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

Topic: Combinatorics

Duration: 10-15 min

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

Individual / Pair / Group work

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

613 - Colouring Edges 133

MATHS / COMBINATORICS

LOGIFACES METHODOLOGY

Erasmus+

TEACHER

Logifaces

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DESCRIPTION

Students colour the edges 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 edge or 1 blue edges

LEVEL 2 2 red edge or 2 blue edges

LEVEL 3 All possibilities.

SOLUTIONS / EXAMPLES

There are 512 colourings of the edges of the blocks 133 and 123. Since the edges of the block 133 or 123 can be distinguished, the number of colourings of the edges is $2^9 = 512$.

There are 1, 9, 36, 84, 126, 126, 84, 36, 9, 1 edge colourings with 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 red edges respectively.

ASSISTANCE FOR STUDENTS

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

GUIDELINES FOR TEACHERS

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

Discuss that the number of colourings with k red edges equals the number of the k element subsets of a set of cardinality 9.

PRIOR KNOWLEDGE

Edge 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.