Grades 5-8 (SA), 9-12 (SA)

Duration: 10-15 min

Tools: one block / 1-3 student (block 113, 112, 122, 133, 223 or 233)

Individual / Pair / Group work

Keywords: Colouring vertices, All cases, Spatial vision, Symmetry

611 - Colouring Vertices 133

MATHS / COMBINATORICS

LOGIFACES METHODOLOGY

Erasmus+

TEACHER

Logifaces

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DESCRIPTION

Students colour the vertices of the block 133 or 123 (or 113, 112, 122, 223, 233, 321) with 2 colours (red and blue) and consider the number of possible colourings. (Two colourings are different, if they cannot be moved into each other.)

LEVEL 1 1 red vertex or 1 blue vertices

LEVEL 2 2 red vertices or 2 blue vertices

LEVEL 3 All possibilities.

SOLUTIONS / EXAMPLES

SOLUTION

There are 64 colourings of the vertices of the blocks 133 and 123. Since the vertices of the block 133 can be distinguished, the number of colourings of the vertices is $2^6 = 64$.
There are 1, 6, 15, 20, 15, 6, 1 vertex colourings with 0, 1, 2, 3, 4, 5, 6 red vertices respectively.

ASSISTANCE FOR STUDENTS

Try to find the number of colourings with 0, 1, 2, etc. red vertices separately.
Can we distinguish the vertices? How?

GUIDELINES FOR TEACHERS

After answering the Level 1 question, discuss that the vertices are distinguishable. The students should be encouraged to find a distinctive description for each vertex.

Discuss that the number of colourings with k red vertices equals the number of the k element subsets of a set of cardinality 6.

PRIOR KNOWLEDGE

Vertex of polyhedron, Number of the subsets of a set of a given cardinality

RECOMMENDATIONS / COMMENTS

This exercise develops combinatorial and logical thinking, while also builds on spatial vision.

The previous level helps answer the next one, but each question can be asked independently of the others.

Level 3 is a more difficult exercise without the Level 1-2 questions.