



AMAZINGMATHS

**Materials:**

- Video of the puzzle
- Pen and paper

# Puzzle

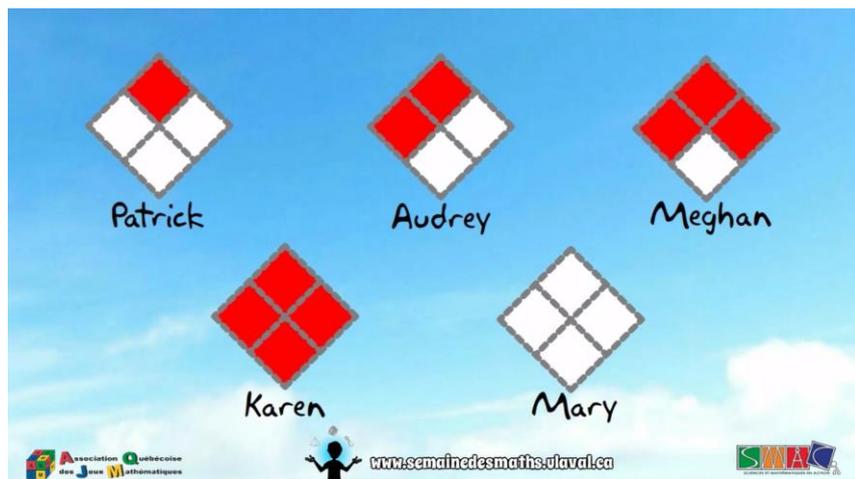
- The Kites -

## The Puzzle

At *Happy Camper* summer camp, one of the activities is to make kites. Patrick, Audrey, Meghan, Karen, Mary, and Ariana receive the same kite modelling kit. The kite's shape is square and is separated into four equal parts by two straight lines. The kite's shape is square and is separated into four equal parts by two straight lines.

Even though they all have the same model, each of the 6 campers want to make a different kit. However, they only have red and white material. To make sure their kites do not look alike, the campers want the kites to be different even if they are rotated.

Here are the models done by Patrick, Audrey, Meghan, Karen, and Mary:



Which kite model can Ariana make if she wants her kite to be different from the others?

Source : Concours AQJM, 21<sup>e</sup> championnat (2006-2007), quart de final, catégorie P1, question 1.



# Puzzle Solution



## The answer:

The model that will be made by Ariana is the following:



## The solution:

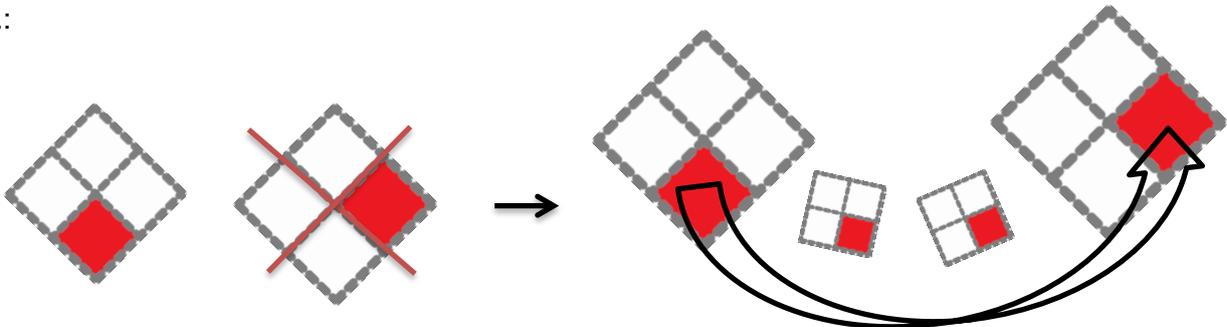
The shape and two colours of the kite allow for only 6 different kite models to be made. If we want to make sure that each possible model is made only once, we must think about each of the kite's area one at a time. Here are the different possibilities:

- 1<sup>st</sup> model: Each quarter\* is white (Mary's kite)
- 2<sup>nd</sup> model: Each quarter is red (Karen's kite)
- 3<sup>rd</sup> model: 1 quarter is red and the other 3 quarters are white (Patrick's kite)
- 4<sup>th</sup> model: 2 adjacent quarters are red and the 2 other adjacent quarters are white (Audrey's kite)
- 5<sup>th</sup> model: 3 quarters are red and 1 quarter is white (Meghan's kite)
- 6<sup>th</sup> model: 2 alternating quarters are red and the other 2 alternating quarters are white.

For the first and second model, there is only one way to have either four red quarters or four white quarters.

For the third model, only one kite with 1 red quarter and 3 white quarters can be made. The reason for this is because, if there was another kite with only 1 red quarter (whether the red quarter be at the top, bottom, left or right), and we rotated both kites, they would eventually overlap one another and look the same. So, to avoid any similarities between the kites (even if turned), there is only one kite that can have 1 red quarter and 3 white ones.

i.e.:



The principle used for the third model also applies itself to the fifth model. Only one model can have 1 white quarter and 3 red ones without it resembling another kite if rotated. So, we only have one kite with 1 white quarter and 3 red quarters.

The option of having 2 red quarters and 2 white quarters is the only option that has two model possibilities that **would not overlap** if rotated. The fact that we must visualise both possibilities with the same amount of coloured quarters is what makes this puzzle challenging.

The fourth kite model is divided in two by 2 adjacent red quarters and 2 adjacent white quarters. So, the last option is to put both red and white quarters facing one another: This way, the colours alternate and none of the kites look alike when they are rotated. Therefore, Ariana's only kite model option is the following:



*\*If you prefer not to use the term "quarter" you may use another term such as area or part.*