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

Duration: 10 min

Tools: one Logifaces Set / 3-4 students

Individual work

Keywords: Surface

412 - Arrange by Area

MATHS / 2D GEOMETRY

LOGIFACES METHODOLOGY

Erasmus+

TEACHER

Logifaces

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DESCRIPTION

LEVEL 1 Students arrange the blocks in ascending order according to the sum of their vertical face areas.

LEVEL 2 Students arrange the blocks in ascending order according to their surface area.

Students can try to find the ordering without exact calculations, only by comparing the areas based on conclusions from the edge lengths. They verify this by calculations.

SOLUTIONS / EXAMPLES

LEVEL 1 To calculate the area of the vertical faces, see exercise 409 - Area of Rectangular Faces.

For some blocks, we get the same value. According to the calculated areas, the ascending order of the blocks is as follows:

Sum of area	Blocks
12	111
16	112
20	122, 113
24	123, 132, 222
28	133, 223
32	233
36	333

Observe that the sum of the areas of the vertical faces depends only on the sum of the three heights (see exercise 410 - Heights and Areas for the explanation).

LEVEL 2 Use the area of the top faces to distinguish between the whole surface areas of the blocks that have the same area in the ordering of the Level 1 exercise.

To calculate the area of the base and the top triangles, see exercise 411 - Area of Triangles.

The areas of the top faces are as follows:

top edge lengths	area of top triangle	blocks
4, 4, 4	$4\sqrt{3} \approx 6.93$	111, 222, 333
4, $\sqrt{17}$, $\sqrt{17}$	$2\sqrt{13} \approx 7.21$	112, 122, 223, 233
4, $\sqrt{20}$, $\sqrt{20}$	8	113, 133
$\sqrt{20}$, $\sqrt{17}$, $\sqrt{17}$	$2\sqrt{15} \approx 7.75$	123, 132

Because the difference between the area of the largest top triangle and the area of the smallest top triangle is $8 - 4\sqrt{3} \approx 1.07$, which is less than 4, adding the area of the triangles does not override the order in the Level 1 exercise, where the difference between two adjacent categories is always 4.

Surface area (vertical faces + base + top face)	Blocks
$12 + 4\sqrt{3} + 4\sqrt{3} \approx 25.86$	111
$16 + 4\sqrt{3} + 2\sqrt{13}$ ≈30.14	112
$20 + 4\sqrt{3} + 2\sqrt{13} \approx 34.14$	122
$20 + 4\sqrt{3} + 8 \approx 34.93$	113
$24 + 4\sqrt{3} + 4\sqrt{3} \approx 37.86$	222
$24 + 4\sqrt{3} + 2\sqrt{15} \approx 38.67$	123, 132
$28 + 4\sqrt{3} + 2\sqrt{13} \approx 42.14$	223
$28 + 4\sqrt{3} + 8 \approx 42.93$	133
$32 + 4\sqrt{3} + 2\sqrt{13} \approx 46.14$	233
$36 + 4\sqrt{3} + 4\sqrt{3} \approx 49.86$	333

PRIOR KNOWLEDGE

Formula of the area of rectangle, trapezium and triangle

RECOMMENDATIONS / COMMENTS

Exercises 409 - Area of Rectangular Faces, 410 - Heights and Areas and 411 - Area of Triangles are recommended before this exercise.

This task is suitable for differentiation, as Level 2 is much more difficult than Level 1. The result of the Level 1 exercise helps the solution of the Level 2 exercise.