

Investigating Perimeter and Area with Square Tiles

Mohan R

Understanding the relationship between perimeter and area can be an exciting exploration for students in grades 3 to 7. Square tiles offer an ideal hands-on method to discover and visualise these concepts intuitively. In this article, we share a set of practical activities involving square tiles. These activities help students explore the relationship between shape, area and perimeter, and learn to optimise shapes to minimise perimeter or maximise area.

Materials required

- 5 cm × 5 cm square tiles cut from a thick chart paper
- Pencil and paper for notes
- Grid paper/graph paper for drawing and rough work.

Activity 1: Starting Small – Classes 3-5

In the new NCERT textbooks, the notion of measuring area by counting unit squares is introduced in Class 3, and measuring length is introduced in Class 4.

The teacher could begin with a short introduction/revision of the notions of area and perimeter, and how to measure them using square tiles. (See Figure 1.) The class is divided into groups of two, and each student is asked to create rectangles with exactly 12 tiles (orientation does not matter). The pairs discuss and find different ways to arrange these tiles and then carefully record each arrangement on grid paper. Students are then asked to count and record the perimeter (which changes), and the area (which is always 12 square units).

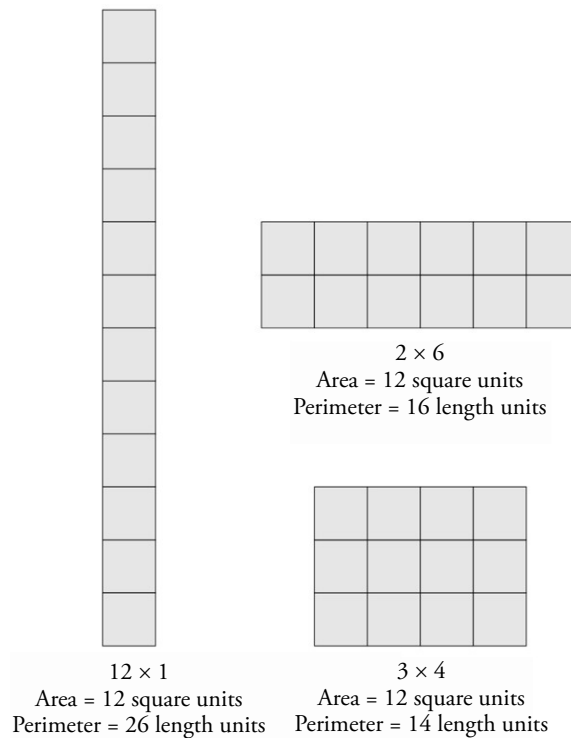


Figure 1: Rectangles formed with 12 square tiles

Keywords: Area, Perimeter, Square tiles, Polyominoes, Floor plans

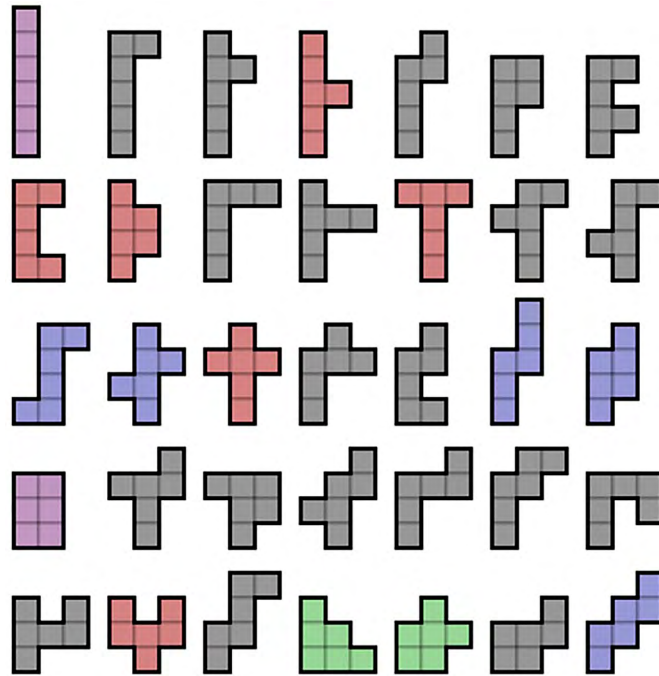
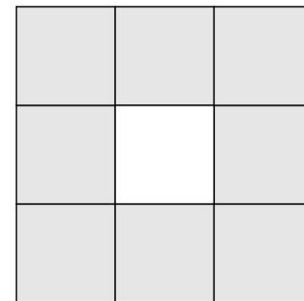


Figure 6. All floor plans that can be created using 6 square tiles. Credits: By R. A. Nonenmacher - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=4773113>

Note: It is possible to have a floor plan with a blank interior as in Figure 7. In such cases, the perimeter is the sum of the interior boundary and the exterior boundary.

The teacher discusses the following questions, and the students *reason and argue* why their answers are correct.

1. Which arrangement had the greatest perimeter? Which arrangement had the smallest?
2. Why do you think changing the arrangement affects the perimeter but not the area?
3. Do you see any relationship between the rectangles and the factors of 12?
4. What do you think happens if we take 13 tiles instead of 12?
5. What do you think happens if we take 24 tiles instead of 12?
6. Will the perimeter always be even?
7. (For advanced learners) What do you think happens if we take n tiles instead of 12?



Area = 8 units
 Perimeter = Length of outer boundary and inner boundary.
 So Perimeter = 12 + 4 = 16 units

Figure 7. A floor plan with 8 square tiles

Activity 3: Conquer the land – Classes 5-7

The final activity in this series explores a related but converse question: Given a fixed perimeter, what rectangle maximizes the enclosed area? This problem could be presented as a real-world scenario: Imagine conquering land represented by square tiles, and you have only enough fencing material of a specific length (the perimeter). How can you arrange your boundary so that the land you've conquered covers the greatest possible area?

To begin, the teacher sets the perimeter at 24 units. Students then generate all possible rectangles with this fixed perimeter, carefully calculating the area for each configuration to identify the one with the largest area. At this stage, teachers can gently introduce the language of algebra, tables and systematic reasoning to help students organise their findings and guide their thinking. After practising with several small perimeter values, students who are comfortable with rectangles can then be challenged further: explore non-rectangular floor plans to find which shapes offer the greatest area given a fixed perimeter.

Conclusion

Through these interactive and exploratory activities, students intuitively grasp key mathematical ideas related to area and perimeter. They discover important patterns, engage in systematic reasoning, and experience how mathematical concepts connect to practical scenarios. Using simple square tiles, these activities build foundational skills and a deeper appreciation for mathematics as being both creative and practical.

For more ideas on this topic

1. Some previous articles of At Right Angles have discussed similar ideas. For example the tearout <https://bit.ly/3L0uH8u> - this includes similar explorations on a square grid.
2. One can start with smaller floor plans with $n = 3$ and find pairs with a) same area and same perimeter b) same area, different perimeter c) same perimeter, different area.
3. There is a notion of L-ing (cutting an L from the corner of a rectangle) preserving perimeter but decreasing area and U-ing (cutting a U from a side of a rectangle) reducing area while increasing perimeter discussed in the link above. This can be explored with polyominoes. See tasks 4 and 5 in <https://bit.ly/47i5jCt>
4. There is another Tearout on hexominoes <https://bit.ly/49fKkmu>



MOHAN R teaches mathematics at Azim Premji University. An algebraist by training, he is also interested in mathematics education and mathematics communication. He is the regional coordinator for the Mathematics Olympiad for Karnataka. He may be contacted at mohan.r@apu.edu.in