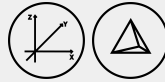|		
Grades 9-12 (S) Duration: 10 min Tools: one Logifaces set / class Individual work Keywords: Coordinates, 3D coordinate system	**526 - Calculate the Coordinates** ⊞ △ **MATHS / COORDINATE GEOMETRY**	LOGIFACES METHODOLOGY Erasmus+ **TEACHER** Logifaces 2019-1-HU01-KA201-0612722019-1

DESCRIPTION

Students position a Logifaces block in a 3-dimensional rectangular coordinate system so that one vertex of the base is at the origin and another vertex of the base is at (4, 0, 0), then calculate the coordinates of the other vertices of the block.

SOLUTIONS / EXAMPLES

The coordinates of the bases are the same for all blocks:

$(0, 0, 0)$, $(4, 0, 0)$, $(2, 2\sqrt{3}, 0)$, since in an equilateral triangle the altitude is: $altitude = \frac{base \times \sqrt{3}}{2} = \frac{4 \times \sqrt{3}}{2} = 2\sqrt{3}$

The x and y coordinates of the top vertices are the same as the x and y coordinates of the corresponding base vertices. The values of the z coordinates (a, b, and c in the figure) depend on the lengths of the vertical edges of the block.
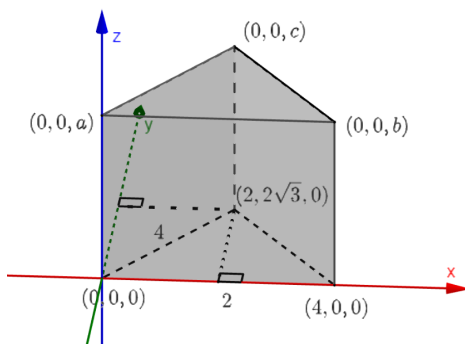
The coordinates of the top vertices of the blocks 111, 222 and 333 are uniquely determined:

- 111: $(0, 0, 1)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 1)$

- 222: $(0, 0, 2)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 2)$

- 333: $(0, 0, 3)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 3)$

The vertex coordinates of the remaining blocks are not uniquely determined, because rotation of the vertical edges rotates the z coordinates of the top vertices. There are three possible rotations for each block. All three possibilities of the coordinates of the top vertices are listed in the table below:

Block			
112	$(0, 0, 1)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 2)$	$(0, 0, 1)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 1)$	$(0, 0, 2)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 1)$
122	$(0, 0, 1)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 2)$	$(0, 0, 2)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 1)$	$(0, 0, 2)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 2)$
223	$(0, 0, 2)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 3)$	$(0, 0, 2)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 2)$	$(0, 0, 3)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 2)$
233	$(0, 0, 2)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 3)$	$(0, 0, 3)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 2)$	$(0, 0, 3)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 3)$
113	$(0, 0, 1)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 3)$	$(0, 0, 1)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 1)$	$(0, 0, 3)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 1)$
133	$(0, 0, 1)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 3)$	$(0, 0, 3)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 1)$	$(0, 0, 3)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 3)$
123	$(0, 0, 1)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 3)$	$(0, 0, 2)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 1)$	$(0, 0, 3)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 2)$
132	$(0, 0, 1)$, $(4, 0, 3)$, $(2, 2\sqrt{3}, 2)$	$(0, 0, 3)$, $(4, 0, 2)$, $(2, 2\sqrt{3}, 1)$	$(0, 0, 2)$, $(4, 0, 1)$, $(2, 2\sqrt{3}, 3)$

PRIOR KNOWLEDGE

Coordinates of points in the 3 dimensional coordinate system, Pythagorean theorem

RECOMMENDATIONS/COMMENTS