

Good practices

MATH_123A_EN

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Description of the problem / exercise: **Hexagon variations**

Set used: Triangle

By selecting 6 triangle elements and arranging them in a regular shape, we construct hexagons taking into account different conditions. The triangles should always be connected with the same size.

a) Hexagon with 1 base colour.

Choose a base colour! Make a hexagon from 6 triangle elements of the chosen basic colour with the same size matching.

How many different hexagons can you make with one base colour? How many different hexagons can you make using the other base colours?

Is it possible to make the hexagon with the same size and colour connection?

Can the hexagon be put out with the triangles on the outside matching in size and colour?

b) Hexagon with another smaller one-coloured hexagon inside.

Choose the colour and size of the triangle you want to fit in the middle (e.g. large, red). Using 6 triangles of the chosen colour and size, make a hexagon with same size and colour connection.

How many different hexagons can you make? How many different hexagons can you make with the same colour in the middle?

c) Hexagons with 2 base colours.

Choose two base colours! Using 6 triangles of the two base colours you have chosen, make a hexagon with same size connection.

Is it possible to solve the problem by alternating the two base colours?

Is there a solution if the two base colours are alternated and the matches are the same size and colour for all elements?

Is it possible to make a hexagon with two base colours so that triangles of the same size and colour fit on the outside?

d) Hexagons with 3 base colours.

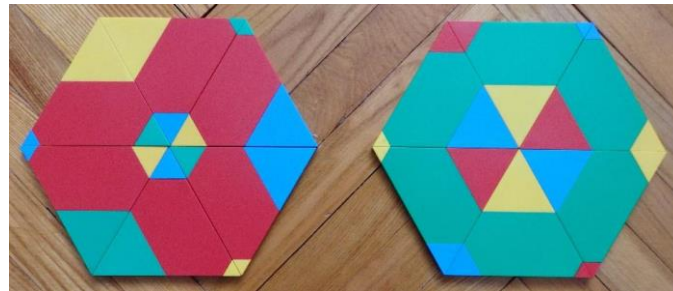
Choose three base colours! Using 6 triangle elements, construct a hexagon with same size and colour connection, so that each of the three base colours you have chosen is included.

e) Hexagons with all the 4 base colours.

Using 6 triangle elements, make a hexagon with same size and colour connection so that each base colour is included!

Solutions:

a) For one base colour, selecting one of the 6 triangles and placing it on the ground gives several possibilities for the placement of the other triangular elements. A hexagon cannot be placed by matching the same size and colour. If only the triangles on the outside of the hexagon match in both size and colour, there is a solution.



b) If you have chosen the colour and size of the triangle in the middle of the hexagon, then by choosing one of the corresponding 6 triangles and placing it on the table, the placement of the other triangles is clear because of the size and colour matching. After pairing all three sizes (large, medium, small) and four colours (red, yellow, blue, green), 3×4 or 12 hexagons can be placed.



c) If two base colours are used, the hexagon can be completed with the same size connection. The hexagon can also be made by choosing 3-3 pieces from the two base colours and placing them alternately. On the outer side of the hexagon, the matching can be of the same size and colour, and with two base colours you can get a hexagon. However, if you require that all the matches are identical in size and colour, there is no solution.



d) With three base colours, there are several solutions. But if you choose the colour of the hexagon in the middle, there is only one solution. This is the same as in case b).

e) There are several solutions using all the base colours. From the hexagons obtained for the 3 base colours, you can obtain a solution for 4 base colours by replacing one or more elements.

- *Why this exercise is good: In this exercise, we deal with basic combinatorial cases in a playful way. We put out each case, count the number of cases, the total number of possibilities and the number of possibilities that we cannot put out of the set. Because of the properties of the base elements (4 colours, 3 sizes), we do not get a solution for some conditions.*
- *Which level is recommended: Lower-grades of elementary school (6-10 years)*
- *School subject(s): Mathematics*