{2} \times 7 \times 4 = 14$ sq. cm



2. WHY PERIMETER IS NOT A MEASURE OF AREA

- **Same perimeter, different areas:**



Perimeter = 18 cm
Area = 20 sq. cm

Perimeter = 18 cm
Area = 18 sq. cm

- **Larger perimeter, smaller area:**

Perimeter = 40 cm
Area = 100 sq. cm

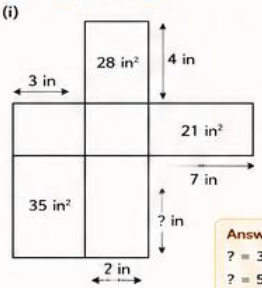
Perimeter = 50 cm
Area = 100 sq. cm

Hence, perimeter does not tell us the area.
Area depends on how much surface is enclosed inside the boundary.

3. FIGURE IT OUT

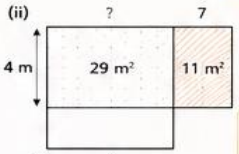
(a) Missing Sidelengths

(i)



Answers:
? = 3 in (top width)
? = 5 in (bottom width)
? = 5 in (bottom height)

(ii)

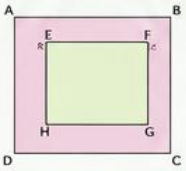


Area = 50 m²

Answers:
Top left width = 10 m
Bottom width = 17 m

4. AREAS AROUND SHAPES (PATHS)

(i) Path around a rectangular park

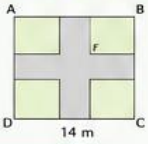


Two ways to find area of the path

Method 1:
Area(Path) = Area(ABCD) − Area(EFGH)

Method 2:
If width of path = x,
Outer: length = L, breadth = B
Inner: length = (L − 2x), breadth = (B − 2x)

(ii) Cross path in a plot

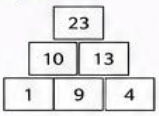


Break the path into rectangles.
If vertical width = x,
horizontal width = y,
Area(Path) = 14x + 12y − xy
(subtract the overlap xy counted twice)

5. NUMBER PYRAMIDS

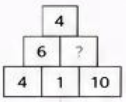
Rule: Each number is the sum of the two numbers directly below it.

Example



How to Fill?

- Work from bottom to top to find known numbers.
- Work from top to bottom to find missing numbers by subtraction.



? = 6 − 4 = 2
(top − left bottom)

General Pattern

For bottom row: a, b, c

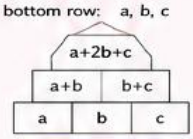


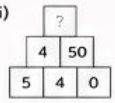
Figure it Out!

1. Fill the pyramids.

(i)

(ii)

(iii)



Write expression for top of a 4-row pyramid in terms of bottom row a, b, c, d.
Top = a + 3b + 3c + d (Coefficients: 1, 3, 3, 1)

6. HOW THE MEAN CHANGES

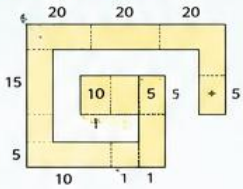
Operation on data	Effect on mean	Example (mean = 10)
Add a value > mean	Mean increases	Add 20 → mean > 10
Add a value < mean	Mean decreases	Add 2 → mean < 10
Remove a value > mean	Mean decreases	Remove 20 → mean < 10
Remove a value < mean	Mean increases	Remove 2 → mean > 10
Add or remove value = mean	Mean unchanged	Add or remove 10 → mean = 10

Relatively Unchanged Mean

- Add k to every value → mean increases by k.
- Subtract k from every value → mean decreases by k.
- Multiply every value by k → mean becomes k times.
- Divide every value by k → mean becomes $\frac{1}{k}$ times.

Math Talk

7. SPIRAL TUBE

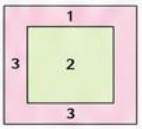


Area of tube = Sum of areas of all rectangular parts.
= 20×15 + 20×10 + 20×5 + 5×10 + 5×5 + 15×5 + 10×1 + 1×1
= 600 sq. units

Straight tube with same area
If width = 5, then required length = 600 ÷ 5 = 120 units.

8. MORE EXPLORATIONS

1. **Doubling the side of a square:**
   - Region 1 (outer square) → 4 times area
   - Region 2 (inner square) → 4 times area
   - Region 3 (frame) → 4 times area



2. **Rearranging 4 equal parts:**
   - Cut square into 4 equal parts.
   - Rearrange to get a larger square with a square hole in the centre.

