

# Exploring Area and Perimeter Through Experience: A Classroom and Cluster-based Journey

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Teaching mathematics in primary schools is often seen as working with numbers, rules, and formulas, but when we apply the mathematics we learn, a world of discovery opens up. This article describes such a journey — working with teachers to explore the concepts of **area and perimeter**, particularly the idea of a **fixed perimeter** and **changing area**. The experiences shared here are rooted in classroom conversations, mistakes, and teacher reflections. This is an experience-based article from four government primary schools and cluster-level teachers' workshops, in Rudraprayag, Uttarakhand.

## Measuring pieces of land having different shapes

It began with a discussion during a primary school teachers' cluster meeting in Rudraprayag district. We were discussing Chapter 11 Area and its Boundary in the Grade 5 NCERT Textbook. I made some rectangular shapes each with a fixed perimeter of 44 metres, on the board, as shown in Figure 1.

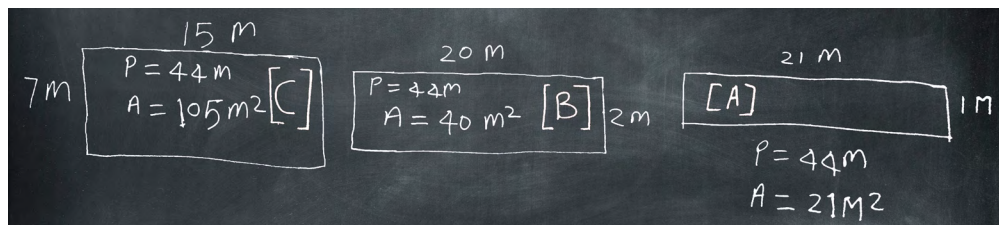


Figure 1

These rectangles immediately caught everyone's attention. Teachers began drawing rectangles with various side lengths — 11 by 11, 12 by 10, 14 by 8, and so on. The calculations followed:

- $11\text{m} \times 11\text{m}$  (square)  $\rightarrow$  Area =  $121\text{ m}^2$
- $12\text{m} \times 10\text{m}$   $\rightarrow$  Area =  $120\text{ m}^2$
- $14\text{m} \times 8\text{m}$   $\rightarrow$  Area =  $112\text{ m}^2$

The rectangles had the same **perimeter** =  $2 \times (\text{length} + \text{breadth}) = 44\text{ m}$ , but their areas varied.

Then we discussed what happens when the breadth of the rectangle is reduced by  $x$  metres and the length is correspondingly increased by  $x$  metres (to keep the perimeter constant).

*Keywords: Contextual mathematics, conversations, exploration, area, perimeter*

**Our observation: The maximum area occurred when the land was in the shape of a square!**

**Adding a Circle: The Biggest Surprise**

In the next cluster meeting, a teacher asked:

“If the square gives maximum area among rectangles, what if we use a rope with the same length as the perimeter (44 m) to make a circle?”

This became the next question:

**If a circle has a circumference (perimeter) of 44 metres, what is its radius and area?**

The estimation shown in Figure 2 was made using a graph paper (replacing m with cm). Using the formula, we arrived at:

$$C = 2\pi r$$

$$44 = 2 \times \pi \times r$$

$$r = \frac{44}{2 \times 3.14} \approx 7 \text{ metres}$$

Using the value of r to calculate the area:

$$A = \pi r^2 = 3.14 \times \left(\frac{44}{2 \times 3.14}\right)^2 \approx 3.14 \times 49 \approx 153.86 \text{ m}^2$$

So, the area of the circle is approximately 154 m<sup>2</sup>, which is larger than that of the square (121 m<sup>2</sup>).

This was an eye-opener. The circle, with the same perimeter as the rectangles, gave the **largest area**.

**Teachers Reflect: Is the circle the most efficient shape?**

We now had a new insight to explore. Among all shapes that can be formed with the same boundary, the circle encloses the largest area. Teachers reflected on this:

- “Is this why tanks, plates, and pots are often round – because they hold more with less material when the height is the same in 3D shapes?”
- “Does Nature use this property of circles – look at nests, fruits, planets? Maybe it’s because it’s more efficient.”

Table 1. Summary

Shape	Dimensions (m)	Area (m <sup>2</sup> )
Rectangle	21 × 1	21
Rectangle	20 × 2	40
Rectangle	15 × 7	105
Rectangle	14 × 8	112
Rectangle	11 × 11 (square)	121
Circle (r = 7m)	C = 44	154

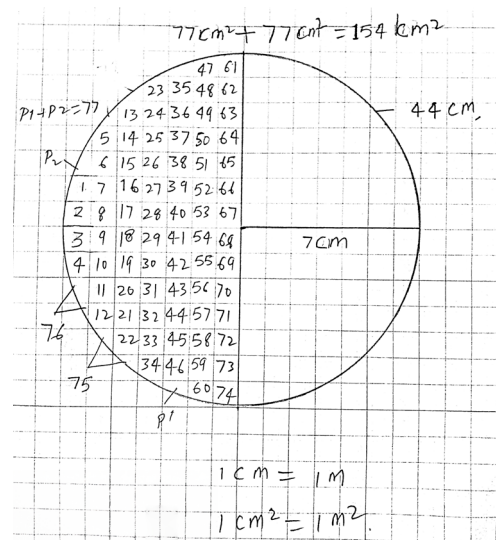


Figure 2

Here are visual diagrams of different shapes—all with the same **perimeter of 44 metres**—that were discussed in the article. These diagrams can be used in teacher training sessions or classroom demonstrations:

