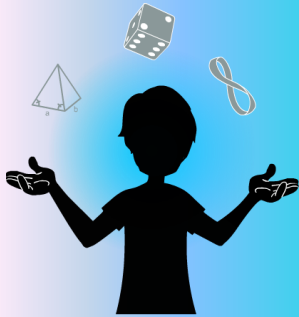


PUZZLING CARTOON

- THE STOLEN MAP -



AMAZINGMATHS

Materials:

- Video of the puzzle
- Sheets of paper
- Pencils
- Scissors (optional)
- Ruler (optional)
- Cardboards (optional)
- 1 set of three paper rectangles of the following dimensions for each team: 11 cm x 2 cm, 9 cm x 5 cm and 6 cm x 4 cm (optional)

The Puzzle

Richard is a museum curator. While he is working in his office, thieves break into the museum to steal a piece of an ancient map. A few hours later, when Richard leaves his office, he finds the map cut in pieces and he realizes a part is missing. He does not remember the map's dimensions, but he knows it was square. The three pieces left are in a rectangular shape. The first one measures 11 dm by 2 dm, the second one measures 9 dm by 5 dm and the last one measures 6 dm by 4 dm.



Knowing it has a rectangular shape, what are the dimensions of the stolen piece?



PUZZLE SOLUTION



The answer:

The stolen piece's dimensions are 5 dm by 6 dm.

The solution:

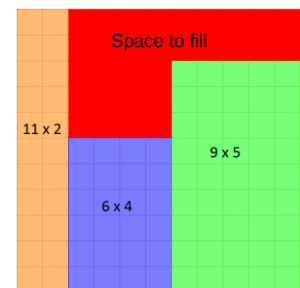
Among the pieces, the one that has the most restrictive dimension is the piece of $11 \times 2 \text{ dm}^2$. It cannot be part of a square which dimensions are lower than $11 \times 11 \text{ dm}^2$. The others could have been included in squares with sides of 9 or 6 dm.

If the square's sides measure exactly 11 dm:

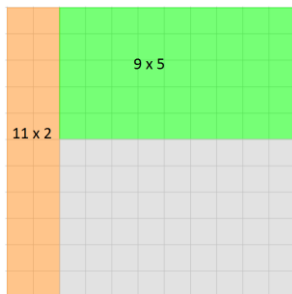
The dimensions of the three rectangles mixed together are 2, 4, 5, 6, 9 and 11. If we try to combine some of them to obtain 11, we could add 9 and 2, 5 and 6 or 2, 4 and 5.

Attempt with 2, 4 and 5 for the width:

The remaining shape (in red) is not a rectangle.

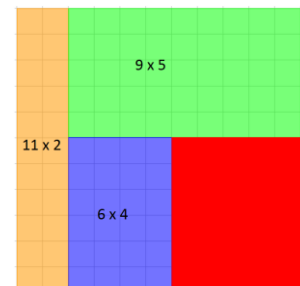


Attempt with 9 and 2 for the width:



The shape left to fill is a rectangle of 6×9 . The third rectangle we have is a rectangle of 6 dm x 4 dm. Plus, 5 and 6 equal 11. So, we can continue this attempt by placing the third rectangle we have.

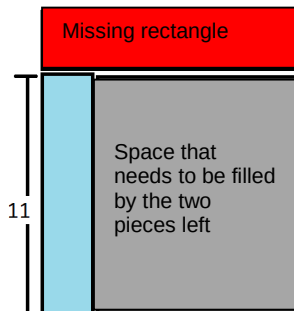
The space to fill to obtain a square (in red) is rectangular and its dimensions are of 5 dm x 6 dm.



What if the square's sides measure more than 11 dm?

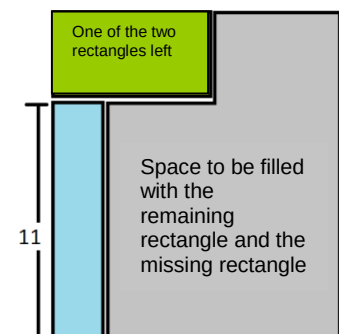
Then, the situation would be one of these two: the side would have to be formed by the long side of the rectangle 11×2 and one side of the missing rectangle or the side would have to be formed by the long side of the rectangle 11×2 and one side of one of the other two rectangles we have.

If we are in the first situation, then the three pieces that we have should form together a rectangle with one side measuring 11 dm, so that, once associated with this new rectangle that is placed next to the 11×2 , they form a square. The following figure illustrates this situation:

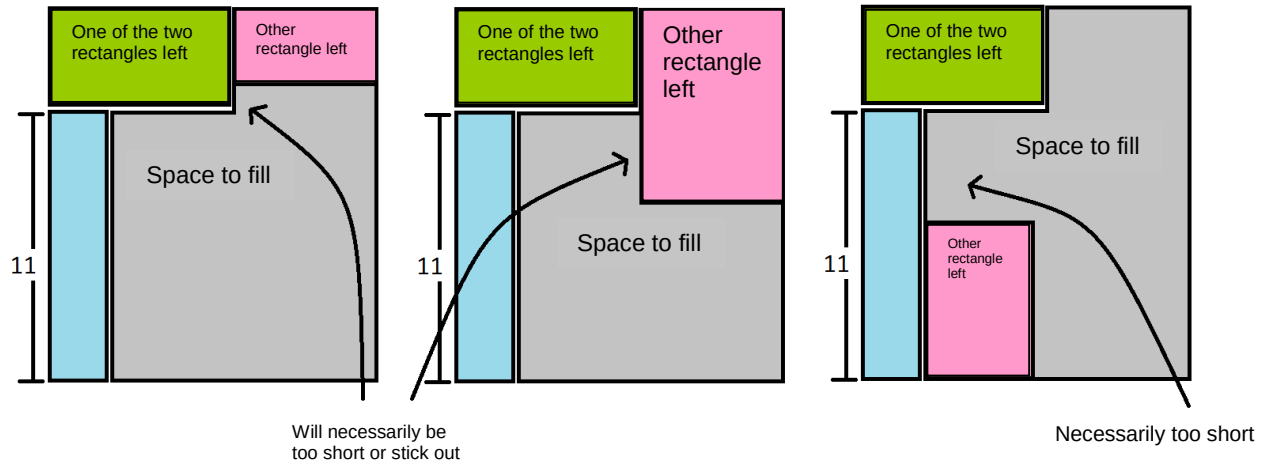


This means forming a rectangle with the two rectangles that have dimensions of 5×9 and 6×4 . However, it is impossible to combine two rectangles that have no side measurements in common to form another one.

If we are in the second situation, that is if we want to create a square that has a side made of the long side of the rectangle 11×2 and of one of the sides of another rectangle that we have, we end up in a similar situation. We know that the rectangle that will be juxtaposed to the side that measures 11 has a length and a width both lower than 11. The situation is illustrated in the adjacent figure.



Since the third rectangle we have has no dimension equal to the ones of the other rectangles we know, we inevitably find ourselves in one of the following configurations.



None of these situations allow to use a rectangle to fill the space. We then conclude it is not possible the original map had sides longer than 11.