KEY DEFINITIONS

- **Area:** The amount of surface enclosed by a shape, measured in square units.
- **Perimeter:** The total length of the boundary of a shape.
- **Unit Square:** A square with side 1 unit (area = 1 sq. unit).

IMPORTANT FORMULAS

- Area of rectangle = length × width
- Area of square = side × side = side²
- Area of triangle (from rectangle) = $\frac{1}{2}$ × length × width
- Path around rectangle (method 1):
  Area = Outer rectangle − Inner rectangle
- Path (cross) in a plot: Area = 14x + 12y − xy
  (x = vertical width, y = horizontal width)

KEY TAKEAWAYS

- ✓ We measure area using unit squares.
- ✓ Perimeter cannot determine area.
- ✓ Algebra helps us find unknown lengths and areas.
- ✓ In number pyramids, each number is the sum of the two below.
- ✓ Mean changes in predictable ways with operations on data.
- ✓ Patterns in numbers can be explored using algebra.

AREA

WORKSHEET-1

Section A: MCQs (Part-1) (10 × 1 = 10 marks)

1. The area of a rhombus whose diagonals are 20 cm and 15 cm is:

a) 120 cm² b) 150 cm² c) 300 cm² d) 75 cm²

2. The formula for the area of a trapezium is:

a) ½ × diagonal × diagonal b) base × height
c) ½ × height × (sum of parallel sides) d) side × side

3. A triangle has base 12 cm and height 8 cm. Its area is:

a) 48 cm² b) 96 cm² c) 24 cm² d) 60 cm²

4. The area of a parallelogram having base 15 cm and height 6 cm is:

a) 45 cm² b) 90 cm² c) 60 cm² d) 75 cm²

5. The area of a square of side 9 cm is:

a) 18 cm² b) 36 cm² c) 81 cm² d) 72 cm²

6. Which figure uses diagonals in its area formula?

a) Rectangle b) Triangle c) Rhombus d) Trapezium

7. If the side of a square is doubled, its area becomes:

a) Double b) Triple c) Four times d) Eight times

8. The SI unit of area is:

a) cm b) m c) m² d) km

9. The area of a rectangle of length 8 cm and breadth 5 cm is:

a) 13 cm² b) 40 cm² c) 80 cm² d) 26 cm²

10. A trapezium has parallel sides 12 cm and 18 cm and height 8 cm. Its area is:

a) 120 cm² b) 240 cm² c) 60 cm² d) 100 cm²

MCQs (Part-2) (10 × 1 = 10 marks)

11. The area of a rhombus whose diagonals are 12 cm and 10 cm is:

a) 60 cm² b) 120 cm² c) 30 cm² d) 22 cm²

12. The area of a triangle with base 16 cm and height 8 cm is:

a) 64 cm² b) 128 cm² c) 32 cm² d) 48 cm²

13. The SI unit of area is:

a) cm b) m² c) m d) km²

14. The area of a parallelogram is:

a) Length × Breadth b) Base × Height c) Side × Side d) ½ × Base × Height

15. The area of a square of side 15 cm is:

a) 30 cm² b) 225 cm² c) 150 cm² d) 75 cm²

16. A rectangular playground is 48 m long and 30 m wide. A square flower bed of side 12 m is made inside it. What is the area of the remaining playground?

(a) 1152 m² (b) 1296 m² (c) 1440 m² (d) 1584 m²

17. A triangular park has a base of 18 m and an area of 126 m². The height of the park is

(a) 12 m (b) 14 m (c) 16 m (d) 18 m

18. A parallelogram and a rectangle have the same base (20 cm) and same height (9 cm). Which statement is correct?

(a) Rectangle has greater area. (b) Parallelogram has greater area.
(c) Both have equal area. (d) Their areas cannot be compared.

19. The diagonals of a rhombus are 16 cm and 10 cm. If one diagonal is doubled while the other remains unchanged, the new area becomes

(a) 80 cm² (b) 160 cm² (c) 240 cm² (d) 320 cm²

20. A trapezium has parallel sides measuring 12 cm and 20 cm, and its height is 9 cm. What is its area?

(a) 126 cm² (b) 132 cm² (c) 144 cm² (d) 156 cm²

WORKSHEET-2

Section B: Short Answer (10 × 2 = 20 marks)