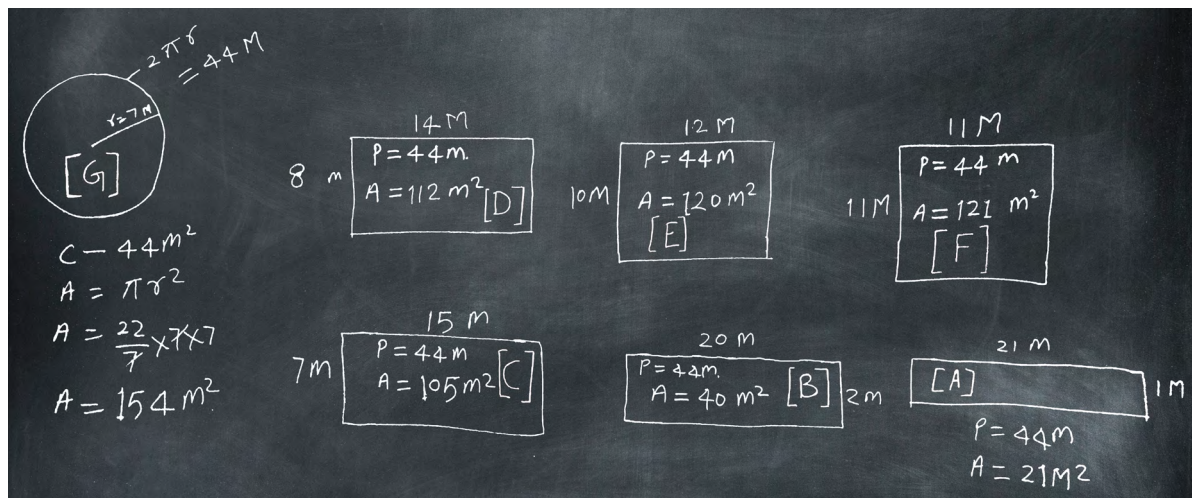


Figure 3

This led to beautiful discussions about protecting agricultural areas, fencing in the garden, making the house, and real-life applications in design and architecture.

### Taking the Idea to the Classroom

Inspired by the discussion, we designed a classroom activity for Grade 5 students. We gave students ropes of 44 cm (using thread or string) and asked them to make different rectangular shapes using graph paper.

Children were excited — it felt like solving a puzzle. The results were similar to what the teachers had come up with.

One group made an 11 by 11 square. Another made 14 by 8 rectangle. Some tried extreme shapes such as 20 by 2 or 21 by 1.

They calculated the area for each. To their surprise, the square had the biggest area, even though all shapes had the same perimeter. One child said:

“Sir, jab chaaron taraf barabar ho to zameen zyada multi hai!”  
(Sir, when all sides are equal, we get more land!)

That one sentence captured a mathematical truth.

In another class, a boy said, “Sir, agar perimeter fix hai to sabse zyada area gol shape deta hai!”  
(If the perimeter is fixed, the round shape gives the maximum area!)

### From Rote to Reasoning: Shifting Teaching Practices

This activity challenged the traditional way area and perimeter are taught. Usually, children memorize formulas:

- Area = length  $\times$  breadth
- Perimeter =  $2 \times$  (length + breadth)

By working with a **fixed perimeter** and **changing area**, including the circle, students were forced to **think, test, and observe patterns**.

Teachers noted that students who struggled with formula-based teaching were actively participating when allowed to reason and **explore using materials**.

### How to Integrate this in Regular Teaching

This concept can be integrated into Grade 4 Math Magic Chapter 13, **Field and Fences**, and Grade 5 Math Magic Chapter 3, **How Many Squares**, and Chapter 11, **Area and its Boundary** in practical and creative ways.

1. **Story context:** “A farmer has 44 metres of fencing material. What shapes can he make for his field to get maximum land?”
2. **Use materials:** Rope, string, paper strips, matchsticks.
3. **Draw and measure:** Let students calculate and compare.
4. **Discuss:** Ask open-ended questions like:
  - “What changes when the rectangle changes?”
  - “What stays the same?”
  - “Which shape gives the biggest area?”
5. **Extension:** Include the **circle** in the conversation. Draw it with a string compass in the graph paper.

### Conclusion

Mathematics is not just about speed and accuracy — it’s about **sense-making**. The experience of exploring the topic of area and perimeter with teachers and students showed us that **when learning is rooted in exploration, guided by curiosity, and connected to real life, deep understanding can emerge**.

The journey from rectangles to squares, and then to the circle, showed a powerful idea:

For a given perimeter, the circle gives the maximum area.

This is not just a mathematical fact — it’s a gateway to critical thinking and appreciation of the natural world. The same thing can be done with other shapes as well and students can note and discuss their observations.



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