1. Find the area of a triangle whose base is 14 cm and height is 9 cm.

2. Find the area of a rectangle of length 18 cm and breadth 7 cm.

3. State the formula for the area of a rhombus.

4. Find the area of a parallelogram whose base is 11 cm and height is 8 cm.

5. Find the area of a rhombus whose diagonals are 16 cm and 10 cm.

6. Find the breadth of a rectangle whose area is 144 cm^2 and length is 12 cm.

7. Find the area of a trapezium with parallel sides 9 cm and 15 cm and height 6 cm.

8. A triangle has area 48 cm^2 and base 12 cm. Find its height.

9. Convert 5 m^2 into cm^2.

10. Find the area of an A4 sheet whose dimensions are 21 cm × 29.7 cm.

Section C: Short Answer (6 × 3 = 18 marks)

11. Find the area of a rhombus whose diagonals are 24 cm and 18 cm.

12. A trapezium has parallel sides 20 cm and 14 cm and height 12 cm. Find its area.

13. A triangular garden has base 25 m and height 16 m. Find its area.

14. A rectangular field is 30 m long and 18 m wide. Find its area and perimeter.

15. A rhombus-shaped field has diagonals 40 m and 24 m. find its area.

16. A trapezium has area 180 cm², height 10 cm and one parallel side 12 cm. Find the other parallel side.

Section D: Long Answer (4 × 5 = 20 marks)

17. A rectangular park is 50 m long and 30 m wide. A path of width 2 m runs inside all around the park. Find the area of the path.

18. A farmer owns a rhombus-shaped field with diagonals 50 m and 30 m. Find its area. If wheat is grown at the rate of 2 kg per m², find the total wheat produced.

19. Find the area of a trapezium whose parallel sides are 16 cm and 24 cm and height is 10 cm.

20. A rectangular hall measures 25 m × 18 m. Tiles of area 0.25 m² are used for flooring. Find the number of tiles required.

SECTION E: Case Study Based Questions (4 × 2 = 8 marks)

21. **School Playground**

A school playground is rectangular in shape. Its length is 50 m and breadth is 30 m. A walking track of width 2 m is constructed all around the playground inside it.

Questions

(i) Find the area of the playground.

(ii) Find the dimensions of the inner rectangular ground.

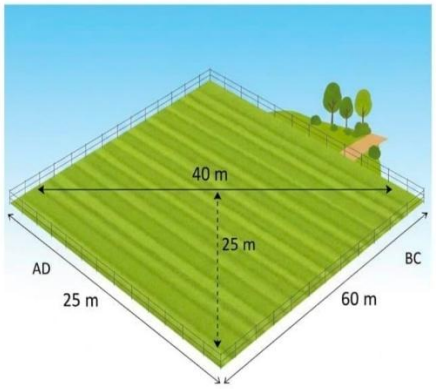
(iii) Find the area of the walking track.

(iv) If grass is planted on the inner ground at ₹15 per m², find the total cost.

22**. Trapezoidal Agricultural Field**

A farmer owns a trapezium-shaped field.

AB ∥ CD , AB = 40 m , CD = 60 m Height = 25 m



(i) Find the area of the field.

(ii) Convert the area into acres (1 acre ≈ 4000 m²).

(iii) Divide the field into two equal-area parts.

(iv) Find the wheat production if yield = 3 kg/m².

Self Assessment:

I understood all the concepts: ☐ Yes ☐ No

I need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Parent's Assessment:

My ward understood all the concepts: ☐ Yes ☐ No

He/She need more practice: ☐ Yes ☐ No

Name of Concepts having doubts/Not Cleared: _____

Signature of Parent:

Teacher's Assessment

Answers of Worksheet-1

Q.No.	1	2	3	4	5	6	7	8	9	10
Ans.	b	c	a	b	c	c	c	c	b	a
Q.No.	11	12	13	14	15	16	17	18	19	20
Ans.	a	a	b	b	b	b	b	c	b	c

Answers of Worksheet-2

Q.No.	1	2	3	4	5	6
Ans.	63 cm^2	126 cm^2	Area of Rhombus = $\frac{1}{2} \times d_1 \times d_2$	88 cm^2	80 cm^2	12 cm
Q.No.	7	8	9	10	11	12
Ans.	72 cm^2	8 cm	50,000 cm^2	623.7 cm^2	216 cm^2	204 cm^2
Q.No.	13	14	15	16	17	18
Ans.	200 m^2	Area = 540 m^2, Perimeter = 96m	480 m^2	24 cm	304 m^2	Area = 750 m^2, Wheat = 1500 kg
Q.No.	19	20	21		22	
Ans.	200 cm^2	1800 tiles	(i) 1500 m^2 (ii) 46 m × 26 m (iii) 304 m^2 (iv) ₹17,940		(i) 1250 m^2 (ii) 0.309 acre (iii) 625 m^2 each (iv) 3750 kg	